

**THE EFFECTS OF PARAFFIN AND PARAFILM APPLICATIONS
AND DIFFERENT ROOTSTOCKS ON YIELD OF GRAFTED VINE
IN 'BLACK MAGIC' GRAPE CULTIVAR**

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ABSTRACT

The scions belonging to 'Black Magic' grape cultivar were grafted on '41B', '1103 P', 'Fercal' and 'SO4' American rootstock cuttings using omega grafting method in the experiment. Paraffin was applied to one half of the grafted cuttings. The other half was wrapped with parafilm and then paraffin was applied. Grafted cuttings were planted in perlite medium at 3.0 x 3.5 cm intervals inside plastic buckets and kept in the stratification room for 4 weeks. Grafted cuttings, which had been maintained under room conditions for one week, were then grown for two months under unheated greenhouse conditions. In order to determine rootstock and application effects, bud burst ratio (%), callus formation rate (%), callus formation degree (0-4), rooting ratio (%), rooting degree (0-4), shoot length (cm), shoot diameter (mm) and grafted vine ratio (%) were examined. According to the results of the study, it was determined that paraffin+parafilm application yielded better results than paraffin application in terms of bud burst ratio (respectively 70.83%, 53.33%), callus formation ratio (respectively 83.75%, 69.58%) and yield of grafted-vines (respectively 68.33%, 51.67%). In terms of the rootstocks, bud burst ratio was determined to be the highest in SO4 rootstock (71.67%) and the lowest in Fercal (54.17%). 1103 P rootstock yielded a highest value than other rootstocks in terms of shoot length (26.17 cm), callus rate at grafting surface (88.33%), and rooting ratio (97.50%). The effect of rootstocks on shoot diameter, rooting degree, and grafted vine ratio was found to be similar.

Key words: *Grafted vine, Rootstocks, Paraffin, Parafilm.*

INTRODUCTION

The production of grapes for early table consumption is becoming more popular in the Mediterranean region of Turkey (Kamilo lu et al., 2011). In Turkey, the Mediterranean region has an important role in grape production, producing 715.781 t in 79.468 ha of vineyard (TU K, 2017). The most appropriate ecology for early grapes cultivars that can be marketed easily and for higher prices in domestic and

foreign markets is the coastline of the Mediterranean region (Söylemezo lu et al., 2005). In the ecology of Mediterranean region, it is observed that producers in the area are quite willing to try early varieties aimed at early-grown grape cultivation. Black magic, which is a new grape variety for the region, is an early variety, with good cluster and berry shape. The clusters are medium sized, conical occasionally winged shaped and loose with an average bunch weight of 450-500 g. The berry is medium sized to large with an average weight of 5.5-6.0 g. The berry is ovoid in shape with dark blue coloration of the skin, neutral taste and 1-2 grape seeds per berry (Dimovska et al., 2013).

The grape phylloxera is one of the worst threats to modern viticulture world-wide. Most of the vineyard areas in Turkey are contaminated by phylloxera. In region where phylloxera occurs, grafting is an indispensable technic of Turkish viticulture. The grafting of *Vitis vinifera* varieties on American rootstocks is still considered to be the most effective means of controlling phylloxera (Vrsic et al., 2015).

The bench grafting is the main technique used for grapevine propagation (Regina et al., 2012). The most common graft section technique in this aspect is Omega. This grafting technique mainly involves the use of cuttings with a diameter of 7 to 10 mm. Tight grip of rootstock and scion tissues throughout callus formation process influences the success of grafting (Çelik et al., 1998). It is considered that, besides its effects on changes on the internal structure of cutting, cutting diameter physically affects tighter grip of scion and rootstock in omega grafting, and increases the success of grafting. As a matter of fact, Çelik et al. (1992) reported that cuttings with a diameter of 12 to 15 mm increase the grafted cutting ratio to be planted in the nursery by 27.92% to 43.14% more than cuttings with a diameter of 8 mm. Accordingly, in this grafting technique, it is important to ensure tight contact between scion and rootstock until callus formation is ensured particularly on cuttings with a certain diameter range.

