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Graft Compatibility Between Florida Prince Peach Cultivar and New Almond X Peach Hybrid Rootstocks

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Abstract: New hybrids coming from hybridization between Om-elfahm almond cultivar (as mother plant) and Okinawa peach rootstock (as father plant) were grafted in two successive seasons by Florida prince peach cv. to evaluate the graft compatibility between them. Hardwood cuttings of these new rootstocks were rooted to have a true to type source for our study. All rootstock combinations showed normal growth ranged between perfect union line (line between bark and wood can hardly visible) and good union line (the line is visible). For physical properties, hybrid No. 5 showed the highest survival percentage of the new scion and the opposite were found with hybrid No.4. In winter (cleft) grafting, hybrids No.1 and No.2 showed good graft compatibility ratio with a slightly differences than other combinations. Results cleared that, hybrids No. 1 and No. 2 showed the highest scion shoot length, average shoot number and average leaves number. Hybrids No. 1 and No. 3 new scion shoots gave the best carbohydrates percentage, nitrogen percentage, C/N ratio, total indoles and chlorophyll concentration. In summer (shield) grafting, hybrids No.3 and No.6 showed the best results in vegetative growth (shoot length, average leaves number and leaf area) and chemical analyses (carbohydrates percentage, nitrogen percentage, C/N ratio, total indoles and chlorophyll concentration. Histo-cytological study of the graft union cleared that, there were no differences in the vascular connection formation of graft union sections of all combinations after 120 days of grafting. In general, hybrids No 1, 2 & 3 reached the highest significant values of the most parameters so they could be recommended as good rootstocks for Florida Prince peach cv.

Key word: Graft compatibility · Almond× peach hybrid rootstocks · Florida prince cv. · Histo-cytological

INTRODUCTION

Prunus is a genus of trees and shrubs, which includes 430 different species. Many members of the genus are widely cultivated for their fruit and for decorative purpose. *Prunus* fruit are defined as drupes, or stone fruits, because the fleshy mesocarp surrounding the endocarp (pit or stone). *Prunus* genus include fruits as plums, cherries, peaches, nectarines, apricots and almonds [1].

The production areas of peach in Egypt are concentrated in Noubaria (27172 Fedden/ 317519Ton) and Nourth Sinai (28286Fedden/64837Ton) Ministry of Agriculture [2]. Florida prince is one of the cultivars, which matches local Egyptian conditions (need low chilling) [3]. It has high fruit quality and productivity compared with other peach cultivars [4].

The role of rootstocks and its use in fruit crops has significant impact on fruit crop production. Commercial peach trees [*Prunus persica* (L.) Batsch] are usually composed of two parts, a scion and a rootstock. The choose of the peach rootstock depends on many factors such as tolerance to nematode, waterlogging and drought [5-7]. However, the limiting factor for the wide spread use of some peach rootstocks is the wide range of compatibility with various cultivars [5].

Peach rootstocks coming from various species of *Prunus* or its interspecific hybrids. Almond× peach hybrid rootstocks are widely used because of some desirable characteristics such as tolerance to nematode, compact soils and waterlogging [5-7].

Graft incompatibility leads to poor health, breakage at the graft union and finally death happened. The mechanism of how compatibility is caused still

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unclear and several hypotheses has been made but overall, incompatibility is usually expressed during the first year of scion growth in the form of tree growth like cessation, premature defoliation and discoloring of leaves (yellowing and bronzing) [8, 9].

This study was established at ARC, HRI, Giza to appraise graft compatibility between peach cultivar Florida prince and new *Prunus* rootstocks. Several levels of response to graft compatibility were discussed by visual symptoms, morphological parameters, chemical parameters and histo-cytological one. The object of this study was to test the compatibility behavior of six almond × peach hybrid rootstocks with peach cultivar Florida prince as a step to commercial production.

