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STUDIUL PRIVIND INFLUENŢA PERIOADEI DE ALTOIRE ŞI A CONDIŢIILOR DE MEDIU LA ALTOIREA NUCULUI ÎN SPAŢII PROTEJATE (SOLARII)

STUDY ON THE INFLUENCE OF GRAFTING PERIOD AND ENVIRONMENT CONDITIONS UPON WALNUT GRAFTING IN CONTROLLED CONDITIONS (PLASTIC GREENHOUSE)

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Abstract

The study was conducted during 2014-2017 to obtain planting material by grafting the walnut directly in solarium conditions. The grafting method used was *chip budding*. The two grafting periods were August (sleeping bud grafting) and April (growing bud grafting). The best results were obtained in the case of walnut grafting in April, when the temperature conditions, the relative humidity of the air and the intensity of the light are close to the optimal, in this case grafting success percent is between 39 and 57%. In the case of walnut grafting in August, the best results were obtained with the use of the grafted branches wrought one month before grafting (grafting success 24%).

Cuvinte cheie: nuc, altoire, metoda de altoire, perioada de altoire, solar.
Keywords: walnut, grafting, chip budding, grafting period, tunnel house.

1. Introduction

The quality of the planting material used for the establishment of walnut plantations is essential for their efficiency.

Unlike other tree species, walnut grafting is a technological sequence that requires special conditions to achieve good results.

Grafting, using improved copulation method and forcing the material into forcing rooms after grafting, remains one of the most used technologies but with quite large production costs (Achim, G., Botu, I., 2001).

Under conditions of walnut grafting in the field, favorable environmental conditions are not recorded until certain periods of the year, but the results obtained are not satisfactory (Karadeniz, 2003).

Success of grafting is influenced by several factors such as grafting, temperature, atmospheric humidity, phenolic compounds, hormonal and nutritive conditions of grafted varieties, and grafting time (Mitrovic, 1995; Mehmet et al., 1997).

Environmental conditions, during and after grafting, play a very important role in the formation of walnut callus (Avanzato and Atefi, 1997). Optimally, the temperature should be maintained at about 27^{o} C after grafting for better callus formation and successful grafting (Avanzato and Atefi, 1997; Germain, 1998).

The study was conducted between 2014 and 2017, aiming to graft the walnut in controlled conditions.

2. Material and methods

For setting up 1st field of nursery, a 20-meter-long, 10 m wide and 4.5 m high tunnel was used. (Figure 3)

Walnuts for rootstock, after harvesting, were disinfected with fungicides, then layered in sand for eight weeks at 4-5^{o}C. Sprouted nuts were used and the sowing distance was 75 cm between the rows and 10 cm per row and the sowing depth was 5 cm.

After approximately 8 months, when the rootstocks were more than 100 cm tall and 14.2 mm thick at 10 cm from the ground, they were grafted. (Figure 5)

Grafting method used chip budding in two grafting periods: August (bud sleeping) and April (with growing bud).

For binding the grafting area, the Buddy Tape was used.

By removing graft leaves 20 days prior to grafting, it is possible to reduce the concentration of phenolic compounds in the tissues and their oxidation, together with the injury of grafting tissues (Hodaj B., Rama P., Hodaj Natasha, 2014).

For grafting in August, scions (grafting branches) were used, which were shaped at two different times: leaf removal and maintenance of a 2 cm petiole, carried out one month prior to the grafting of the branches, and, respectively, shaping at the time of harvesting the grafting branches. For grafting in April, branches were harvested late in autumn and kept in winter in warehouses at temperatures of 2-4^{o}C.

Since temperature and humidity have a decisive effect on the process, they were recorded during grafting period, using the maximum and minimum thermometer and hygrometer (Figures 1 and 2). As reference indicators, the temperature was 27° C and the relative humidity was 40%.

During the vegetation period, specific maintenance works were carried out.

During the experiments, observations and determinations were made regarding: grafting success and graft growth.

3. Results and discussions

In greenhouse conditions the best results are obtained when the temperatures are maintained at 25° C on the day and 21° C at night and relative humidity of 39 and 70% respectively during the three weeks after grafting (Ebrahimi, A., Vahdati, K., Fallahi, E., 2006).

The optimum environmental conditions, grafting method and grafting period are of utmost importance for the success of walnut grafting, depending on the particularities of the region (Ahmed et al., 2012).

