

The Effect of Grafting Periods on Graft Success in Topworking of Walnut

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Abstract

In Turkey, the demand on walnut production is increasing everyday. However, Turkey's walnut production is so low according to number of trees it has. Most of these trees are not grafted (seedlings), grafted with wrong named cultivar or not suitable for the region's climate conditions. A lot of farmers tended to cut down those trees, but these trees can be graft by suitable cultivars. This study was carried out to determine the best grafting time for walnut in Samsun ecological conditions. For this aim, in 2014 (Tekkeköy district of Samsun) and 2015 (Alaçam district of Samsun) four grafting times (5 April, 20 April, 5 May and 20 May) were tested. In the study, graft success (%), shoot length (cm) and diameter (mm) were examined. As a result of the study, grafting times were statistically affected the graft success. The best graft success was obtained from the graft made on 20 May. Also, shoot length and diameter were affected by grafting times. The longest and thickest shoots were obtained from the graft made on 5 April. To obtain longer shoots and better graft success, grafting should be made in the early and without precipitation period.

Keywords: Grafting times, xylem exudation, *Juglans regia* L.

1. Introduction

Walnut is an important nut tree of the world. World's total walnut production is 3.747.549 tons and China is in the first place with 1.785.879 tons of production (FAOSTAT 2018). There are 20 species of walnuts which are spread in subtropical and temperate climate conditions in the world. Among these species *Juglans regia* L. is the most spread species because of its economic importance (Ramos 1997; Şen 2009). Anatolia is one of the native land of *Juglans regia* L. Turkey's walnut production is 195.000 tons. Kahramanmaraş is in the first place with 10.902 tons (TUIK 2018). The demand of the market on walnut is rapidly increasing in Turkey. Unfortunately, in Turkey the yield per plant is lower than the main producer countries (FAOSTAT 2018). There are 8.766.811 plants which bears nuts in Turkey (TUIK 2018). The reasons for the low yield are, most of the trees are not grafted (seedlings), grafted with misnomer cultivars or they are not suitable for the region's ecological conditions. Also, most of these tree's yield and nut qualities are so low (Karadeniz 2014). Because of these reasons, growers used to cut down or uproot those trees. So, they prefer to renew the orchards. To earn money, farmers should buy new grafted plants and then wait until the end of their precocity period. This leads to lose time and money lost. To solve these problems, the best method is grafting those low yielded walnut trees with high yielded cultivars (Kömür and Sütyemez 2017). There are lots of grafting methods in walnut grafting, however for topworking, bark grafting method is most likely suggested (Dehghan et al., 2009; Serdar et al., 2013;

Karadeniz, 2014; Rezaee et al., 2014; Akyüz et al., 2016);).

For this purpose, we have carried out a study about cutting times of the rootstock's top and rootstock's stem thickness (Akyüz et al., 2016). Walnut requires higher temperature for graft healing than the other temperature fruit species. Therefore, we just tried one grafting time having high temperature (20 June). As a result of this study, we suggested cutting the rootstock's top before leaf appearance and grafting thicker rootstocks. Even in rootstocks top were cut in early period (20 April), due to probably late grafting time, shoot development and lignifying were poor. As a result of the previous study, to determine the best time for grafting were required.

We aimed to find out the effects of different grafting times on graft success of top-working of walnut in this study.

2. Material and Method

The study was carried out at Samsun, Turkey. In 2014 at Tekkeköy and in 2015 at Alaçam districts. Both orchards were established with 'Yalova-1', 'Şebın' and 'Bilecik' cultivars grafted on seedlings in 2000. Due to low yield, these grafted trees were used as rootstocks for topworking. Also, 'Chandler' cultivar used as scion, which had been determined as suitable cultivar for this region (Öztürk et al., 2016).

'Chandler' scion woods were cut in dormant period (February) and they were immediately put inside wet perlite and stored at 2-4°C until grafting dates. The plants top was cut 15 cm above from the graft area on 15 March, before bud breaking (Akyüz et al., 2016). Graftings were made by bark grafting method for topworking (Serdar et al., 2013; Er et al., 2017). In order to determine the effects of grafting times on graft success, grafting's were made on 5 April, 20 April, 5 May and 20 May in 2015 and 2016 years.

In the study, the graft success (sprouting of scion) ratio was determined 60 days later after grafting. Lengths (cm) and diameters (mm) of shoots were measured in December. Shoot length was measured by meter and shoot diameter was measured by digital caliper.