MATERIALS AND METHODS

This study was carried out in Horticulture Research Center, Giza, Egypt in two seasons (2017/2018 and 2018/2019). Rootstocks chosen for this study included six almond × peach hybrids coming from hybridization between Om-elfahm almond cv. as mother tree and Okinawa peach rootstock as father tree which are resistant to nematode [10]. The chosen hybrid trees were 8 years old grown in clay loamy soil and regular horticulture practices were applied to them as recommended.

Fifty hardwood cutting of each hybrid were rooted in each season to have true to type plantlets for grafting. Cuttings were taken in late winter (at mid of January till the first week of February). Cuttings were rooted by immersing them in 3000ppm IBA then they were cultured in green house. Rooted cutting of the six rootstocks were grafted with peach cultivar Florida prince by cleft graft in winter and shield graft in summer. Shoots of Florida prince peach cv. were selected from trees in private farm.

After grafting the graft union was tied with parafilm and scions were untidy covered by paper bags till new leaves appeared (about two to three weeks depending on temperature). Pots were irrigated one time per week in winter and two to three times per week during the peak of summer.

After 120 days visual symptoms of grafting were recorded to normal or abnormal. Also, survival percentage of grafted plants was recorded. Grafted union was classified to A, B, C and D categories and recorded according to Mosse and Herrero [11].

From each combination, nine seedlings were taken from each hybrid for winter grafting and another nine for summer grafting in each seasons in randomized block design (three seedlings× three replicate× six hybrid× two times each season) to record morphological parameters at the end of the growing season.

Morphological parameters were as follows:

- Stem diameter above and below˜3cm. of the graft union were measured.
- Shoot length
- average shoots number
- average leaves number
- Leaf area (cm^2) was determined using Leaf Area meter model (1-203, CID, Inc, USA).

Chemical Analysis: Leaf samples were taken randomly from the new shoots of each combination after 120 day of grafting. Leaf samples were washed with tap water and dried at 70°C till constant weight and then ground and stored for analysis. The ground samples were digested with sulphoric acid and hydrogen peroxide according to Evenhuis [12].

Total Carbohydrates: (mg/100g dry weight) were determined according to Dubois *et al*. [13].

Total Nitrogen: Was determined according to A.O.A.C. [14].

C/N Ratio: Was calculated by dividing the total carbohydrates by total nitrogen.

Total Indoles: (mg/g dry weight) were determined according to Lareson [15].

Total Chlorophyll: Minolta chlorophyll meter SPAD-502 (Minolta camera. Co, LtD Japan) was used to record leaf chlorophyll at the field. It was taken as average of ten recordings.

Histo-Cytological Study: Longitudinal sections of successive samples were taken to study histo-cytological study.

Data Analysis: Data were statistically analyzed in complete randomized block design according to the method of Snedcor and Cochran [16], LSD test at 5%level was used for comparison between means of each rootstock.

RESULTS AND DISCUSSION

Effect of Hybrid Rootstocks on Visual Symptoms and External Examination of the Graft Unions: Table (1) showed visual symptoms of grafting on each hybrid in both seasons. Graft compatibility with normal growth was clear in all new scions. Incompatibility visual symptoms which were leaf yellowing and leaf defoliation or wood yellowing or wood reddish then finally death were recorded. The localized compatibility categories of graft union were ranged between perfect (category A) and good (category B) with all studied hybrids according to Mosse and Herrero [11].

At the end of the study the survival percentage of the new scion was recorded in both years. Hybrids No.5 (100%) and No.1 (97%) recorded the highest survival percentage while, hybrid No.4 (75%) has the least value. Other hybrids were in between.

These results are in harmony with Zarrouk *et al.* [17] who cleared that all peach and nectarine trees on *Euamygdalus* subgenus rootstocks showed good graft compatibility.

