

# EFFECT OF GRAFTING MACHINES ON SUCCESS OF GRAFTED VINE PRODUCTION

Y. Sabit AĞAOĞLU\*  
Hasan ÇELİK\*\*

## ÖZET

*Bu araştırmada, Automatic-II ve PM-450 aşı makinelerinin, aşılı köklü asma fidanı üretiminde başarı üzerine etkileri, farklı aşı kombinasyonları kullanılarak, karşılaştırmalı olarak incelenmiştir. Her ikisinde omega aşı yapan bu makinelerden Automatic-II, ayak gücü ile çalışan pedal sistemine sahiptir. Batı Almanya yapısı olan bu makine, otomatik olarak kalemi anaca bağlayabilmektedir. PM-450 ise elektrikle çalışmakta, 6-12 mm arasındaki çap değerlerine göre ayarlanabilmektedir. Bulgaristan yapımı olan bu makine kalem ve anacın aşı kesitlerini ayrı ayrı açmakta ve bu iki kısım elle birbirine bağlanmaktadır. Araştırmada, Hafızali, Hamburg misketi ve Hasandede üzüm çeşitlerinden alınan kalemler, Kober 5 BB ve 99 R asma anaçlarından alınan anaçlık çelikler üzerine aşılanmıştır.*

*Araştırma sonuçlarına göre, incelenen diğer özellikler (aşı yerinde cepeçevre kallus oluşumu (%), çimlendirme sırasında sürme oranı (%), I. sınıf aşılı köklü fidan oranı (%)) ve fidan başına ana kök sayısı yönünden aşı kombinasyonlarına göre kimi önemli sayılabilecek farklılıklar gözlenmesine karşın, aşı makineleri, aşılı köklü asma fidanı randımanını önemli ölçüde etkilememişlerdir. Diğer yandan 99 R'nin hemen bütün kombinasyonlarında, Kober 5 BB'den oldukça düşük randıman sağlanması ilgi çekici bir gözlem oluşturmıştır.*

*Her iki aşı makinesinin ortalaması olarak, en yüksek randıman değerleri, Hafızali/Kober 5 BB (% 60.0) ile Hasandede/Kober 5 BB (% 54.7) kombinasyonlarından elde edilmiştir.*

*Sonuç olarak, bu araştırmada üzerinde çalışılan her iki aşı makinesi de ülkemiz koşullarında kullanılabilir özellikte bulunmuştur.*

## SUMMARY

*This experiment was carried out to determine the performances of two grafting machines (Automatic II. and PM-450) on the success of grafted vine pro-*

\* Professor of Department of Horticulture, Faculty of Agriculture, University of Uludağ, Bursa.

\*\* Assis. Professor of Department of Horticulture, Faculty of Agriculture, University of Ankara.

duction. Scions of Hafızali, Muscat of Hamburg and Hasandede were grafted on the cuttings of Kober 5 BB and 99 R using these machines.

Present data showed that there were no significant differences in take between grafting machines in all graft combinations used, although some considerable variations in callus-ring formation (%) at union, bud-burst (%) during callusing, first-grade transplants (%) and the number of main roots (n) per grafted vine were observed. It was a clearly evident that Kober 5 BB always gave better results than 99 R in all graft combinations.

The best takes were obtained in Hafızali/Kober 5 BB (60.0 %) and Hasandede/Kober 5 BB (54.7 %) combinations as an average of both grafting machines.

As a result of this present experiment, both grafting machines can be recommended for Turkey's conditions.

## INTRODUCTION

In recent years, grafting machines designed according to different models and capacities have widely been used in the production of grafted vines. Grafting machines are generally designed to be operated by electricity (Kulinich et al. 1974), or foot-drive systems (Pohl 1975, Schumann 1975, Çelik and Ağaoğlu 1980). Furthermore, the grafting surfaces were prepared by some of the machines but the union had to be made manually (Kulinich et al. 1974); whilst, machines can assemble them in a single operation (Buldini 1974, Pohl 1975, Schumann 1975, Schenk 1976).

While the productivity of electrically powered MP-7M grafting machine was more than 260 vine grafts/h (Kuz et al. 1972, Lukashovich et al. 1973, Kulinich et al. 1974) and the capacity of PM-450 E was about 333 grafts/h (Petrov and Gargov 1971). Buldini (1974) reported that Dueffe automatic grafting machine was capable of dealing with 500 grafts/h.