Vine sapling production in Turkey is 3.362.663 in 2017 (FÜAB, 2017). This value is well below our country's annual vine sapling requirement. The production of grapevine sapling in Mediterranean region (163.400) is also quite low in agricultural regions of Turkey.

The main goal of this research was to study the influences of paraffin and parafilm applications and some grape rootstocks; '41B', '1103 P', 'Fercal' and 'SO4' on yield of grafted vine of 'Black Magic' grapevines in Eastern Mediterranean Region.

MATERIAL AND METHODS

This research was conducted in 2016 at the Department of Horticulture of Hatay Mustafa Kemal University (Turkey). The scions belonging to 'Black Magic' grape cultivar were grafted on '41B', '1103 P', 'Fercal' and 'SO4' American rootstock cuttings using omega grafting method in the experiment (on March 21, 2016). Paraffin was applied to one half of the grafted cuttings, the other half was rolled with special plastic parafilm (Zenginbal, 2015) and then paraffin was applied (Hamdan and Basheer-Salimia, 2010), (Figure 1a,b,c). Grafted cuttings were

planted in perlite medium at 3.0 x 3.5 cm intervals and 15 cm depth inside plastic buckets and kept in the stratification room for 4 weeks (Figure 1d,e). Grafted cuttings, which had been maintained under room conditions for one week, were then grown for about 2 months under unheated greenhouse conditions (Figure 1f). In order to determine rootstock and application effects, rootstock cutting diameter (mm), callus formation rate (%), callus formation degree (0-4), rooting ratio (%), rooting degree (0-4), bud burst ratio (%), shoot length (cm), shoot diameter (mm) and grafted vine ratio (%) were examined (Figure 1g). In experiment, temperature and humidity values within the stratification room and the greenhouse were recorded with 30-minute intervals using a datalogger.

The research was planned so that there would be three replications and 20 grafted cuttings would be involved in each replication in 'Two Factor Completely Randomised Design' pattern. Variance analyses of obtained data were made by using Mstat-C computer software. Differences between the averages were evaluated by Tukey test at 0.05 or 0.01. Angular transformation was applied to % values.



Figure 1. General appearances in some stages of the experiment

RESULT AND DISCUSSION

Temperature and humidity values recorded in the experiment are provided in Figure 2. as weekly averages. In order to accelerate the formation of callus at the graft surface, temperature should be kept at 26-28°C, while relative humidity should be kept at 85-90% in the stratification room (Celik, 2007). During the study, temperature varied between 24.37-26.18 °C and relative humidity varied between 89.55-96.26% in the stratification room. During the growing period in the greenhouse (8 weeks), average humidity was recorded as 67.43±6.88% and average temperature was recorded as 25.36±2.51 °C

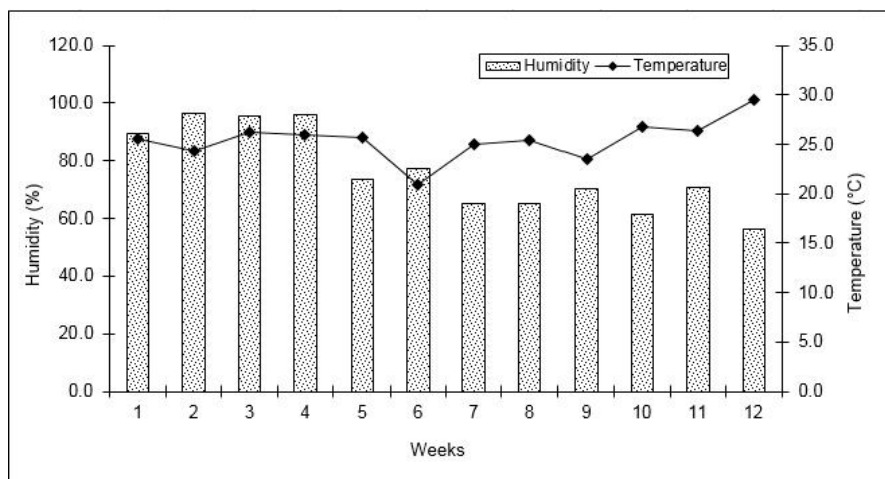


Figure 2. Changes in temperature and relative humidity during the experiment

The results obtained in terms of examined parameters according to rootstocks and applications in the study are given in Table 1 and Table 2.