Winter Grafting

Effect of Hybrid Rootstocks on Stem Diameter (Cm.) Above and below ≈3cm. The Graft Union and Stem Diameter Ratio: It is quite clear as shown from Table (2) that all measurements (stem diameter (cm.) above and below ≈3cm. the graft union and stem diameter ratio) were affected by the different hybrids.

As for the response of stem diameter above and below the graft union in response to hybrid strength, Table (2) displays that in the 1st season, hybrid No.1stem diameter was closed below and above. Hybrid No.1 in 1st season recorded stem diameter 1.68 cm. below graft union and 1.67 above it. The same hybrid recorded 1.78 and 1.73 stem diameter below and above graft union respectively in the 2nd season. Hybrid No.2 followed hybrid No.1 in stem diameter below and above the graft union. On the other hand hybrid No.5 was the least one in the same measurements (1.75 below graft union and 1.82 above graft union in the 1st season and 1.53 & 1.61 in the 2nd one). Other hybrids combinations were in between.

Concerning stem diameter ratio below and above graft union, data cleared that hybrid No.1 was the best one (1.00 in 1st season and 1.02 in 2nd season). Hybrids No.2 had slightly significant differences with hybrid No.1 (1.01 & 1.02 in the two seasons) and hybrid No.4 came after them (1.02 & 0.97 in the two seasons). Hybrid No.3 recorded 1.08 in the first season and 1.01 in the 2nd one. While hybrid No.5 recorded 0.96 and 0.95 in the two seasons respectively. Finally hybrid No.6 got 1.06 in the 1st season and 0.98 in the 2nd one.

The relationship between stem diameter above and below the graft line reflects the degree of compatibility between the scion and the rootstock. The values for this relationship closest to 1.0 had the highest compatibility Zuleide *et al*. [18].

These results are inagreement with those of Zarrouk *et al.* [17] and Wertheim and Webster [19] who recorded that the stem diameter above the graft union of the most incompatibility combinations is smaller than below it (It may be explained by the decrease in water and nutrient supply from roots throughout the graft union).

Table 1: Effect of hybrid rootstocks on visual symptoms (leaf and wood) and external examination of the graft unions.

Rootstock number	Visual compatibility symptoms	Localized compatibility category					
		Survival%	A	B	C	D	Dead
1	N	97%	+	+	-	-	3%
2	N	85%	+	+	-	-	15%
3	N	81%	+	+	-	-	19%
4	N	75%	+	+	-	-	25%
5	N	100%	+	+	-	-	0%
6	N	83%	+	+	-	-	17%

Categories A, B, C D and E: classification of the rating of localized graft incompatibility according to Mosse and Herrero [11].

N, visual normal trees; Ab, abnormal scion behavior, leaf yellowing, reducing in vigor.

A: perfect union as line between bark and wood hardly visible.

B: good union the line was visible.

C: the tissue of rootstock and scion were separated by a dark brown layer.

D: visual wood tissue of rootstock and scion were separated.

Table 2: Effect of hybrid rootstocks on stem diameter (cm.) above and below ≈3cm. the graft union and stem diameter ratio

Rootstock number	Stem diameter below graft union (cm.)		Stem diameter above graft union (cm.)		Stem diameter ratio	
	2017	2018	2017	2018	2017	2018
1	1.68a	1.78a	1.67ab	1.73a	1.00	1.02
2	1.57a	1.72ab	1.55bc	1.68a	1.01	1.02
3	1.72a	1.69ab	1.60bc	1.67a	1.08	1.01
4	1.80a	1.56b	1.75ab	1.61a	1.02	0.97
5	1.75a	1.53b	1.82a	1.61a	0.96	0.95
6	1.62a	1.56b	1.52c	1.59a	1.06	0.98

*|Means within each column followed by the same letter(s) are not significantly different at 5% level

Table 3: Effect of hybrid rootstocks on the new scion shoot length (cm), average shoot number and average leaves number of scion

