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Performance of Different Grape Cultivars for Rooting and Grafting

سلوك أصناف مختلفة من العنب في التجذير والتطعيم

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Abstract

Four local grape cultivars (Halawani, Beiruiti , Zaini and Beituni) were bench grafted on four different grape rootstocks (B41, Paulsen , Rugerri and Richter). Two grafting methods were used: whip tongue and wedge grafting. The experiment was conducted for two successive seasons (1997 and 1998). All rootstock basis were treated with Indolebutyric- acid (IBA) at 8000 ppm in the form of powder. The results showed a great variability in the rooting ability of the different rootstocks with Paulsen rootstock which resulted in the higher rooting ability, while Rugerri and B41 resulted significantly in the lower rooting percentage in both seasons. The scion as well as the grafting method did not affect the rooting ability of the rootstocks.

The rootstock scion combination showed high healing ability with a significant interaction between both graft partners. Rugerri and Richter resulted in the highest healing of grafts. The vegetative bud growth of the graft varied among the different scion cultivars but without any significant effect of grafting method or rootstocks in both seasons. Both Halawani and Beiruiti resulted in the higher vegetative growth during propagation.

طعمت أربعة أصناف من الأعناب المحلية (حلواني، بيروتي، زيني وبيتوني) على أربعة أصول (B41، Palusen، Rugerri و Richter) لموسمين متتاليين ١٩٩٧، ١٩٩٨ وبطريقتي تركيب مختلفتين، عوملت اسفل العقل للأصول بهرمون التجذير [بودرة اندول حمض البيوتيرك (IBA)] بتركيز ٨٠٠٠ جزء بالمليون.

أظهرت النتائج تباينا واضحا للقدرة التجذيرية للأصول دون تأثير لطريقة التركيب أو الصنف. كان هناك تفوق معنوي واضح للأصل Paulsen على باقي الأصول وأظهرا الأصلين Rugerri و B41 اقل نسبة تجذير في الموسمين. أظهرت الأصول والأصناف المستخدمة نسبة التحام عالية وبتأثير معنوي واضح من الأصل والصنف دون تأثير لطريقة التطعيم. كان للأصليين Richter و Rugerri أكبر نسبة التحام على جميع الأصناف المطعمة عليهما. بالنسبة للنمو الخضري في الطعم فقد أظهرت الطعوم نسب مختلفة لنمو البراعم الخضرية دون تأثير معنوي لأي من الأصل وطريقة التطعيم. تميز الصنفين حلواني وبيروتي بأعلى نسبة للنمو الخضري أثناء عملية الإكثار.

Introduction

Grapevine is the second important fruit crop in Palestine after olive. It covers about 9000 hectares (ARIJ 1994). Most of the cultivated grape is used as table fruit. Grapevine varieties cultivated in Palestine belong to Vitis vinifera. There are over thirteen seeded grape varieties. (Alkowni, 1997) The important varieties are Shami, Halawani, Beituni , Beiruti, Dabogi and Zaini. These varieties are of local origin and are growing well under rainfed condition. To avoid phylloxera infection, these varieties are propagated by bench grafting them on to American grape rootstocks. Several rootstocks are used including 41B, 140 Rugerri, 1103 Paulsen, 110 Richter and Dogridge). In spite of the significant benefit of using these rootstocks, the rooting ability and the healing with the local varieties has not been locally studied. several factors are affecting the rooting of grape hard wood cuttings. Some of these factors were studied, such as hormonal application, cold treatment of the cuttings (Shatat, 1986, Al-Sheikh, 1987, Wample 1997, Alley. 1978, Alley and Peterson, 1977 and Goode et al., 1982), time of grafting (Dass and Melanta , 1973). By studying several factors on bench grafting of grape, it was concluded that the characteristics of the rootstock is the main factor for success of grafting (Astudillo and Teresa. 1993). Therefore, This study was designed to evaluate the rooting of four grape rootstocks and their healing with four grape varieties using two grafting methods.

Materials and Methods

Hardwood cuttings of 30cm long and 7 -10 mm diameter of 4 different grape rootstocks were bench grafted with 4 different grape cultivars. two grafting technique were used; whip tongue and wedge grafting. In the later method, the scion was wedged from two sides, simultaneously a cleft opening was made in the stock. The experiment was conducted for two successive seasons, March 1997 and March 1998. The scion consists of one single bud.