During the trial, rootstock, application, and rootstock x application interaction were found to be statistically significant at the level of 1 % in terms of the ratio of callus formation at grafting surface. While callus formation ratio was 95.00 % on cuttings grafted on 1103 P rootstock, on which parafilm + paraffin was applied, cuttings grafted on 41 B and Fercal rootstocks, on which paraffin was applied, yielded the lowest value (respectively 56.67 %, 58.33 %). While application and rootstock x application interaction was found to be insignificant in terms of callus formation degree at grafting surface, the difference between rootstocks was found to be statistically significant (1%). The highest callus formation degree was identified on SO4 rootstock with 2.92. Although no difference was observed between rootstocks and applications in terms of rooting degree of cuttings, it was determined that 1103 P yielded the highest value (97.50 %) and Fercal yielded the lowest value (81.67 %) in terms of rooting ratio (Table 1).

During their study conducted to find out the effect of different IBA doses, Celik and Gargin (2009) reported that rooting degrees varied between 2.31-2.97 according to rootstock averages. Kamiloglu and Güler (2014) reported in their study that 1103 P rootstock yielded a higher value than SO4 and 41 B in terms of rooting ratio. It is seen that the findings obtained from this study support the results of the researchers.

There are endogenous and exogenous factors that affect the termination of dormancy in *Vitis vinifera*. Exogenous factors are temperature, light intensity, day length, oxygen, water, minerals, and cultural operations. On the other hand, internal factors are plant growth regulators, enzymes, amino acids, proteins, lipids and carbohydrates (Eris and Celik, 1981). It is seen in this study that rootstocks are effective on the bursting of buds in grafted cuttings. As a matter of fact, in terms of bud burst ratio, the differences between rootstocks were found to be significant at

the level of 5 %, and the differences between applications were found to be significant at the level of 1%, while rootstock x application interaction was not found to be statistically significant. Bud burst ratio was determined to be the highest in SO4 rootstock (71.67 %) and the lowest in Fercal (54.17%).

Table 1. The effects of paraffin and parafilm+paraffin on rooting and callus formation for Black Magic grafted onto 4 rootstock

Rootstock	Treatment	Rootstock cutting diameter (mm)	Callus formation rate (%)	Callus formation degree (0-4)	Rooting ratio (%)	Rooting degree (0-4)
41 B	Paraffin	7.49 abc ¹	56.67(48.87) d	2.43	88.33(70.50)	2.82
	Parafilm+paraffin	7.78 a	86.67(68.67) b	3.03	90.00(71.97)	2.53
	Mean	7.64 A	71.67(58.77) C	2.73 AB	89.17(71.23) AB	2.68
1103 P	Paraffin	7.19 bcd	81.67(64.67) bc	2.33	98.33(85.70)	2.90
	Parafilm+Paraffin	7.19 bcd	95.00(77.10) a	2.20	96.67(83.87)	2.92
	Mean	7.19 B	88.33(70.88) A	2.27 B	97.50(84.78) A	2.91
Fercal	Paraffin	6.65 d	58.33(49.83) d	2.80	75.00(60.27)	2.80
	Parafilm+Paraffin	6.96 cd	70.00(56.83) cd	2.70	83.33(73.53)	2.86
	Mean	6.81 C	64.17(53.33) D	2.75 AB	81.67(66.90) B	2.83
SO4	Paraffin	7.70 ab	81.67(64.67) bc	2.60	83.33(66.83)	2.80
	Parafilm+Paraffin	6.90 d	83.33(65.93) b	3.23	93.33(75.27)	3.18
	Mean	7.30 AB	82.50(65.30) B	2.92 A	88.33(71.05) AB	2.98
Treatment Mean	Paraffin	7.26	69.58(57.01) Y	2.54	86.25(70.83)	2.83
	Parafilm+paraffin	7.21	83.75(67.13) X	2.79	92.08(76.16)	2.87
D Rootstock		**	**	**	**	N.S.
D Treatment		N.S.	**	N.S.	N.S.	N.S.
D RootstockxTreatment		**	**	N.S.	N.S.	N.S.