Rootstock number	Shoot length (cm.)		Av. shoot No.		Av. leaves No.	
	2017	2018	2017	2018	2017	2018
1	8.17a	8.54a	4.23a	4.25a	39.3a	41.21a
2	7.85a	8.32a	3.00c	4.00ab	26.23c	39.14ab
3	5.41b	8.07a	3.30bc	3.75ab	32.6b	35.73b
4	3.86c	5. 97b	2.25d	3.50bc	21.0d	28.25c
5	4.75bc	4.23c	3.70ab	3.50bc	35.6ab	24.56c
6	7.69a	4.11c	3.00c	3.25c	23.5cd	23.15c

*|Means within each column followed by the same letter(s) are not significantly different at 5% level

Effect of Hybrid Rootstocks on the New Scion Shoot Length (Cm.), Average Shoot Number and Average Leaves Number: Table (3) showed the effect of hybrid combinations on the new scion shoot length (cm.), average shoot number and average leaves number.

Reflecting to the effect of hybrids on new shoot length, it is obvious from Table (3) that hybrid No. 1 & No. 2 reached the highest significant values in both seasons (8.17 & 8.54 cm. for hybrid No. 1 and 7.85 & 8.32 cm. for hybrid No. 2 in the 1st season and the 2nd season respectively). While hybrid No. 4 got the lowest value (3.86 in the 1st season & 5.97 cm. in 2nd season).

With regard to the specific effect of hybrid to the average shoot number, it is quite evident that hybrid No.1 got the highest average shoot number (4.23 in the 1st season & 4.25 in the 2nd one). From the other hand hybrid No.4 reached the lowest value in 1st season (2.25) and hybrid No.6 in 2nd season (3.25).

As for the specific effect of hybrid on average leaves number, Table (3) displays that variances were so obvious between hybrids. Hybrid No.1 was the superior as it exhibited significantly the highest leaves number in both seasons (39.3 & 41.21 in 1st and 2nd seasons respectively) while hybrid No.4 recorded the least value (21.0 in 1st season & 28.25 in 2nd season).

We can conclude that the studied parameters not only responded significantly to the specific effect of hybrid rootstock but also followed typically the same trend, all results in the greatest stem diameter above and below the graft union with the tallest shoot and the greatest number of both shoots and leaves with hybrid No.1 followed by hybrid No. 2. However, hybrid No.4 reached good value in stem diameter above and below the graft union, but it recorded the lowest value of the other measurements.

These results in agreement with Webster [20] who cleared that scion growth and vigor are influenced by mass factors. One of the most important factors is choice of the suitable rootstock. Warner [21] also cleared that rootstocks have significant effects on the degree of scion shooting (length of shoots and shooting).

Effect of hybrid on carbohydrates%, nitrogen%, C/N ratio, indoles (mg/100g DW) and chlorophyll% concentrations in scion leaves: Table (4) reveals to the effect of hybrid on carbohydrates, nitrogen C/N ratio, indoles and chlorophyll concentrations in leaves.

As for the effect of hybrid on carbohydrate%, it is quite clear to be noticed from tabulated data in Table (4) that hybrid No.1 was the superior one (39.14 in the 1st season & 40.56 in the 2nd season) with slightly differences between it and hybrid No. 3 in the 1st season (36.58). Meanwhile, hybrid No. 4 (27.85 in 1st season & 29.11 in the 2nd one) and No. 6 (30.14 in the 1st season & 29.41 in the 2nd one) reached the lowest significant values. Other hybrids were in between.