The reduced light intensity, 3000-4000 lux positively influences grafting success, compared with the high light intensity of 20000-30000 lux, recorded under field conditions (Kasmi Mojlinda, Rama P., Veizi Aulona, Vrapi H., 2016).

The April environmental conditions were closer to the benchmarks (27° C temperature, 40% humidity and light intensity 3000-4000 lux) and had a positive influence on grafting. Thus, grafting success was 51.8% in 2015 and 48.6% in 2017.

In the case of grafting in August (2014 and 2015), grafting success was lower, 8.3% (in 2014) and 16.0% (2015), as the recorded temperatures of 31-37° C and humidity of 55-75%, were higher than the benchmarks.

By removing graft leaves 20 days prior to grafting, it is possible to reduce the concentration of phenolic compounds in the tissues and their oxidation, together with the injury of grafting tissues (Hodaj B., Rama P., Hodaj Natasha, 2014).

High content of polyphenols in the plant negatively influences grafting. In the grafting section these phenolic compounds are oxidized by polyphenoloxidase and molecular oxygen, than transformed into a complex of brown or blackish molecules, resulting in tissues necrosis near the graft area (Karadeniz, 2005).

Data on the growth of grafted trees in 2nd field of the nursery highlights the very good results obtained during the two grafting periods, the differences between them being insignificant. Thus, at the time of removal from the nursery, the grafted trees had over 180 cm high and 12 mm diameter at 80 cm height above the soil. (Table 1, Figures 4, 6, 8 and 9).

Among walnut varieties and selections grafted in April in the years 2015 and 2017, some were noted by grafting results: President (57% grafting success), Velniţa (53%), Miroslava (52%) and Belceşti Selection (52%). (Table 2)

4. Conclusions

Controlling the temperature and humidity around optimum values under controlled conditions ensures good callus formation and therefore improves grafting success.

Chip budding is a successful method for walnut grafting, with grafting success percentage of 48.6-51.9% when grafting took place in mid-April and poor results when grafting in mid-August.

Establishing the first field in the solarium, by direct sowing and budding seedlings using chip budding method, can be one of the technological sequences that ensure the production of grafted material both in quantitative and qualitative terms, allowing easier control of environmental conditions in protected areas.

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Tables and Figures

Table 1. The influence of grafting period on the growth of scion in walnut.

Grafting period	Year	Total number of grafted plants	Plants successful grafted (no.)	Grafting success (%)	Average thickness at grafting area (cm)	Scion average thickness at 1 m. height (cm)	Grafted trees height (cm)
August	2014	3280	274	8.3	1.9	1.6	201
	2015	2873	459	16.0	1.8	1.6	192
April	2015	1930	1001	51.9	1.5	1.2	183
	2017	1104	536	48.6	1.9	1.7	210

Table 2. The influence of the grafting period on the grafting success percentage on some walnut selections, using chip budding grafting method, during 2014-2017.

Grafting period	Year	Walnut selection (biotype)	Total number of grafted plants	Plants successful grafted (no.)	Grafting success (%)
August	2014	Miroslava	1059	77	7
		Anica	840	37	4
		Velnita	524	94	17
		Prezident	432	33	7
		Şorogari selection	315	27	8
		Grădinar	110	6	5
	2015	Anica	300	54	18
		Miroslava	380	22	12
		Velniţa	245	41	16
		Grădinar	105	12	11
		Săbăoani selection	450	95	21
		Belceşti selection	364	88	24
		Şorogari selection	315	54	17
		Bălţaţi selection	714	93	12
April	2015	Anica	264	127	48
		Miroslava	358	186	52
		Grădinar	56	22	39
		Velniţa	355	188	53
		Şorogari selection	276	124	45
		Prezident	621	354	57
	2017	Săbăoani selection	324	155	48
		Belceşti selection	288	150	52
		Bălţaţi selection	492	231	47