Grafting machines can also prepare different graft surfaces such as omega, lamella (Schenk 1976), whip, tenon etc. (Pohl 1975, Schumann 1975, Schenk 1976). Omega and lamella machine grafts were found most successful when joined dorsiventrally (Schenk 1976); however, whip and tongue grafting were found to be better for cvs with "soft" wood, whilst the tennon or omega methods were better for those with "hard" wood (Schumann 1975). As a result of earlier experiments on grafting machines, it is clear evidence that grafting machines are much more productive than hand grafting in every case.

This experiment was undertaken to determine the performances of two grafting machines on callusing, growth and development of vine grafts and take in different graft combinations.

## MATERIALS and METHODS

This experiment was carried out at the Department of Horticulture, Faculty of Agriculture, University of Ankara, in 1979.

The single-bud scions of Hafızali, Muscat of Hamburg and Hasandede were grafted on the cuttings of Berlandieri X Riparia Teleki 8 B Sel. Kober 5 BB (Kober 5 BB) and Berlandieri X Rupestris du lot 99 R (99 R).

Two grafting machines were used. *Automatic II*: made in west Germany, foot-drive, automatic, omega system, capable of dealing with 300 grafts/h. *PM-450*: made in Bulgaria, electrically powered, union have to be made manually, omega system, can deal with grafting material from 6 to 12 mm and have a counter, capacity is 250 grafts/h. Take, storage and preparation of plant material; grafting, stratification and other technical procedures of grafted vine production were done according to the methods described in Çelik and Ağaoğlu (1981).

## RESULTS and DISCUSSION

### Completed callus-ring formation at union (%):

The data in Table 1 revealed that grafting machines did not effect markedly completed callus-ring formation at union in Hafızali, but Automatic-II in Muscat of Hamburg/Kober 5 BB and PM-450 in Hasandede/Kober 5 BB combinations decreased significantly (5 % level). When Hafızali grafted on Kober 5 BB using both machines, much lower completed callus-ring formation were observed. In grafted cuttings of 99 R combinations, completed callus-ring formation was always found to be more than 95.0 % that was significantly higher than in Kober 5 BB combinations.

Since callus is a meristematic tissue derived from cambium or secondary floem that provides union, it may be considered most important factor in grafting (Hartmann and Kester 1975), but insufficient or excessive callus formation at union usually cause the decline in success of grafting as in most of the combinations of 99 R in the present paper (Table 1 and 3).

Table: 1  
Effects of Grafting Machines on Completed Callus-Ring Formation (%)  
At Union In Different Graft Combinations.

Varieties	Rootstocks	Grafting Machines		
		Automatic-II	PM - 450	
Hafızali	Kober 5 BB	46.3	46.0	46.2 a2**
	99 R	91.0	100.0	95.5 b2
		68.7 a*	73.0 a	
Muscat of Hamburg	Kober 5 BB	56.1	70.0	63.5 a2
	99 R	97.1	100.0	98.5 b2
		76.6 a1**	85.0 b1	
Hasandede	Kober 5 BB	74.8	53.8	64.3 a2
	99 R	94.7	100.0	97.4 b2
		84.7 b1	76.9 a1	

\* a and b indicate significant difference

\*\* 1 and 2 indicate significant difference at 5 % (1) and 1 % (2) levels.

**Bud-burst during callusing (%):**

There was a considerable variation in the percentage of bud-burst. Although the differences in Hafızali were negligible, stimulative effects of Automatic-II on Muscat of Hamburg and PM-450 on Hasandede were observed. Furthermore, Kober 5 BB caused much higher percentage of bud-burst in Muscat of Hamburg, but results were quite similar in other two varieties (Table 2).

**Table: 2**  
**Effects of Grafting Machines on Bud-Burst (%) During Callusing in Different Graft Combinations**

Varieties	Rootstocks	Grafting Machines		
		Automatic-II	PM-450	
Hafızali	Kober 5 BB	70.5	58.2	64.3 a
	99 R	64.1	64.8	64.5 a
		67.3 a	61.5 a	
Muscat of Hamburg	Kober 5 BB	72.4	68.9	70.6 b2
	99 R	64.1	49.0	56.6 a2
		68.3 b2	58.9 a2	
Hasandede	Kober 5 BB	42.2	59.0	50.6 a
	99 R	42.7	55.9	49.3 a
		42.5 a1	57.5 b1	

Bud-burst at the later periods of callusing is always preferable, because earlier bud-burst generally causes a competition with callus formation at union to use the nutrients reserved in scion that may result in sufficient callus formation.

Preliminary studies showed that numerous factors were effective on the time of bud-burst of grafted cuttings during callusing such as period at which scions were taken, stratification and soaking before grafting, paraffining, stratification material, some chemical treatments and temperature regime of callusing room etc. (Saraswat 1973, Naidina and Bukatar 1976, Becker and Hiller 1977, Çelik and Ağaoğlu 1980).

