7. Sparks, D. 1992. Pecan cultivars - The orchard's foundation. Pecan Production Innovations, Watkinsville, Ga.
8. Sparks, D. 1995. Kernel development in pecan - A function of soil moisture. Annu. Rpt. Northern Nut Growers Assn. 86: 116-118.
9. Sparks, D. 1996. A climatic model for pecan production under humid conditions. J. Amer. Soc. Hort. Sci. 121:908-912.
10. Sparks, D. 2000. Management of pecan nut growth. Annu. Rpt. Northern Nut Growers Assn. 91:35-50.
11. Sparks, D. 2003. Effect of topography, crop, and irrigation on pecan nut volume and percentage kernel. Annu. Rpt. Northern Nut Growers Assn. (In press).

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Effect of Transplanting Rootstocks Before Grafting on Xylem Exudation and Graft Success in Walnut

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Abstract

The effect of transplanting seedlings before grafting on xylem exudation of seedlings and graft success was studied in early spring grafts of walnut under uncontrolled conditions. Scions of 'Yalova-1' walnut were grafted by the whip and tongue method on one- and two-year-old walnut (*J. regia* L.) seedlings on two dates (15 March and 15 April). Transplanting seedlings did not affect either the amount of xylem exudate or the graft survival on the earlier date (March 15), but decreased the xylem exudation and increased graft survival of two-year-old rootstocks on the later date (April 15). On this date, graft survival percentage of two-year-old rootstocks was increased 20% in 2000 and 25% in 2001 by transplanting seedlings. Xylem sap exudate of two-year-old seedlings - regarded as one of the negative factors for graft success in walnuts, was decreased 2.0 ml in 2000 and 1.3 ml in 2001 by transplanting seedlings before grafting.

Introduction

Walnut (*J. regia* L.) is one of the nut crops gaining in importance in the world. Grafting is still the most common vegetative propagation method for walnut, but there are some problems that may hinder the advancement of good cultivars.

Encouraging progress of grafting technique for walnut has been made in recent years. However, the graft survival percentage of walnut may be low and unstable. Some researchers consider that one of the main factors affecting grafting success is xylem exudation (1,4,5,6,7, 10, 11).

Xylem sap exudation, often called bleeding, occurs in other fruits species such as grape, chestnut and hazelnut, but the bleeding is more severe in walnut than other species. Xylem sap exudation results from root pressure and is increased by rising soil temperature and humidity in the spring (3,4,5,6)

According to Prataviera et al. (7), the existence of juglone (5-hydroxyl-1 4-naphthoquinone) in xylem sap exudates of walnut blocks callus formation at the graft union. Contrarily, Rongting and Pinghai (8,9) reported that there was a only trace amount of juglone in xylem exudate and that negative effects of xylem exudate on callus formation was not due to juglone. They stated that xylem sap exudation caus-

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es anaerobic respiration and negatively affects callus initiation and differentiation at the graft union.

Barut (1) reported that pulling up and transferring rootstocks into pots before grafting decreased bleeding severity and increased graft success in walnut.

The objective of the present study was to examine the effect of transplanting seedlings before grafting on the amount of xylem sap exudate and the graft survival in early spring graft of walnut.

Materials and Methods

The study was conducted under uncontrolled conditions in 2000 and 2001. Scions of 'Yalova-1' walnut were grafted on one- and two-year-old walnut (*J. regia* L.) seedlings on two dates (March 15 and April 15). Before grafting, half of the seedlings were pulled up and transferred into another location. The other half of the seedlings was kept intact and grafted in place. The experiment was conducted with four replications, each replicate having 20 grafts. After grafting, cylindrical plastic pipes were fitted around the graft area and filled with soil in order to protect the grafting area from cold and moisture loss (2). This method is widely used in early spring walnut graft in Turkey.

To determine the amount of xylem sap exudate, 15 seedlings for each treatment were not grafted. Tops of these seedlings were removed and the cut end bent over. Plastic bags were placed on the cut tops of the seedlings for three days. The xylem exudates collected in these bags were measured by using a volumetric cylinder.

The survival of grafts was checked 60 days after grafting, and expressed as a percentage. Statistical analysis was carried out by analysis of variance and means were compared by Duncan's multiple range test (0.05).

Results and Discussion

The amount of xylem sap exudate was less on the earlier date (March 15) than on the later date (April 15) in both years (Tables 1 and 2). Likewise, some researchers (1,3) reported that xylem exudation was less on earlier dates and increased with higher humidity and soil temperatures during the spring period. On the other hand, in spite of less xylem sap exudate, graft success was lower in March than in April. This situation may have resulted from ecological conditions such as temperature which may have been more appropriate for grafts in April than in March. On March 15, transplanting seedlings did not significantly affect either xylem sap exudation or graft success on either one-year-old or two-year-old rootstocks in either year (Tables 1 and 2).

