BAHÇE 47 (Özel Sayı 2: Uluslararası Tarım Kongresi (UTAK 2018)): 112–117 (2018)
ISSN 1300–8943

THE EFFECTS OF VARIOUS APPLICATIONS ON ADVENTITIOUS ROOT FORMATION AND ROOTING IN SOME FRUIT SPECIES

Faik Ekmel TEKİNTAŞ[1], Kezban KESKİN[1], Turan KARADENİZ[2]

[1]Adnan Menderes Üniversitesi, Ziraat Fakültesi, Bahçe Bitkileri Bölümü, AYDIN
[2]Abant İzzet Baysal Üniversitesi, Ziraat Fakültesi, Bahçe Bitkileri Bölümü, BOLU
Geliş Tarihi / Received: 02.07.2018 Kabul Tarihi / Accepted: 03.12.2018

ABSTRACT

In the treatment; Cresthaven peach, Iğdır apricot, Margaret pear and Black Bursa fig varieties grafted on seedling rootstock were used. In thesis study; the following applications were made 0.5 cm above the node in one year old 15 shoots which were taken from a tree (each tree is one replication); A) parallel scrapes 2 for each side on the bark to the wood, B) 5 mm. bark compression and 2 parallel scrapes, C) 2 notches to the xylem, D) darkening by wrapping with 1 cm black band on cutting base, E) shaking on the shaker 5 hours long. When the results of the treatment were examined, phenologically; it was seen that the least bud swell and bud burst was in Cresthaven and Iğdır varieties; while the most bud swell and bud burst were respectively in B, E, C, A and D applications in Margaret variety and respectively in E, C, D, B and A applications in Black Bursa variety. Considering the viability rate of cuttings, it was identified that in each different applications on Cresthaven, Iğdır, Margaret and Black Bursa varieties, the viability rate of the cuttings was different due to different applications. When the number of cutting with callus was observed among the cuttings whose rooting happened in 3 different lifting period from rooting unit, the cutting was seen which developed callus with different rate, changing according to applications due to lifting periods. When the number and rate of the rooted cutting was observed, the rooted cutting was seen in C, D and E applications in Cresthaven variety while the rooted cutting was not seen in any application of Iğdır variety due to the liftings. In Margaret variety, the most rooted cutting was respectively on the applications of D as the first, E as the second and A, B and C as the third. In Black Bursa variety, it was identified that all of the cuttings lifted from A, B, C, D and E applications were rooted at the same level.

Keywords: Shoot, application, cutting, callus, rooting

INTRODUCTION

Rooting capability varies according to tree species, and clonal differences are observed within the same species. This situation may arise from genetic characteristics as well as from the characteristics of different growing environments (3).

(5) Stated that 3 conditions are important to be able to ensure rooting in propagation with cutting. These are; 1. Source of cutting and its endogenous state, 2. Practices between the preparation and planting of cutting, 3. Environmental conditions during the rooting period.

(14, 15) and (6), William carried out rooting studies by taking cutting in pear species during the different periods of the year. As a result of the study, they found rooting by 63–93% and 62–63% in William's softwood cuttings and in the hardwood cuttings, respectively.

The easy and short–term propagation of fig is performed by the method of propagation with cutting (10; 9). In a study in which the effect of cutting time, IBA applications and rooting media in fig cuttings on rooting was investigated, rooting was obtained at ratios ranging between 0% and 90% (9).

(13) Investigated the effect of different rooting media in hardwood cuttings of Bursa Siyahı variety of fig on rooting. As a result of the study, the highest rooting ratio was obtained in the sand media (71%). This was followed by peat (31%), perlite (27%) and soil (25%), respectively. In a study carried out by Antunes et al. (1996), they examined the effect of different stratification times, IBA concentrations and rooting media on rooting in fig cuttings and observed that the best root and shoot development in the cuttings planted in the sand: soil mixture at the ratio of 1:1 for which 1000 ppm IBA was applied and stratification was not performed.

In particular, some conditions such as rooting media, water, temperature and light should be at the optimum level for the renewal capability of the cutting to be at the maximum level by protecting its viability during rooting in

propagation with semi–hardwood and softwood cuttings (usually in species and varieties that are rooted difficultly). Daytime temperatures and night temperatures should be 21–27℃ and 15℃, respectively for the realization of rooting. It has been indicated that a high temperature (30℃) is suitable for the start of the root primordium in cutting and that a lower temperature (25℃) is suitable for the root growth (5).