The following grape rootstocks were used; B41 which belongs to V. vinifera x V. berlandieri, 1103 Paulsen, 140Rugerri and 110 Richter that belong to Vitis berlandieri x V. rupestris. The cultivars were: Halawani, Beiruiti, Zaini and Beituni. All scion cultivars belong to V. vinifera. The

grafting was done by knife, the proximal end of the stock cuttings was treated with Indolebutyric acid (8000 ppm) using a powder hormone (Hartmann and Kester, 1983). The grafts were placed horizontally in hard polyethelyne perforated boxes covered with moist wood shaving and placed in a growth room where temperature was kept at 28 ± 2 °C for the first two weeks and at 20 ± 2 °C for another two weeks, the boxes were moisten regularly. The experiment in each season consists of the combinations of the two grafts with a total of 32 factorial treatments (4×4×2), each treatment was replicated 5 times with 50 cuttings for each treatment. The treatments were arranged in a completely randomized design.

At the end of the experiment, the grafts were removed and the data regarding the number of rooted cuttings, the average number of roots per rooted cutting, number of healed grafts and the number of cuttings with vegetative bud scion growth for each treatment were recorded. Three way analysis of variance was conducted on the data followed by means separation using the least significant difference (LSD) at 5% level (Little and Hills, 1978). The significant main effect and the interactive effect were only presented in the results.

Results

The rooting percentage of each rootstock and the average root number per rooted cutting is shown in Table 1. Paulsen rootstock significantly resulted in the higher rooting percentage in both seasons (81 and 77.03%) respectively, followed by Richter and B41. Rugerri gave the lowest rooting percentage in both seasons. There was no effect of the grafting method on the rooting of the stocks, however, the scion cultivars expressed a different effect on rooting in both seasons, but without any interactive effect with rootstock or grafting method. Paulsen gave also the highest and significantly different root number followed by B41, Richter and Rugerri. There was no significant effect of the grafting method and the scion cultivars on the average number of roots. Furthermore no significant interactive effect among the different factors was observed. (Table 1).

The healing percentage of the different grafts showed a significant interactive effect between rootstock and scion cultivars in both seasons. A

Table 1: Rooting percentage and average root number per rooted cuttings of four grape rootstock cultivars

Rootstock	Rooting percentage		Average root number	
	1997	1998	1997	1998
B41	z 51.25c	39.44c	9.15b	3.10b
Palusen	81.00a	77.03a	12.80a	6.30a
Rugerri	50.75c	37.52c	3.10c	2.03c
Richter	62.50b	50.01b	3.30c	2.68cb
LSD	8.26	6.87	1.509	0.721
ANOV				
Graft	ns	ns	ns	ns
Rootstock	***	***	***	***
Scion	*	ns	ns	ns
Graft x rootstock	ns	ns	ns	ns
Graft x scion	ns	ns	ns	ns
Graftx scion x rootstock	ns	ns	ns	ns

Z: Each value is an average over 4 scion cultivars, two graft methods and 5 replicates.
*** highly significant. ** significant at .01 level. * significant at .05. ns non significant.

graft was considered healed when callus was conspicuous and both graft partners were firmly intermingled.

It is shown in table 2 that almost all the graft combinations resulted in a high healing percentage. However, B41 rootstock grafted with Zaini and Beituni expressed the lower healing pecentage in both seasons. Both Rugerri and Richter resulted in the highest healing percentage with all scion cultivars except in Rugerri with cultivar Beiruti in 1998. It ranged between 95-100%, followed by Paulsen combined with other scion cultivars. The healing percentage for the different combinations was similar with the two grafting methods used, resulted in a non significant interaction between grafting method and other factors (stock and scion).

The percentage of the grafts with vegetative bud growth was shown in table 3. The scion cultivars showed significantly different percentages of

Table 2: Healing percentage of different grape scion cultivars grafted on to four different rootstocks.

