Volume 16(3), 73- 78, 2012
JOURNAL of Horticulture, Forestry and Biotechnology
www.journal-hfb.usab-tm.ro

Impact of biostimulators and of rooting substratum on sapling growth in *Ficus carica* L. – Part II

Poşta Daniela Sabina[1]

[1]Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara, Faculty of Horticulture and Forestry

Corresponding author. Email: posta.daniela@gmail.com

Abstract The biological material is represented by saplings of *Ficus carica* L. obtained vegetatively through cuttings using lignified cuts.

The rooting substratum used in the experiment was made up with well-washed river sand.

The rooting biostimulators we used were: a solution of Atonik, 1:4,000, i.e. 0.25 ml solution per 1 l of water, and Radistim 2 powder.

We made morphological feature biometric measurements in each sapling: sapling height, diameter of the collar, diameter of root system, number of roots, and root length.

Key words

Ficus carica L., cuttings, biostimulators, rooting substrate nutrient

Common fig tree is a shrub of the family Moraceae, originating in Asia and in the Mediterranean area. In Romania, it is cultivated only in milder climate areas, in southern Banat – Timişoara, Drobeta-Turnu Severin, Moldova Veche, and Tismana – as well as in northern Dobruja – Mangalia, Techirghiol [5].

Common fig tree is a species known ever since Ancient times: it was mentioned by Theophrastus, Dioscorid, Pliny the Older and Homer. Its scientific name comes from the locality name Carica in Asia Minor, where it was identified in the spontaneous flora.

Common fig tree reaches a height of 4-5 m: its leaves are deciduous, very lobate, with 3-5 lobes. Leaf size and leaf asymmetry vary depending on the insertion place on the stem (upper, median, or lower) and on their position on the stem (inside, outside). There are also significant differences of leaf asymmetry between common fig tree shrubs [1].

The flowers are dioic, and pollination is done by the wasp *Blastophaga psenes*, that lays eggs inside male flowers, thus contributing to female flower pollination [6].

Common fig tree blooms, in Romania too, twice a year – in spring and in summer – but only spring fruit reach full maturity in September. Fruit from second harvest do not fully develop. Common fig trees fructify when they reach 3 years, but the best harvest quantitatively is when they reach 10 years of age [8].

It is recommended to cultivate firm pulp cultivars to preserve the flavour of fruit harvested when enough mature to tolerate the harvesting technique and the post-harvest manipulation. These cultivars should be selected to develop the industry of fresh figs [2].

This species loves sunlight and it grows on sandy, limey and even rocky soils. It prefers warm climate areas, it suffers because of early or late frosts, and it does not bear harsh winter frosts. In cold climate areas, it needs protected by mulching and covering with plastic sheets or microporous canvas [8]. It multiplies through lignified cuts, tillers, and layers.

Roots, leaves, shoots, and fruit are used in traditional medicine to treat gastro-intestinal, respiratory, and cardio-vascular conditions [4].

It is cultivated for its fruit consumed fresh, dried and as preserves: in syrup, jam, compote, and wine. The fruit have a high content of nutrients: 1 kg of figs contain about 714 calories, 12.8 g of proteins, 31.6 g of lipids, 178 g of sugars, 490 g of calcium, 290 mg of phosphorus, 14 mg of vitamin C. The fruit have also medicinal properties (energising and diuretic). The leaves are used to produce an infusion used in the treatment of circulatory conditions.

Materials and Methods

The biological material is represented by saplings of *Ficus carica* L. Obtained vegetatively through cuttings using lignified cuts harvested from plants that fructify abundantly [3].

To stimulate rooting, we used two rooting biostimulators: Atonik and Radistim. With Atonik, we used a rate of 1:4,000 (0.25 ml/ 1 l of water) in aqueous solution in which we introduced the cuts for 5 minutes. This was done right after the cuts were harvested. The second biostimulator we used was Radistim. The basis of the cuts was introduced in powder over a length of 1-2 cm. Excess powder was removed by slightly kicking the curs.

After they were treated with biostimulators, the cuts were carefully introduced in the rooting substrata made up of river sand, in a previously prepared subculturing procedure orifice [7].