Table 4: Effect of hybrid rootstocks on carbohydrates%, nitrogen%, C/N ratio indoles and chlorophyll concentrations in scion leaves

Rootstock No.	Carbohydrate%		Nitrogen%		C/N ratio		Indoles mg/100g.D.W.		Chlorophyll%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
1	39.14a	40.56a	2.16ab	2.09a	18.12a	19.40a	0.370a	0.392a	0.866a	0.867a
2	31.75cd	32.57bc	2.31a	2.21a	13.74c	14.73c	0.257cd	0.315b	0.726cd	0.774bc
3	36.58ab	35.94b	2.11ab	2.11a	17.33ab	17.03b	0.327ab	0.238c	0.811ab	0.835ab
4	27.85d	29.11c	2.08b	2.13a	13.38c	13.66c	0.241d	0.291b	0.701d	0.769bc
5	34.74bc	31.56bc	2.14ab	2.25a	16.23b	14.02c	0.306bc	0.263bc	0.782bc	0.747c
6	30.14d	29.41c	2.19ab	2.20a	13.38c	13.36c	0.284bd	0.274bc	0.753bd	0.791b

*|Means within each column followed by the same letter(s) are not significantly different at 5% level

Table 5: Effect of hybrid rootstocks on scion shoot length, average leaf No. and average leaf area of scion.

Rootstock No.	Average shoot length (cm.)		Average leaves No.		Average leaf area (cm^2)	
	2017	2018	2017	2018	2017	2018
1	15.9b	13.4bc	18.7b	16.7c	23.0a	24.5a
2	8.7d	9.3de	15.3c	12.4d	19.7ab	19.3b
3	20.8a	18.3a	20.3ab	25.1a	20.7ab	21.4ab
4	6.2d	7.5e	8.7d	9.6d	18.3b	19.7b
5	11.4c	12.1cd	11.2d	17.3c	17.7b	14.8b
6	17.3b	15.6b	22.4a	21.7b	22.4a	23.7a

*|Means within each column followed by the same letter(s) are not significantly different at 5% level

It is quite clear as shown from Table (4) that nitrogen concentration with all hybrids had slightly significant differences in the 1st season, while in the 2nd season there were no significant differences.

Referring the effect of different hybrids to the C/N ratio, it is quite clear that the response of hybrids on C/N ratio followed to great extent the same trend of carbohydrates. The greatest value was recorded with hybrid No.1 (18.12 & 19.40 in both seasons respectively). While, a relative shift in response was observed with hybrids No.4 (13.38 in the 1st season & 13.66 in the 2nd one) and hybrid No.6 (13.38 in the 1st season and 13, 36 in the 2nd one).

Regarding the effect of different hybrids on indoles (mg/100g) in leaves. It was clear from Table (4) that the highest significant value was recorded with hybrid No. 1 (0.370 & 0.392 in 1st season and 2nd season respectively). On the other hand hybrid No.4 recorded the lowest significant value in the 1st season (0.241) and hybrid No.3 in the 2nd season (0.238).

As for the effect of hybrids on chlorophyll%, hybrid No.1 resulted in the highest significant value (0.866 in the 1st season & 0.867 in the 2nd one). While the lowest significant value was recorded with hybrid No.4 in 1st season (0.701) and hybrid No.5 in 2nd season (0.747). Other hybrids were in between

These results are in agreement with Ali *et al.* [22] who cleared that, rootstocks affected on the mineral element accumulation of Santa Maria pear cv. which was significant. He also cleared that, leaf analysis showed different mineral uptake efficiencies throughout the early season with different rootstocks. Also, Mary-Rus Martinez *et al.* [23] cleared that biomass differences between citrus trees are likely related to plants' increased ability to assimilate CO_2 during photosynthesis. Trees on rootstocks that enhance photosynthetic capacity grow more vigorously than on other genotypes. This is reflected on photosynthetic product distribution through the differences induced in scion: stock dry matter ratios, which implies changes in source-sink relationships. A high leaf mass with enhanced CO_2 results in the translocation of increased C-compounds (mainly sucrose and starch) from shoots to roots.

Summer Grafting

Effect of Hybrid Rootstocks on Average Shoot Length (cm.), Average Leaf Number and Average Leaf Area (cm^2): Table (5) showed effect of different rootstocks on average shoot length (cm.), average leaves number and average leaf area (cm^2) of scion.