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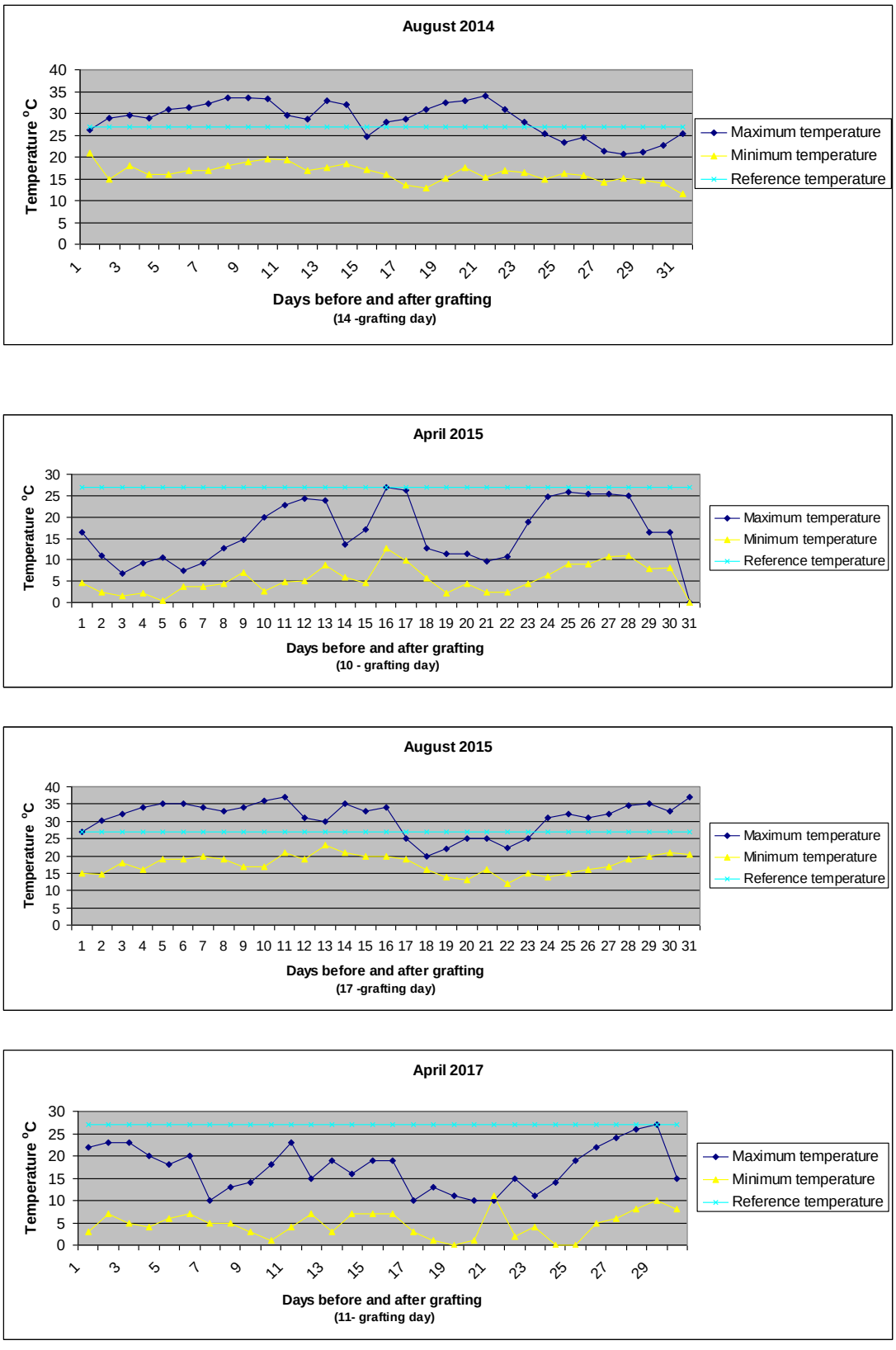

Fig. 1. Trend of daily temperatures before and after walnut grafting under controlled condition

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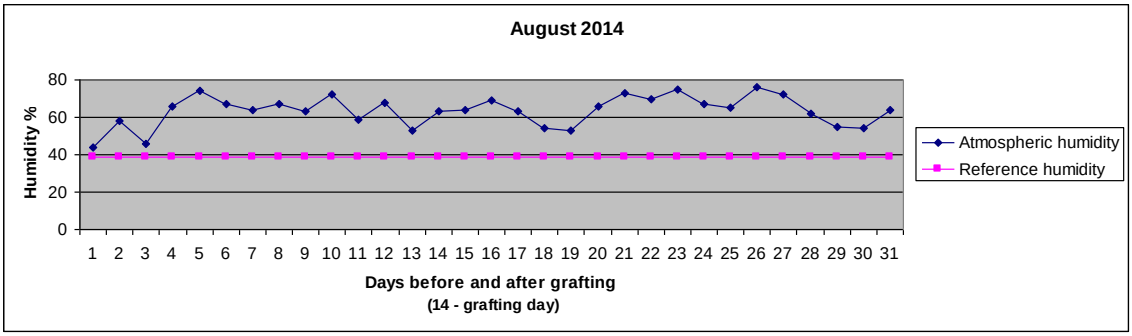