The experience was set in the glasshouse of the Department of Tree Culture of the Teaching and Research Station of the Banat University of Agricultural sciences and Veterinary Medicine of Timişoara.

The type of cut was the simple one, obtained from upright, not ramified stems. The cuts were subcultivated on equidistant rows (7-10 cm), at a distance of 3-5 cm between cuts per row, and at a depth of 2-3 cm. Thus, in the nursery glasshouse, we raised the temperature to 18-20° and the air moisture to 40-45%.

The cutting was done on October18, 2011. After rooting, the saplings were subcultivated on March 19, 2012, i.e. 151 days later.

Research was organised after the bifactorial experiment model, i.e.:

Factor A (bioactive substance) with 2 graduations:

a_1 – Atonik;

a_2 – Radistim 2.

Factor B (nutrient mixture) with 4 graduations:

b_1 – 40% manure + 60% sand;

b_2 – 30% manure + 70% sand;

b_3 – 50% manure + 50% sand;

b_4 – 60% manure + 40% sand.

Biometric measurements concerned the following morphological features: sapling height, collar diameter, diameter of root system, number of roots, and root length.

Results and Discussions

To point out the effect of biostimulator and of the composition of the rooting substratum on sapling vigour, we made biometric observations and measurements 151 days after rooting. To do so, we present, in the following tables, the experimental results obtained for each studied factor apart and for all the studied factors together, in interaction.

Table 1

Impact of bioactive substance and of nutrient mixture on sapling height (Teaching and Research Station of Timişoara, 2011-2012)

Nutrient mixture	Bioactive substance		Medium stem height (cm)	Relative stem height (%)	Difference to experiment mean (cm)	Significance
	a_1	a_2				
b_1	17.36	16.83	17.09	101.18	0.20	*
b_2	17.13	16.70	16.91	100.11	0.02	-
b_3	16.60	16.72	16.66	98.63	-0.23	0
b_4	16.84	16.99	16.91	101.11	0.02	-
Medium stem height (cm)	16.98	16.81	Average experience = 16.89 cm			
Relative stem height (%)	100.53	99.52	A factor	$LSD_{5\%}$ = 0.15 cm; $LSD_{1\%}$ = 0.53 cm; $LSD_{0.1\%}$ = 1.81 cm.		
Difference to experiment mean (cm)	0.09	-0.08	B factor	$LSD_{5\%}$ = 0.17 cm; $LSD_{1\%}$ = 0.37 cm; $LSD_{0.1\%}$ = 1.52 cm.		
Significance	-	-				

As far as experimental research on sapling height presented in Table 1 is concerned, we can see that, using the two bioactive substances to root cuts and subcultivate them in a nutrient mixture of 40% manure and 60% sand, there is significant height increases (17.36 cm) compared to the mean of the experiment (16.89 cm).

Analysing experimental data presented in Table 2, we can see that, in the variants of nutrient mixture b_1, there are significant differences of the sapling collar diameter compared to the mean of the experiment.

Table 2

Impact of bioactive substance and of nutrient mixture on sapling collar diameter (Teaching and Research Station of Timişoara, 2011-2012)

Nutrient mixture	Bioactive substance a_1	Bioactive substance a_2	Medium collar diameter (mm)	Relative collar diameter (%)	Difference to experiment mean (mm)	Significance
b_1	4.59	4.47	4.53	102.48	0.11	*
b_2	4.47	4.25	4.36	98.64	-0.06	-
b_3	4.40	4.46	4.43	100.22	0.01	-
b_4	4.32	4.44	4.38	99.09	-0.04	-
Medium collar diameter (mm)	4.44	4.40	Average experience = 4.42 mm			
Relative collar diameter (%)	100.45	99.54	A factor $LSD_{5\%}$ = 0.08 mm; $LSD_{1\%}$ = 0.19 mm; $LSD_{0.1\%}$ = 0.41 mm.			
Difference to experiment mean (mm)	0.02	-0.02	B factor $LSD_{5\%}$ = 0.07 mm; $LSD_{1\%}$ = 0.15 mm; $LSD_{0.1\%}$ = 0.33 mm.			
Significance	-	-				