Regard the effect of hybrid, on average shoot length (cm.), hybrid No.3 recorded the highest significant value in both seasons (20.8 & 18.3cm. in the 1st season and the 2nd season correspondingly). On the other hand, hybrid No.4 recorded the lowest significant value (6.2 & 7.5cm. in both seasons respectively). Other hybrids ranged in between.

Table 6: Effect of hybrid rootstocks No. on carbohydrates, nitrogen, C/N ratio, Indoles and chlorophyll concentrations in scion leaves

Hybrid	Carbohydrates%		Nitrogen%		C/N ratio		Indoles mg/g DW		Chlorophyll%	
No.	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
1	37.11b	35.71b	2.24a	2.07a	16.56b	17.25b	0.354ab	0.334ab	0.804bc	0.796bc
2	32.18c	30.93cd	2.09a	2.15a	15.39b	14.38c	0.332b	0.329ab	0.831ab	0.825ab
3	41.13a	43.25a	2.11a	2.21a	19.48a	19.57a	0.361ab	0.347a	0.872ab	0.853ab
4	31.97c	27.51d	2.13a	2.11a	15.00b	13,03c	0.276c	0.284b	0.852ab	0.841ab
5	34.32bc	33.15bc	2.17a	2.23a	15.81b	14.86c	0.317bc	0.306d	0.893ab	0.832ab
6	38.74ab	36.54b	2.03a	2.14a	19.08a	17.07b	0.395a	0.376a	0.811b	0.824ab

*|Means within each column followed by the same letter(s) are not significantly different at 5% level

As for the specific effect of hybrids on average leaves number, it is quite clear that hybrid No.3 showed the highest significant value (20.3 for 1st season & 25.1 for 2nd season) as well as hybrid No.6 in the first season (22.4). While, hybrid No.4 recorded the lowest significant value in both seasons (8.7 & 9.6 in the 1st season and the 2nd one respectively).

Referring to the effect of hybrids on average leaf area (cm^2), data tabulated in Table (5) cleared that average leaf area took the same trend as shoot length and average leaves number with a slightly differences. It is clear that hybrid No.1 reached the highest value in 1st and 2nd seasons (230. & 24.5cm^2 respectively) with hybrid No.6 (22.4 cm^2 in 1st season & 23.7 cm^2 in 2nd season) and hybrid No.3 (20.7 cm^2in 1st season & 21.4 cm^2 in the 2nd season). On the other hand hybrid No. 4 recorded the lowest significant value (18.3 cm^2in 1st season & 19.7 cm^2 in 2nd season) as well as hybrid No.5 (17.7 & 14.8 cm^2 in 1st and 2nd seasons respectively). Hybrid No.2 was in between the aforesaid two extents (19.7 & 19.3 cm^2 in both seasons). These results are in line with those which mentioned by VanHong and Chung-Ruey [24] who cleared that summer grafts of papaya gave the best results as compared to autumn grafts for the following variables: sprouting time, percentage of graft success, scion sprout length and number of new leaves per graft.

Effect of Hybrid Rootstocks on Carbohydrates%, Nitrogen%, C/N ratio, Indoles (mg/100g) and Chlorophyll% in Scion Leaves: Table (6) cleared the effect of hybrids on carbohydrates%, nitrogen%, C/N ratio, Indoles (mg/g) and chlorophyll% in leaves.

Concerning the effect of different hybrids on carbohydrates%, it is obvious from Table (6) that hybrid No.3 got the highest significant value in the two seasons (41.13 & 43.25 respectively), while hybrid No.4 recorded the lowest significant value (31.97 for 1st season & 27.51 for 2nd one). Other hybrids ranged in between the abovementioned two extremes.

Referring to nitrogen% in leaves, Table (6) cleared that there were no significant differences between hybrid rootstocks in both seasons of study. Hybrids ranged between 2.24 & 2.03.