Data of Table 1 and 2 did not indicate any clear correlation between callusing formation and bud-burst during callusing, considering the effects of grafting machines and rootstocks. For example, although Kober 5 BB and 99 R that were grafted on Hafızali and Hasandede had too similar bud-burst percentages, but 99 R always showed much higher callus-ring formation than Kober 5 BB in these graft combinations (Table 1 and 2).

**Percentage take (output):**

There were no significant differences in take between grafting machines in the combinations of Hafızali and Muscat of Hamburg but Automatic-II showed a slightly higher take (41.1 %) than in Hasandede as an average of both rootstocks

(Table 3). Furthermore, interaction between grafting machines and rootstocks were found to be significant in Hafizali "Automatic II x Kober 5 BB" and "PM-450 x 99 R" gave better results for this variety.

Mainly, takes of 99 R combinations (Particularly with Hafizali and Hasandede) were found significantly lower, even less than 25.0 % in "Automatic-II x Hafizali and Hasandede", "PM-450 x Hasandede" combinations (Table 3).

**Table: 3**  
**Effects of Grafting Machines on Take (%) in**  
**Different Graft Combinations**

Varieties	Rootstocks	Grafting Machines		
		Automatic-II	PM-450	
Hafizali	Kober 5 BB	64.8	52.2	60.0 b2
	99 R	24.4	41.0	32.7 a2
		44.6 a	48.1 a	
Muscat of Hamburg	Kober 5 BB	47.2	41.0	44.1 a
	99 R	33.1	37.7	35.4 a
		40.7 a	39.4 a	
Hasandede	Kober 5 BB	58.7	50.7	54.7 b2
	99 R	23.5	15.4	20.0 a2
		41.1 b1	33.1 a1	

These results are extremely in contrast to excellent callus-ring formation at union in these combinations. According to the data of Schenk (1975), the main cause of grafting losses in grafted vine production is a corky layer formation between the two callus layer that finally prevents fusion. These much lower takes were possibly due to this formation.

#### First grade grafted vines (%):

Data in Table 4 shows that the effects of grafting machines and rootstocks on the percentage of first grade grafted vines were mostly negligible except Hafizali/ Kober 5 BB that gave significantly higher value. Lowest (46.2 %) and highest (91.2 %) results were obtained in the combinations of "Automatic-II x 99 R with Hafizali and Muscat of Hamburg", respectively.

#### Number of main roots per grafted vine:

No significant difference was observed in Hafizali and Muscat of Hamburg, but only PM-450 and Kober 5 BB increased the number of main roots in Hasandede, significantly (Table 5).

According to the results of this present experiment, grafting machines (Automatic-II and PM-450) showed quite similar results of success in grafted vine production in the combinations of Hafizali, Muscat of Hamburg and Hasandede with Ko-

**Table: 4**  
**Effects of Grafting Machines on The Percentage of First Grade Grafted Vines in Different Graft Combinations**

Varieties	Rootstocks	Grafting Machines		Ort.
		Automatic-II	PM-450	
Hafizali	Kober 5 BB	75.2	66.5	70.9 b1
	99 R	46.2	61.4	53.8 a1
	Ort.	60.7 a	64.0 a	
Muscat of Hamburg	Kober 5 BB	70.5	66.6	68.5 a
	99 R	91.2	75.0	83.1 a
	ort.	80.9 a	70.8 a	
Hasandede	Kober 5 BB	66.9	53.8	60.4 a
	99 R	67.8	73.2	70.5 a
	Ort.	67.4 a	63.5 a	

**Table: 5**  
**Effects of Grafting Machines on the Number of Main Roots Per Grafted Vine in Different Graft Combinations**

Varieties	Rootstocks	Grafting Machines		Ort.
		Automatic-II	PM-450	
Hafizali	Kober 5 BB	7.6	8.0	7.8 a
	99 R	7.4	8.3	7.9 a
	Ort.	7.5 a	8.2 a	
Muscat of Hamburg	Kober 5 BB	9.5	10.0	9.8 a
	99 R	9.5	9.5	9.5 a
	Ort.	9.5 a	9.8 a	
Hasandede	Kober 5 BB	8.5	11.2	9.8 b1
	99 R	8.0	9.1	8.6 a1
	Ort.	8.3 a2	10.2 b2	

ber 5 BB and 99 R; but Kober 5 BB always gave the better results than 99 R, especially is we consider the final take.

Best takes were obtained in Hafizali/Kober 5 BB (60 %) and Hasandede/Kober 5 BB (54.7 %) combinations as an average of both grafting machines.

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