According to (5), the rooting medium has the duties such as keeping the cutting fixed during rooting, providing the necessary moisture for the cutting and allowing the ventilation of the cutting ground. Mixtures in different ratios such as peat moss, sand, vermiculite and perlite can be used as the rooting media. Perlite is a good rooting medium and is mostly preferred because it is easy and cheap to supply.

Adventitious root development is an important factor in plant propagation with cutting. To be able to perform propagation with cutting quickly and successfully depends on the variety and species of the plant to be propagated, the wood structure and the adventitious root formation capability. Although adventitious roots can directly grow up in the plant under natural conditions, they can also grow up as a result of any injury or damage. Adventitious roots can grow up in the nodes and internodes of the stems, on the leaves and in underground stems. While most of the roots are endogenous, it is also possible to see those that develop exogenously (1).

Rooting may start in different tissues of the stems in various plants. The root formation can start from the rind, cambium, callus tissue, primer phloem and medullary rays. In a study carried out, it was reported that meristematic activity in the root formation began around the primer phloem and that the root went out by the disintegration of cortical and epidermal tissues at the end of development along with the addition of two or three eye rays in the activity (4). In the poplar, the root initiation occurs in the primer phloem region. The meristematic activity that starts in this region also affects the medullary rays, and the medullary rays are also involved in the root formation (16).

One–year–old shoots to be prepared as cutting in olives consist of three parts as a base, middle and end cutting, and the middle parts are generally recommended to be prepared as cutting (2).

Although the production of quince with generative methods is easy, vegetative production is necessary so that varieties can maintain their own characteristics (12). It has been known for a long time that the plants propagated by generative production methods do not have the same characteristics as the main plant and they usually lie late fruit (11). Individuals obtained by the asexual propagation methods exactly show the characteristic of the main plant as long as there is not any change like mutation. Although the propagation of quinces with hardwood cuttings, semi–hardwood cuttings and softwood cuttings is possible, propagation with hardwood cuttings is a simpler method than the other methods (17).

(13) Examined the root development, callus formation and differentiation in the cuttings of Bursa Siyahı variety of fig. The root primordium formation was encountered 40 days after the planting of cuttings in the rooting media. It was reported that the primordium was formed near the cambium and passed through the cortex by developing in the phloem. It was stated that there was not any obstacle to the development of primordium and sclerenchymatic cells had no inhibitory effect on the root formation in fig.

(8) Examined the hazelnut hardwood cuttings and indicated that the callus tissue began to form 10 days after planting in cuttings and the callus tissue was largely originated from the cambium. However, they found that parenchymatic cells were also involved in it from time to time. They reported that adventitious root formation started 97 days after the planting of cuttings.

In a study carried out in the production area of Eğirdir Horticultural Research Institute between 1991–1994, semi–hardwood and hardwood cuttings taken from one–year–old shoots of Early Red, Dixired, Cardinal, J.H. Hale, Monreo, Shipper's Late Red, Cherokee and Independence varieties of peach and nectarine were used. After the cuttings were treated with 1000, 2000 and 4000 ppm IBA, they were planted in "soil + pumice + sand" and "soil + perlite" media during April, September, October, November and December periods. The results obtained from the study were summarized as follows: 1. The highest rooting occurred in October, November and December. 2. The best rooting levels in each treatment were in Monreo (55.00%), Cherokee (41.25%) and J.H. Hale (40.00%). Independence variety was rooted in December 1992 by 60.0%, and same success ratio could not be achieved in

other years. 3. Concentrations of 2000 and 4000 ppm of IBA, which was used with the aim of encouraging rooting, were found to be more effective. 4. As the rooting media, "soil + perlite" was found to be more appropriate than "soil + pumice + sand" media in terms of both callusing and rooting. 5. No linear relationship was found between endogenous hormones and rooting. The fact that this relationship could not be revealed was seen natural since the amounts of endogenous hormones could not be determined qualitatively. 6. The plantings in November were observed to have satisfactory results after 2000 or 4000 ppm IBA treatment in the field conditions in the media, the structure of which was improved with perlite (7).

MATERIAL AND METHOD

Materiel

Species and Varieties Included in the Study

Çöğür/Iğdır variety of apricot, Çöğür/ Cresthaven variety of peach, Çöğür/Margaritte variety of pear and Bursa Siyahı variety of fig were used in the study.