On April 15, graft success on two-year-old rootstocks was greater than on one-year-old rootstocks in both 2000 and 2001, although the sap exudate was less in one-year-old than two-year-old seedlings (Tables 1 and 2). On April 15, transplantation of rootstocks before grafting significantly decreased xylem sap exudation of both one-year-old and two-year-rootstocks. Transplanting did not significantly affect graft success on one-year-old rootstocks. However, it significantly increased graft success on two-year-old rootstocks. This

Table 1. Amount of xylem exudate and graft success on transplanted and non-transplanted one- and two-year-old seedlings on two dates in 2000

Date of grafting	Age of rootstock	Amount of xylem ex. (ml)		Percentage of graft survival	
		Transplanted	Non transplanted	Transplanted	Non transplanted
March 15th	1	0.45 c[Z]	0.50 c	20 f	20 f
	2	0.55 c	0.60 c	35 e	40 de
April 15th	1	0.80 bc	1.10 bc	50 c	45 cd
	2	1.50 b	3.50 a	80 a	60 b

[Z]Means followed by a letter in common are not significantly different by Duncan's multiple range test (0.05)

Table 2. Amount of xylem exudate and graft success on transplanted and non-transplanted one- and two-year-old seedlings on two dates in 2001.

Date of grafting	Age of rootstock	Amount of xylem ex. (ml)		Percentage of graft survival	
		Transplanted	Non transplanted	Transplanted	Non transplanted
March 15th	1	0.30 c[Z]	0.40 c	20 e	25 de
	2	0.40 c	0.50 c	25 de	30 d
April 15th	1	0.60 c	1.50 b	55 bc	50 c
	2	1.20 b	2.50 a	85 a	60 b

[Z]Means followed by a letter in common are not significantly different by Duncan's multiple range test (0.05)

result is agreement with those Barut (1), who reported that transferring seedlings to pots before grafting increased success and that bleeding severity had a significant effect on graft success. He hypothesized that the transfer of seedlings caused a negative effect on water absorption by roots which made bleeding difficult.

This study has shown that the amount of the xylem sap exudation of seedlings and success of early spring graft of walnut are affected by the grafting date and the age of rootstocks. Grafting at the later date (April 15) was more successful than earlier date (March 15) and two-year-old seedlings had better success than one-year-old seedlings. The amount of xylem sap exudate of two-year-old seedlings was more on the later date (April 15). However, transplanting two-year-old seedlings before grafting decreased xylem sap exudate and increased graft success on this date.

Although transplanting seedlings before grafting requires additional handling for commercial propagation, it can significantly increase graft success by decreasing xylem exudate in periods when xylem exudate is severe in walnut seedling.

Literature Cited

1. Barut, E. 2001. Different whip grafting methods on walnut. Acta Hort. 544:511-503.
2. Barut, E. and A. Eris. 1987. A research on application of fall and growing season grafting and budding on walnuts (in Turkish). Bahçe. 16: 3-11.
3. Eris, A., E. Barut 1989. A research on yearly variation of bleeding severity in the walnut (*J. regia* L). (in Turkish). Bahçe. 18: 3-7.
4. Lagerstedt, H. B. 1979. Propagation-seed, grafting, budding. Nut Tree Culture in North America (Ed: R. A. Jaynes). North. Nut Grow. Assoc. Broken Arrow Road Hamden, CT. 06518. pp: 240-271.
5. Lagerstedt, H. B. and, W. W. Roberts. 1972. Walnut grafting in Oregon. Problems and solutions. 63. Annual Report of the Northern Nut Growers Assoc. pp:17-34.
6. Knuiyuki, A.H. and H.I. Forde. 1985. Propagation. Walnut orchard management. (Ed: D. E. Ramos, D. J. Durzan) Cooperative Extension, University of California, Division of Agriculture, USA. pp:34-36.
7. Prataviera, A.G., A.H. Kuniyuki and K. Ryugo. 1983. Growth inhibitors in xylem exudates of Persian walnut (*J. regia* L.) and their possible role in graft failure. J. Amer. Soc. Hort. Sci. 108: 1043-1045.
8. Rongting, X. and D. Pinghai. 1990. Theory and practice of walnut grafting. Acta Hort. 284: 69-88.
9. Rongting, X. and D. Pinghai. 1993. A study on the uniting process of walnut grafting and the factors affecting. Acta Hort. 311: 160-170.
10. Tekintas, F.E. 1988. The investigations on graft formation and grafting problems in the walnuts (*J. regia* L). PhD Thesis (in Turkish). Ege University Faculty of Agriculture, Department of Horticulture, Izmir, Turkey.
11. Yildiz K, 1997.The effect on graft success of buds taken from different places of the scion in walnut (*J. regia* L) PhD Thesis (in Turkish).Yüzüncü Yil University, Faculty of Agriculture, Department of Horticulture, Van, Turkey