Table 3

Impact of bioactive substance and of nutrient mixture on sapling root diameter (Teaching and Research Station of Timişoara, 2011-2012)

Nutrient mixture	Bioactive substance a_1	Bioactive substance a_2	Medium root diameter (mm)	Relative root diameter (%)	Difference to experiment mean (mm)	Significance
b_1	7.70	6.80	7.25	101.11	0.08	-
b_2	7.73	6.99	7.36	102.64	0.19	*
b_3	7.35	6.75	7.05	98.32	-0.12	-
b_4	7.17	6.94	7.05	98.32	-0.12	-
Medium root diameter (mm)	7.48	6.87	Average experience = 7.17 mm			
Relative root diameter (%)	104.32	95.81	A factor $LSD_{5\%}$ = 0.25 mm; $LSD_{1\%}$ = 0.59 mm; $LSD_{0.1\%}$ = 1.51 mm.			
Difference to experiment mean (mm)	0.31	-0.30	B factor $LSD_{5\%}$ = 0.13 mm; $LSD_{1\%}$ = 0.21 mm; $LSD_{0.1\%}$ = 0.33 mm.			
Significance	0	0				

Experimental data presented in Table 3 show that, after using the biostimulating substance Atonik (7.48 mm) and the nutrient mixture (b_2 – 7.36 mm) made up of 30% manure and 70% sand as rooting substratum, there are significant differences of the growth and development of the root diameter compared to the mean of the experiment (7.17 mm).

Table 4

Impact of bioactive substance and of nutrient mixture on sapling root number (Teaching and Research Station of Timişoara, 2011-2012)

Nutrient mixture	Bioactive substance a_1	Bioactive substance a_2	Medium root number	Relative root number (%)	Difference to experiment mean	Significance
b_1	9.36	7.52	8.44	100.59	0.05	-
b_2	9.80	8.56	9.18	109.41	0.79	**
b_3	8.76	7.52	8.14	97.02	-0.25	-
b_4	8.32	7.28	7.80	92.96	-0.59	00
Medium root number	9.06	7.72	Average experience = 8.39 mm			
Relative root number (%)	107.98	92.01	A factor $LSD_{5\%}$ = 0.27; $LSD_{1\%}$ = 0.43; $LSD_{0.1\%}$ = 1.11.			
Difference to experiment mean	0.67	-0.67	B factor $LSD_{5\%}$ = 0.31; $LSD_{1\%}$ = 0.55; $LSD_{0.1\%}$ = 0.93.			
Significance	**	00				

Analyzing experimental results concerning the sapling root number presented in Table 4, we see that there significant distinctly differences in the case of the variant b_2 of nutrient mixture compared to the mean of the experiment. Comparing the two rooting bioactive substances, we can see there are distinctly significant differences of the mean number of roots when using the product Atonik (9.06) compared to the product Radistim.

Table 5

Impact of bioactive substance and of nutrient mixture on sapling root length (Teaching and Research Station of Timişoara, 2011-2012)

	Bioactive substance		Medium root length (cm)	Relative root length (%)	Difference to experiment mean (cm)	Significance
Nutrient mixture	a_1	a_2				
b_1	5.16	4.00	4.58	107.51	0.32	***
b_2	5.14	4.20	4.67	109.62	0.41	***
b_3	4.66	3.28	3.97	93.19	-0.29	00
b_4	4.45	3.20	3.82	89.67	-0.44	000
Medium root length (cm)	4.85	3.67				
Relative root length (%)	113.84	86.15				
Difference to experiment mean (cm)	0.59	-0.59				
Significance	***	000				

Average experience = 4.26 mm

A factor $LSD_{5\%} = 0.07$ cm; $LSD_{1\%} = 0.19$ cm; $LSD_{0.1\%} = 0.31$ cm.

B factor $LSD_{5\%} = 0.14$ cm; $LSD_{1\%} = 0.23$ cm; $LSD_{0.1\%} = 0.36$ cm.

As for experimental data presented in Table 5 concerning sapling root length, we can point out the fact that there is a very significant influence of the composition of the nutrient mixture (b_2 – 4.67 cm and b_1 – 4.58 cm) and of the bioactive substance Atonik (a_1 – 4.85 cm).