¹: Values not associated with the same letter are significantly different (P<0.05 or P<0.01)

*: Significant at 0.05 level ; **: Significant at 0.01 level; N.S.: Not Significant

However, it can be suggested that, in addition to the rootstocks, the differences in internal structure of scions used for grafting might also have been effective on the bursting ratio of buds. Parafilm + paraffin application (70.83 %) yielded the highest values in terms of this characteristic. The longer shoots were obtained from plants grafted on 1103 P than other rootstocks. The effects of rootstocks on shoot diameter and grafted vine ratio was not found significant. In terms of treatments, shoot diameter and grafted grapevines were found to be statistically significant at the levels of respectively 5 % and 1 %. Parafilm+paraffin application yielded better results than paraffin application (respectively 68.33 %, 51.67 %) in terms of grafted vine ratio (Table 2).

Table 2. The effects of paraffin and parafilm+paraffin on bud burst and shoot growth and grafted vine ratio for Black Magic grafted onto 4 rootstock

Rootstock	Treatment	Bud burst ratio (%)	Shoot length (cm)	Shoot diameter (mm)	Grafted vine ratio (%)
41 B	Paraffin	53.33(46.93)	20.83	2.92	53.33(46.93)
	Parafilm+paraffin	65.00(53.87)	19.47	2.86	61.67(51.93)
	Mean	59.17(50.40) AB¹	20.15 B	2.89	57.50(49.43)
1103 P	Paraffin	55.00(48.07)	24.43	2.59	55.00(48.07)
	Parafilm+Paraffin	71.67(58.07)	27.90	2.78	71.67(58.07)

		Mean	63.33(53.07) AB	26.17 A	2.69	63.33(53.07)
Fercal	Paraffin	38.33(38.17)		17.03	3.22	35.00(36.23)
	Parafilm+Paraffin	70.00(57.00)		15.63	2.24	68.33(55.87)
		Mean	54.17(47.58) B	16.33 B	2.73	51.67(46.05)
SO4	Paraffin	66.67(54.83)		20.20	2.92	63.33(52.80)
	Parafilm+Paraffin	76.67(61.13)		20.20	2.36	71.67(57.90)
		Mean	71.67(57.98) A	20.20 B	2.64	67.50(55.35)
Treatment	Paraffin	50.33(47.00) Y		20.63	2.92 X	51.67(46.01) Y
Mean	Parafilm+paraffin	70.83(57.52) X		20.80	2.56 Y	68.33(55.94) X
D _{Rootstock}		*	**	N.S.	N.S.	N.S.
D _{Treatment}		**	N.S.	*	**	**
D _{RootstockXTreatment}		N.S.	N.S.	N.S.	N.S.	N.S.

¹: Values not associated with the same letter are significantly different (P<0.05 or P<0.01)

*: Significant at 0.05 level ; **: Significant at 0.01 level; N.S.: Not Significant

Similar studies have not been found in the literature in terms of parafilm+paraffin application. Therefore, the findings obtained from the study cannot be compared with other studies. But; this application generally gave higher values than the paraffin application in terms of the properties examined. American grapevine rootstocks can give similar or different results in terms of features examined in grafting studies. In our study, 1103 P yielded higher values than other rootstocks in terms of shoot length, callus formation rate and rooting ratio. When the results of some researches are examined; 1103 P rootstock shoot length (Dardeniz and ahin, 2005), callus formation (Kamiloglu and Güler, 2014; Köse et al., 2015) and root development (Sa lam et al. 2005; Kamiloglu and Güler, 2014; Köse et al., 2015) gave better results than the other rootstocks.

CONCLUSION

Wrapping at the graft union is not a common practice in the omega grafting technique. However, this practice, performed on thin diameter rootstock cuttings, have a positive effect on the success of grafting. This is caused by the increase in the ratio of grafted vines due to parafilm+paraffin application. According to the results of the study, parafilm+paraffin application provided 16.00 % improvement on the ratio of grafted vines in comparison with application of only paraffin. In terms of the rootstocks, 1103 P yielded better performance than other rootstocks in terms of shoot length (26.17 cm), callus formation rate at grafting surface (88.33 %), and rooting ratio (97.50%). The effects of rootstocks on shoot diameter, rooting degree, and grafted vine ratio were found to be similar.

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