Method

15 cuttings with 15–20 cm length were taken from all trees that were selected with 3 replications in a way that there would be 1 tree in each repetition, from among the varieties included in the study at the beginning of February 2015. The following applications were made above 0.5 cm of the first node in 15 pieces of the one–year–old shoot in 3 trees (1 repetition in each tree).

A) Two opposing parallel scratches going down up to the wood only in the rind

B) Rind compression with 5 mm diameter and immediately two opposing parallel scratches

C) 2 opposing notches going down up to the woody tissue

D) Darkening by rolling with 1 cm wide black tape on the cutting ground.

In the middle of February, 15 pieces of one–year–old shoot from all 3 trees (1 repetition in each tree) were cut from the tree without performing any application and E) shaking application was performed in the shaker for 5 hours. In the shaker, the cuttings were placed in empty glasses and shaken.

The number of cuttings with the callus and the number of rooted cuttings that were determined after all these applications had been presented with separate tables and interpreted.

Figure 1. Various applications in the cuttings (Orig.)

RESLUTS

After various applications, in the cuttings that were planted to be rooted, the callus and rooting values observed on the 44. day after planting (final uprooting time) were observed as following.

Number of Cuttings with The Callus (Number/Cutting)

3 scale values ranging between 1/4 and 1 were used to determine the level of callusing in the cuttings, and accordingly scoring was made. The values determined are presented in Table 2 and the related pictures are presented in Figure 2.

Number of Rooted Steel (Piece) and Rooting Percentages (%)

The number of rooted cuttings was determined by taking into account the rooted cuttings among the cuttings that were uprooted. The rooting percentage was calculated by observing the cuttings that were uprooted during the final uprootings performed 44 days after planting. The number of rooted cuttings during the final uprooting time in the cuttings are collectively presented in table 3, and the pictures of the rooted cuttings are presented in Figure 3.

Table 2. Number of cuttings with the callus (piece/cutting) during the final uprooting time

Final uprooting	Applications	Number of the cuttings uprooted	¼ callus	½ callus	Whole
Cresthaven	A	39	–	–	–
	B	39	–	–	–
	C	39	–	–	–
	D	39	–	–	–
	E	39	–	–	–
Iğdir	A	39	–	–	–
	B	39	–	–	–
	C	39	–	–	–
	D	39	–	–	–
	E	39	–	–	–
Margaritte	A	39	3	–	1
	B	39	3	1	–
	C	39	–	1	3
	D	37	–	3	1
	E	36	9	–	3
Bursa Siyahi	A	32	–	–	–
	B	24	–	–	–
	C	15	–	–	–
	D	27	–	–	–
	E	22	–	–	–

Figure 2. Examples of cuttings formed with the callus at different ratios

In the final uprootings performed 44 days after planting in the cuttings, while no rooted cutting was encountered in Cresthaven and Iğdır cuttings, rooting occurred in Margaritte and Bursa Siyahı cuttings. Although root formation was difficult in Margaritte cuttings, rooting occurred in applications A and D. In Bursa Siyahı cuttings, 100% rooting success was achieved due to the ease of root formation. In general, the rooting of the cuttings taken from Bursa Siyahı variety was easy, the rooting of the cuttings taken from the other varieties and species was either difficult or never occurred. However, rooting occurred in the cuttings that were difficult to be rooted even if just a bit thanks to different applications performed on the species and varieties.

Table 3. The number of rooted cuttings during the final uprooting time (piece) and their percentages (%)

Final uprooting	Applications	Number of the cuttings uprooted	Number of rooted cuttings	Percentage of rooted cuttings (%)
Cresthaven	A	39	–	–
	B	39	–	–
	C	39	–	–
	D	39	–	–
	E	39	–	–
Iğdir	A	39	–	–
	B	39	–	–
	C	39	–	–
	D	39	–	–
	E	39	–	–
Margaritte	A	39	1	2,56
	B	39	–	–
	C	39	–	–
	D	37	2	5,40
	E	36	–	–
Bursa Siyahi	A	32	32	100
	B	24	24	100
	C	15	15	100
	D	27	27	100
	E	22	22	100

DISCUSSIONS

When the results of this study are evaluated, it is understood that different applications performed on the shoots had different effects on the basis of species and varieties and they were not very effective in general. Useful results can be presented with the likelihood that such applications performed on trees while being

connected to the main plant would be more effective, and the testing of different doses/combinations of growth regulatory applications and application times in the studies to be carried out later.

Figure 3. The image of the cutting forming root during the final uprooting time (Org.)