Tables 6-10 present experimental results concerning the interaction of experimental factors and their effect on the analysed morphological features.

Table 6

Effect of the interaction of bioactive substances and nutrient mixture variants on sapling stem height (Teaching and Research Station of Timişoara, 2011-2012)

Factor combination	Mean stem height (cm)	Relative stem height (%)	Difference to experiment mean (cm)	Significance
a_1b_1	17.36	102.79	0.47	*
a_1b_2	17.13	101.42	0.24	-
a_2b_4	16.99	100.59	0.10	-
Average experience	16.89	100.00	0.00	-
a_1b_4	16.84	99.70	-0.05	-
a_2b_1	16.83	99.64	-0.06	-
a_2b_3	16.72	98.99	-0.17	-
a_2b_2	16.70	98.87	-0.19	-
a_1b_3	16.60	98.28	-0.29	-

$LSD_{5\%} = 0.33$ cm; $LSD_{1\%} = 0.57$ cm; $LSD_{0.1\%} = 0.91$ cm.

Analyzing experimental data in Table 6, we can see that stem height had a significant increase with the factor combination a_1b_1 (17.36 cm) compared to the mean of the experiment (16.89 cm).

Table 7

Effect of the interaction of bioactive substances and nutrient mixture variants on sapling collar diameter (Teaching and Research Station of Timişoara, 2011-2012)

Factor combination	Medium collar diameter (mm)	Relative collar diameter (%)	Difference to experiment mean (mm)	Significance
a_1b_1	4.59	103.84	0.17	**
a_1b_2	4.47	101.13	0.05	-
a_2b_1	4.47	101.13	0.05	-
a_2b_3	4.46	100.90	0.04	-
a_2b_4	4.44	100.45	0.02	-
Average experience	4.42	100.00	0.00	-
a_1b_3	4.40	99.54	-0.02	-
a_1b_4	4.32	97.73	-0.10	-
a_2b_2	4.25	96.15	-0.17	00

$LSD_{5\%}$ = 0.11 mm; $LSD_{1\%}$ = 0.16 mm; $LSD_{0.1\%}$ = 0.35 mm.

As for experimental data presented in Table 7, we can see that sapling collar diameter increased significant distinctly in the variants a_1b_1 (4.59 mm) compared to the mean of the experiment (4.42 mm).

Table 8

Effect of the interaction of bioactive substances and nutrient mixture variants on sapling root diameter (Teaching and Research Station of Timişoara, 2011-2012)

Factor combination	Medium root diameter (mm)	Relative root diameter (%)	Difference to experiment mean (mm)	Significance
a_1b_2	7.73	107.81	0.56	**
a_1b_1	7.70	107.39	0.53	*
a_1b_3	7.35	102.51	0.18	-
a_1b_4	7.17	100.00	0.00	-
Average experience	7.17	100.00	0.00	-
a_2b_2	6.99	97.48	-0.18	-
a_2b_4	6.94	96.79	-0.23	-
a_2b_1	6.80	94.83	-0.37	0
a_2b_3	6.75	94.14	-0.42	0

$LSD_{5\%}$ = 0.23 mm; $LSD_{1\%}$ = 0.55 mm; $LSD_{0.1\%}$ = 0.87 mm.

The increase of the sapling root diameter was good with the combination of the factors a_1b_2 (7.73 mm) and a_1b_1 (7.70 mm) compared to the mean of the experiment (7.17 mm), with very significant differences.

Table 9

Effect of the interaction of bioactive substances and nutrient mixture variants on sapling root number (Teaching and Research Station of Timişoara, 2011-2012)

Factor combination	Medium root number	Relative root number (%)	Difference to experiment mean	Significance
a_1b_2	9.80	116.20	1.41	***
a_1b_1	9.36	111.56	0.97	**
a_1b_3	8.76	104.41	0.37	*
a_2b_2	8.56	102.02	0.17	-
Average experience	8.39	100.00	0.00	-
a_1b_4	8.32	99.16	-0.07	-
a_2b_1	7.52	89.63	-0.87	00
a_2b_3	7.52	89.63	-0.87	00
a_2b_4	7.28	86.76	-1.11	000

$LSD_{5\%}$ = 0.27; $LSD_{1\%}$ = 0.61; $LSD_{0.1\%}$ = 1.09.