Regard the C/N ratio, Table (6) showed that hybrid No.3 reached the highest significant value (19.48 & 19.57 in both seasons). It was followed by hybrid No.6 with no differences in the 1st season (19.08) then hybrid No.1 (16.65 & 17.25 in the two seasons respectively). On the other hand hybrids No. 2 (15.39 in 1st season & 14.38 in 2nd one) as well as hybrid No. 4 (15.00in 1st season & 13.03 in 2nd season) and hybrid No. 5 (15.81 & 14.86 in both seasons) recorded the lowest significant value in both seasons.

As for the effect of hybrids on Indoles (mg /100g), Table (6) cleared that hybrid No.6 reached the highest significant value (0.395 & 0.376 in both seasons respectively). On the other hand hybrid No.4 recorded the lowest significant value in 1st season (0.276) and hybrid No.5 in 2nd season (0.306).

It was clear from the obvious data that, hybrid No.5 recorded the highest chlorophyll% value in the 1st season (0.893), while hybrid No.1 was the least one in both seasons (0.804 in the 1st season and 0.796 in the 2nd one). There were slightly significant differences in chlorophyll value with all hybrids in the two studied seasons.

These results are in agreement with those found by Attalla [25] who revealed that the highest number of leaves is developed on Okinawa peach, local apricot and sweet almond during the season. Leaf measurements indicate a significant elongation of peach leaves than the other stocks.

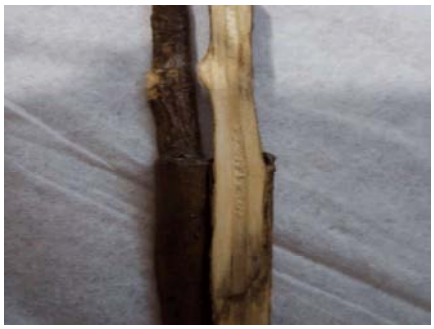
Histo-Cytological Study of the Graft Union: Successive grafting comes from the good joining of vascular tissues between the scion and rootstock. Plants lacking vascular cambium, such as monocots, can not normally be grafted. As a general rule, the closer two plants are genetically, the more likely the graft union will form. Genetically identical

A
Grafted plantlet

B
Grafted plantlets

C
Graft union section

D
Longitudinal section of graft union



E
Longitudinal section of graft union

Fig. 1: Grafted plantlets, graft union section and longitudinal section of graft union

clones and intra-species plants have a high success rate for grafting. Grafting between species of the same genus is sometimes successful. Grafting has a low success rate when performed with plants in the same family but in different genera. And grafting between different families is rare.

In the last step of graft formation, the formation of vascular connections is considered for most authors the basic requirements for a successful graft. The main reason for incompatibility in woody plants that the new vascular connections could be poorly differentiated or weakly established. In the present study as shown in Fig (1), the vascular connection was established successfully between rootstock and scion 120 days after grafting. A few necrotic areas were observed on leaves on the new shoots, but cambial connection was observed in all longitudinal sections

Some researchers have emphasized that cambial connections formed within 45 to 60 d. and, 12 months after grafting in chestnuts. It is possible that this variation may arise from the use of different stock-scion combinations and environmental factors. The anatomical structure of the wood tissues around the graft union and the successful cambial development was recorded. The results from this study showed in Fig (1) cleared that, graft compatibility exists between graft combinations and callus formation and differentiation of vascular tissues was established 120 days following grafting. Such findings confirm existence of graft compatibility between Florida prince cv. and all new hybrids in the nursery. The success of grafting depends primarily on the identification of stress and pathogen-resistant rootstocks and on the compatibility of the graft union in terms of fast formation of the vascular connections between the rootstock and the scion and fast renewal of root and canopy growth. These results in agreement with Selime and Engin [26] who mentioned that the vascular connection of the graft union between chestnut and oak was established successfully after 150 days after grafting.

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