Scion	Halawani		Beiruti		Zaini		Beituni	
Rootstock	**1997**	**1998**	**1997**	**1998**	**1997**	**1998**	**1997**	**1998**
B 41	z82b	90a	84b	89b	62c	75b	47c	70b
Palusen	79b	89a	88b	95ab	77b	89a	80b	90a
Rugerri	97a	96a	99a	88b	95a	89a	100a	96a
Richter	95a	90a	99a	100a	95a	95a	95a	95a
LSD	**1997(6.7)**		**1998 (9.28)**					
ANOV.			**1997**		**1998**			
Graft			ns		ns			
Rootstock			**		**			
Scion			**		**			
Graft x Rootstock			ns		ns			
Graft x Scion			ns		ns			
Scion x Rootstock			**		**			
Graftx Scion x Rootstock			ns		ns			

Z: Each value is an average of 5 replicates and two grafting methods. *** highly significant. ** significant at .01 level. * significant at 0.05 level. ns: non significant.

vegetative bud growth in both seasons with the highest obtained by Beiruti, Halawani and Zaini in 1997, and Halawani and Beiruti in 1998. However, in 1998, vegetative bud growth of Beiruti was not significantly different from Zaini. In both seasons, Beituni resulted in the lower growth. Moreover, the vegetative bud growth was not significantly influenced by the grafting method or the rootstock, therefore, it resulted in a non statistically significant interaction.

Discussion

The rooting ability of the four studied grape rootstocks showed a great variability with the superiority of Paulsen stock and low ability of both Rugerri and B41. This finding agrees with pervious work of Shatat, 1986a and Al-Sheikh, 1987 who found that Paulsen cultivar gave higher rooting

Table 3: Vegetative growth percentage of different grape cultivars grafted on to different rootstocks

Cultivar	1997	1998
Halawani	z 65.00a	72.00a
Beiruti	71.25a	65.75ab
Zaini	61.00a	59.50b
Beituni	46.75b	38.25c
LSD	10.35	9.19
ANOV		
Graft	ns	ns
Cultivar	***	***
Graft x stock	ns	ns
Graft x cultivar	ns	ns
Rootstock x cultivar	ns	ns
Graft x cultivar x rootstock	ns	ns

Z: Each value is an average over 4 rootstocks two graft methods and 5 replicates. *** highly significant. ** significant at .01 level. * significant at .05 level. ns: non significant

and root number than B41. It also agrees with the report of Bhujbal (1993) who found that rooting of cuttings and the grafting success was best in Palusen 1103 compared to other studied cultivars. Palusen cultivar has been classified as an easy to root cultivar. On the other hand, B41 was reported as a difficult to root cultivar (Alley and Peterson, 1977), this could explain the variability in the rooting between the different rootstocks which may be related to both physically or physiologically factors associated with the cultivar itself (Hartmann and Kester, 1983).

A high healing ability among the different stock-scion combination was obtained with some variability. Richter and Rugerri expressed the highest healing with all scion cultivars , this result disagrees with Al-Sheikh, 1987, who found that no clear effect of stock on healing for two grafting seasons. The healing of any graft depends on callus formation (Hartmann and kester, 1983). The callusing ability of grape hardwood cuttings exposed to warm temperature and high relative humidity was varied among different cultivars

(Stadnik. et al., 1988), they explained this by the different biochemical contents of the cuttings.

The variability in the rooting ability and the healing between the two seasons could mainly be due to the annual variation of the grafted material used, this agrees with the work of Shatat 1986a, 1986b and Al-Sheikh, 1987.

The grafting methods did not affect the healing ability of the graft. This findings agrees with Astudillo and Teresa (1993), who reported no differences between two bench grafting systems using different grafting machines. The high healing ability expressed between the different cultivars could explain the non significant effect of the grafting method. The exposed cambium, in both types of grafts seems to be enough to induce callusing which resulted into a firm union.

The variation in vegetative bud push is mainly a cultivar character, since all the materials were dormant buds. However, the effect of vegetative bud growth on rooting was not clear. This may be because the scion cultivar did not affect rooting and the vegetative bud push is a cultivar character. In contrast, it was found that radioactive compound (C-14) moved from the rootstock in the graft after the two components were connected and when the graft bud has emerged (Popove, 1989), this might adversely affect rooting.

This study indicated clearly the variation in rooting ability of the different rootstocks with Palusen the easiest to root. It also showed a high healing ability of the studied scion cultivars. The rooting ability of these rootstocks could be improved by further investigation with other factors, mainly the auxin application. In addition, work in the future could focus on investigating other rootstock cultivars. Moreover, a field performance study is necessary to evaluate the compatability, growth and productivity of the different stock-scion combinations.

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