The study was designed by randomized block method with 3 replications. Each replication contained 5 plants. The data were evaluated by SPSS 21.0 statistical program and the differences between the averages were evaluated by 'Duncan Multiple Range Test' ($P < 0.05$).

3. Results and Discussions

As a result of this study, graft success ratios were found higher in the grafts made on 20 May (100 %) and 5 April (96.7 %) in 2014. These results were followed by the grafts made on 5 May (89 %) and 20 April (87.7 %) (Table 1). There are different factors that can affect graft success on fruit species. Among these species, walnut needs more care than others because of its xylem exudation problem and high temperature requirement for callus formation (Lagerstedt 1979; Knuyuki and Forde 1985; Yildiz and Yılmaz 2003; Şen 2009; Akyüz et al., 2016; Akyüz and Serdar 2017). Dong (2010), stated that there is a positive correlation between xylem exudation and precipitation. In 2014, higher precipitations were recorded after grafting made on 20 April and 5 May than the other grafting times (TSMS, 2018). We thought that as a result of higher precipitations after 20 April and 5 May xylem exudation increased and had a negatively effect on graft success.

In 2015, there were no statistically differences in terms of graft success amongst the grafting times. We thought that all grafting times had similar precipitations in this year. However, the best graft success ratio was obtained from the grafts made on 20 May (97.3%) (Table 1). Kömür and Sütyemez (2017) also obtained 91 and 97% graft success with cleft grafting method at different ages and growing stages of walnut trees. The obtained results from this study is in accordance with previous studies about graft success in walnut (Dehghan et al., 2009; Karadeniz, 2014; Akyüz et al., 2016; Kömür and Sütyemez, 2017).

Shoot developments decreased depending on late grafting times in both years. The grafts made on 5 April had longer vegetation period than 20 April, 5 May and 20 May. So, the longest shoots were obtained on 5 April (respectively, 191 cm in 2014, 264.1 cm in 2015) (Table 1). Similar results were measured also from shoot diameter. The thickest shoot diameter was measured from the grafts made on 5 April (respectively, 29.6 mm in 2014 and 31.7 mm in 2015). Kömür and Sütyemez (2017) also obtained 178-189 cm shoot length with cleft grafting method at different ages and growing stages of walnut trees. In our study, we measured longer shoots especially from the grafts made on 5 April. It may be resulted from ecology, cultivar, rootstock's thickness and cultural practices.

In the study, there were no differences between early and late grafting times (5 April and 20 May) in terms of graft success. Akyüz and Serdar (2017) cited that growing stages of rootstocks affects to graft success more than temperature for walnut grafted nursery tree production. However, we didn't observe any differences for graft success amongst the grafting periods in adult trees. We detected that precipitation has higher effects on graft success than the growing stages of rootstocks in the topworking of walnut.

Table 1. The effect of grafting times on graft success (%), shoot length (cm) and shoot diameter (mm) on walnut.

Year	Grafting time	Graft Success (%)	Shoot Length (cm)	Shoot Diameter (mm)
2014	5 April	96.7 a	191.0 a	29.6 a
	20 April	87.7 b	187.9 a	27.9 ab
	5 May	89.0 b	152.5 ab	24.0 bc
	20 May	100.0 a	136.9 b	22.7 c
2015	5 April	89.7 a	264.1 a	31.7 a
	20 April	89.0 a	224.8 b	27.2 b
	5 May	91.7 a	205.3 c	24.6 c
	20 May	97.3 a	181.5 d	22.6 d
SEM		2.09	9.25	0.77
Factor Means				
Grafting Time	5 April	93.2 ab*	227.5 a	30.6 a
	20 April	88.3 b	206.5 b	27.6 b
	5 May	90.3 b	178.9 c	24.3 c
	20 May	98.7 a	159.2 d	22.6 c
Year	2014	93.3 a	167.1 b	26.1 a
	2015	91.9 a	217.3 a	26.5 a
P				
Grafting Time		P<0.014	P<0.005	P<0.002
Year		P<0.567	P<0.001	P<0.588
Grafting Time x Year		P<0.516	P<0.202	P<0.651

4. Conclusion

As a result of the study, we advise that topworking of walnut should be started beginning of the April immediately after bark separating. However, grafting times should be arranged according to weather forecast. Walnut grafting should be postponed in rainy periods. But, if it postponed for a long time, it will have negative effect on shoot development.

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