In the final uprootings performed 44 days after planting in the cuttings, while no rooted cutting was encountered in Cresthaven and Iğdır cuttings, rooting occurred in Margaritte and Bursa Siyahı cuttings. Although root formation was difficult in Margaritte cuttings, rooting occurred in applications A and D. In Bursa Siyahı cuttings, 100% rooting success was achieved due to the ease of root formation. In general, the rooting of the cuttings taken from Bursa Siyahı variety was easy, the rooting of the cuttings taken from the other varieties and species was either difficult or never occurred. However, rooting occurred in the cuttings that were difficult to be rooted even if just a bit thanks to different applications performed on the species and varieties. When the results of this study are evaluated, it is understood that different applications performed on shoots had different effects on the basis of species and varieties and they were not very effective in general. Useful results can be presented with the likelihood that such applications performed on trees while being connected to the main plant would be more effective, and the testing of different doses/combinations of growth regulatory applications and application times in the studies to be carried out later.

REFERENCES

1. Esau, K., 1977. Anatomy of seed plants 2. *Edition, New York*.
2. Fabbri, A., Bartolini, G., Lambardi, M., Kailis, G.S., 2004. Olive propagation manual. *CSIRO Publ; 141p.*
3. Fröhlich, H.J., 1959. Grundlagen und Voraussetzungen der autovegetativen. *Vermehrung Silvae Genetica 8(5):49–58.*
4. Girouard, R.M., 1967. Initiation and development of adventitious roots in stem cuttings of hederahelix. *Can. J. Bot. 45:1883–1886*.
5. Hartmann, H.T., Kester, D.E., Davies, F.T., Geneve, R.L., 2002. Plant propagation, principles and practices. *7. Ed., Prentice Hall Inc., New Jersey, 880p*.
6. Hermann, L., 1968. Bouturage herbace chez *Prus communis* (Variete Williams). *Ann. Amelior. Plantes. 18(4):447–454.*
7. Kankaya, A., 1996. Şeftalilerin çelikle çoğaltılması ve köklenme ile bünyesel hormonlar arasındaki ilişkiler (Doktora Tezi). *Yüzüncü Yıl Üniversitesi Fen Bilimleri Enstitüsü, Van*.
8. Koyuncu, F., Tekintaş, F.E., 1999. Fındık çeliklerinde köklenmenin anatomik ve histolojik olarak incelenmesi üzerine

araştırmalar. *Türkiye 3. Ulusal Fidancılık Sempozyumu, 25–29 Eylül 2000, İzmir.*

9. Küden, A.B., Kaska, N., Yılmaz, M.A., 1993. Bursa siyahi ve 01.IN.10 incir çeşitlerinde farklı çelik alma zamanları ile köklendirme ortamları ve IBA uygulamalarının karşılaştırılması. *Çukurova Üniversitesi Ziraat Fakültesi Dergisi 8(4):181–188.*
10. Özbek, S., 1978. Özel meyvecilik. *Çukurova Üniversitesi Ziraat Fakültesi Yayınları, 128. Ders Kitabı: 11, 485s.*
11. Roach, F.A., 1988. History and evolution of fruit crops. *Hort. Science 23(1):51–55.*
12. Rumpunen, K., 2002. Chaenomeles: potential new fruit crop for northern Europe. *In: Janick J. & Whipkey A. (Eds.) Trends in new crops and new uses. ASHA Press, Alexandria, VA, USA 385–392.*
13. Tekintaş, F.E., Seferoğlu, G., 1998. Propagation of fig by hardwood cuttings in the field conditions (*Ficus carica* L.). *Acta Horticulturae 480:119–120.*
14. Thibault, R., Hermann, L., 1966. Essais de bouturage herbace de La variete Williams (*Pyrus communis* L.). *Ann. Amelior. Plant. 16(3):273–298.*
15. Thibault, R., Hermann, L., 1971. Essais de bouturage herbace de La variete Williams (*Pyrus communis* L.). *Ann. Amelior. Plant. 16(3):273–298.*
16. Toker, M.C., Yalçın, İ., 1989. Üç farklı kavak türünde (Populus) kabuk anatomisi ve çeliklerinde kök oluşumu. *Cumhuriyet Üniversitesi Fen–Edebiyat Fakültesi Fen Bilimleri Dergisi 8:47–62.*
17. Tsipouridis, C., Thomidis, T., Michailides, Z., 2005. Influence of some external factors on the rooting of GF677, peach and nectarine shoot hardwood cuttings. *Australian Journal of Experimental Agriculture 45(1):107–113.*