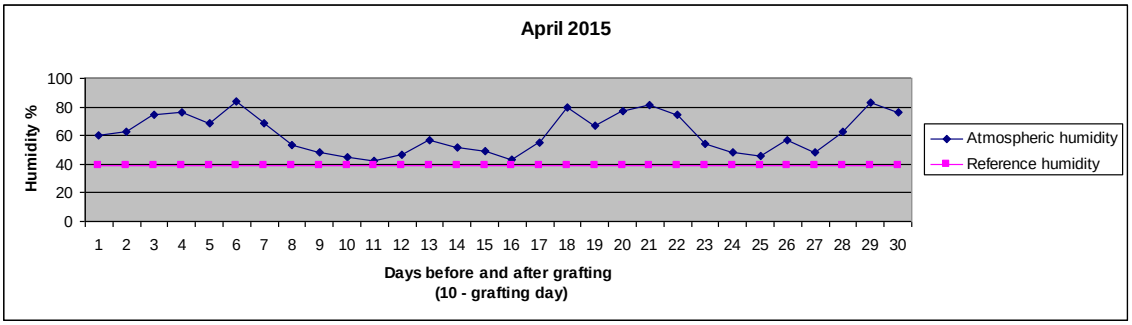

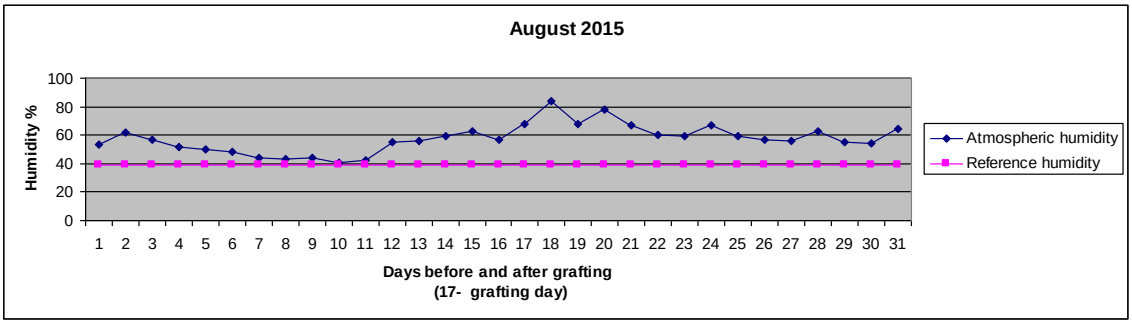

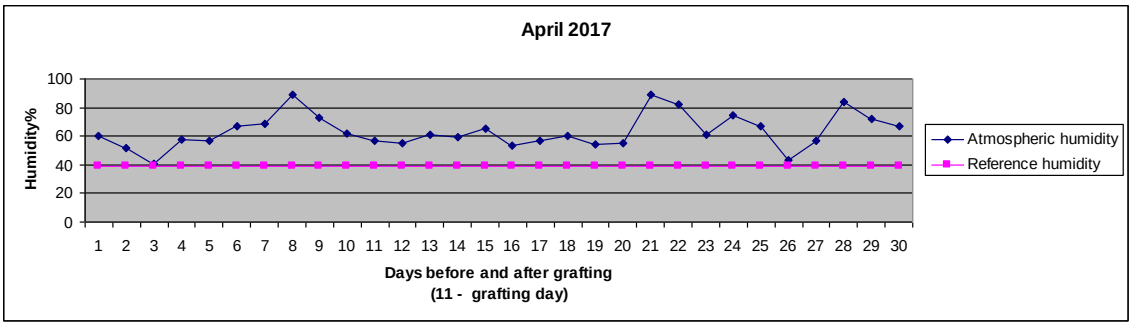

Fig. 2. Trend of daily humidity before and after walnut grafting under controlled condition

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Fig. 3. The location of nursery

Fig. 4. Images from 1st field of nursery

Fig. 5. The preparation of the 1st field for grafting

Fig. 6. The dripping irrigation 2nd field

Fig. 8. Images from 2nd field of nursery

Fig. 9. Walnut tree from 2nd field of nursery