As far as the number of roots per sapling is concerned, we can point out very significant and distinctly significant differences oscillating between 0.37 and 1.41, compared to the mean of the experiment.

Table 10

Effect of the interaction of bioactive substances and nutrient mixture variants on sapling root length (Teaching and Research Station of Timişoara, 2011-2012)

Factor combination	Medium root length (cm)	Relative root length (%)	Difference to experiment mean (cm)	Significance
a_1b_1	5.16	121.12	0.90	***
a_1b_2	5.14	120.65	0.88	**
a_1b_3	4.66	109.38	0.40	*
a_1b_4	4.45	104.46	0.19	-
Average experience	4.26	100.00	0.00	-
a_2b_2	4.20	98.59	-0.06	-
a_2b_1	4.00	93.89	-0.26	0
a_2b_3	3.28	76.99	-0.98	000
a_2b_4	3.20	75.11	-1.06	000

$LSD_{5\%}$ = 0.21 cm; $LSD_{1\%}$ = 0.43 cm; $LSD_{0.1\%}$ = 0.89 cm.

As for root length, the factor combinations a_1b_1 (5.16 cm) are significantly better than the mean of the experiment (4.26 cm).

Conclusions

On the ground of experimental results concerning the vegetative production of planting material in the species *Ficus carica* L., we can draw the following conclusions:

- sapling height growth and development is influenced significantly with the nutrient mixture b_2 (30% manure + 70% sand);
- using the product Atonik determines significant differences of the root diameter compared to the mean of the experiment in the four variants of rooting mixture;
- there are distinctly significant differences in root number in the mixture variant b_2 (30% manure + 70% sand) compared to the mean of the experiment;
- estimate mean values of root length are very significantly higher in the mixture variants b_2 (4.67 cm) and b_1 (4.58 cm) compared to the mean of the experiment (4.85 cm);
- we recommend the product Atonik (0.25 ml/1 l of water) to root common fig tree cuts since it influences significantly the growth and development of the root system.

References

1.Cowart Natalie M. and Graham J.H., 1999, Within- and among-individual variation in fluctuating asymmetry of leaves in the Fig (*Ficus carica* L.). Int. J. Plant Sci. 160(1):116–121.

2.Ciulca S., 2002, Tehnică experimentală. Ed. Mirton, Timişoara.

3.Crisosto C.H., Bremer Vanessa, Ferguson Louise, and Gayle M.C., 2010, Evaluating Quality Attributes of Four Fresh Fig (*Ficus carica* L.) Cultivars Harvested at Two Maturity Stages. HortScience 45:707-710.

4.Dolgun O., and Tekintas F.E., 2009, Effective use of vegetative material in fig (*Ficus carica* L.) nursery plant production. African Journal of Agricultural Research Vol. 4 (8), pp. 701-706.

5.Kahrizi D., Molsaghi M., Faramarzi A., Yari K., Kazemi E., 2012, Medicinal Plant in Holy Quran. American Journal of Scientific Research, 42, pp. 62-71

6.Poşta Daniela Sabina, 2009, Arboricultură ornamentală. Ed. Agroprint, Timişoara.

7.Pigé Laure Grison, Salager J.L., Hossaert M., McKey, Roy J., 2001, Carbon allocation to volatiles and other reproductive components in male *Ficus carica* L. *(Moraceae)*. American Journal of Botany, Volum: 88, Nr: 12, Pagini: 2214-2220.

8.Poşta Daniela Sabina, Cornelia Hernea, 2011, The influence of rooting biostimulators and substrate on biometric characteristics of *Kerria japonica* (L.) DC *seedlings*, Journal of Horticulture, Forestry and Biotechnology, 15 (4):88-92.

9.Rubţov Şt., 1961, Cultura speciilor lemnoase în pepinieră. Ed. Agro-Silvică, Bucureşti.