

RESPONSE OF *Hibiscus* sp. PLANTS TO DIFFERENT TYPES OF CLEFT GRAFTING

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ABSTRACT

This investigation was performed at the nursery of Horticulture Research Institute, Giza throughout two successive seasons (2007/2008 and 2008/2009) with the aim of investigating the possibility of using grafting for the propagation of *Hibiscus rosa-sinensis* L. and *Hibiscus syriacus* L. plants of good quality. Different types of cleft grafting were carried out by using different scion of *Hibiscus rosa-sinensis* cultivars Fire Truck, Charles September, Miss Kitty, Cane Fire, Cooperi, and two scions for *Hibiscus syriacus* 'Alba and Blue' for grafting two Hibiscus rootstock cultivars Fire Truck and Apple Blossom in both seasons. The results emphasized that 'Fire Truck' stock was the best in improving most of plant traits in both seasons, when compared with those obtained from the other stocks used 'Apple Blossom'. It increased survival percentage, the length/scion, number of main branches/scion, stem diameter and fresh weight of newly established plants, besides the improvement of some chemical constituents of the plant, as it increased total chlorophylls and carbohydrates content in the leaves, in addition to decreasing leaf phenol content.

Scion cultivars also differed in their effects on the above mentioned traits. 'Cooperi' and 'Fire Truck' scions were the best in most cases for improving most plant traits as they increased survival percentage, the length/scion stem diameter and fresh weight of newly established plants. Meanwhile, the number of main branches/plant increased as a result of using 'Cooperi' scion in grafting whereas a decrement on the registered values was detected in most cases due to using 'Miss Kitty' scion. Similarly, an improvement on chemical constituents of the plant was also observed due to using Fire Truck' scion followed by that of either 'Charles September' or 'Cooperi' scion as they increased leaf total chlorophylls and total carbohydrates contents, besides their decrement effect on phenols content in leaves. In contrast, undesirable effects were observed in most cases on chemical constituents of the plant due to using 'Miss Kitty' scion in grafting.

The interactions revealed the superiority of the combined effect between 'Fire Truck' as a rootstock and either 'Cooperi' or 'Fire Truck' scions in improving most plant traits studied. Also, using Fire Truck cv. as a rootstock with using the same cv. as a scion or 'Charles September' scion had a marked effect in elevating the total chlorophyll and total carbohydrate contents in leaves.

From the aforementioned results, it could be recommended to use 'Fire Truck' as a rootstock with using the same cultivar or 'Cooperi' as a scion.

Key words: *cleft grafting, Hibiscus rosa-sinensis L, Hibiscus syriacus L.*

1. INTRODUCTION

Hibiscus is the largest genus in family Malvaceae, comprising more than 200 species of herbs and shrubs of showy flowers, which are widely distributed in the tropical and sub-tropical areas of the world, but only few are of ornamental importance (Li, 1959). Rendle (1975) described *Hibiscus rosa-sinensis* L. as summer flowering hardy shrubs generally cultivated as a garden flower and is also called Chinese hibiscus or rose of China. It is a 1-3 m high flowering plant, but

sometimes reaches 8 or 9 m in the subtropical regions, becoming tree like. *Hibiscus rosa-sinensis* L. has many colorful cultivars and is becoming popular as a specimen plant in all kinds of decorations. Besides its ornamental values, it also has a medicinal value. The flower buds of *Hibiscus rosa-sinensis* L. are used in oriental medicine as a demulcent agent and to treat diarrhoea (Tomoda and Ickikawa, 1987). Similarly the flower buds can also be used for making anti-diabetic medicines (Alam *et al.*, 1990).

As for the popularity of using *Hibiscus rosa-sinensis* L. in landscape design, many authors focused their studies on the propagation methods of this plant under local conditions in Egypt. Grafting methods are of paramount importance in this concern. It is well known that the success or failure of grafting plants depend mainly on compatibility or incompatibility. The mechanism of graft incompatibility is not yet fully understood and many reports focus on this problem in order to understand the mechanism of graft development. These reports refer to both histological and biochemical responses occurring at an early phase in response to grafting, as well as the consequences of these events on the future graft response.

Formation of a successful graft union involves many processes and cell recognition is the first step in graft compatibility (Pina and Errea 2005). Callus cells are able to reject partner cells at an early stage, and hence bring about incompatible response. Cell necrosis and vascular connection discontinuity at the unions are reported to be the main indicators of graft incompatibility (Ermel *et al.*, 1997). Cell differentiation takes place after cell recognition (Considine, 1983) and callus initiates cell continuity in compatible partners, but necrosis occurs in the incompatible partners (Pina and Errea, 2005). Cell necrosis is often seen when callus tissues grow together for sometime (Ermel *et al.* 1997), but can also occur at any stage, especially during callus proliferation (Moore and Walker, 1981). Therefore, grafting compatibility is complex and involves a number of processes.

Referring to grafting methods, many authors agreed that cleft grafting is the best when compared with other methods used in improving plant characters as was mentioned by Awasthi *et al.* (1982) on walnut, El-Rouby (1994) on *Annona*, Raham *et al.*, (2002) on *Hibiscus rosa-sinensis* cv. Hawaiian, Jalil and Kashyap (2006) on neem, Sunil and Shukla (2008) on custard apple, Thakur and Rajesh (2008) on *Robinia pseudoacacia* L. and Krdar *et al.* (2009) on blue spruce.

Therefore, the present experiment aimed to

study the effect of using two cultivars from *Hibiscus rosa-sinensis* L. as rootstock for grafting with different cultivars aiming to find out the possibility of producing plants of good quality and superior morphological traits by using different types of grafting.

2. MATERIALS AND METHODS

This experiment was conducted throughout two successive seasons (2007/2008 and 2008/2009) at the nursery of Horticulture Research Institute, Giza. It was intended to attempt the production of *Hibiscus rosa-sinensis* L. and *Hibiscus syriacus* L plants of good quality with superior morphological traits.

2.1. Plant materials

Rootstocks of one year age (48-50 cm length, 0.8 – 1 cm. diameter) of two *Hibiscus rosa-sinensis* cultivars Fire Truck and Apple Blossom were prepared in both seasons by planting them in 25 cm. plastic pots filled with 2.5 kg sand/clay (1:1, v/v) medium. Physical and chemical properties of the growing medium are shown in Table (a).

Scion of five *Hibiscus rosa-sinensis* cultivars Fire Truck, Charles September, Miss Kitty, Cane Fire and Cooperi and two *H. syriacus* cultivars Alba and Blue were prepared for cleft grafting. All scions were 5-6 cm. long, with no leaves.

2.2. Procedure

On April 1st in both seasons, rootstocks of the two *Hibiscus rosa-sinensis* cultivars Fire Truck and Apple Blossom were grafted by using scions of five *Hibiscus rosa-sinensis* cultivars Fire Truck, Charles September, Miss Kitty, Cane Fire and Cooperi and two *Hibiscus syriacus* cultivars Alba and Blue. Plastic tape was wrapped round the graft part to seal it.

Factorial experiment in randomized complete block design of three replicates was carried out in the two seasons. The first factor rootstock cvs. (2cvs.), whereas the second one scion cvs. (7scion cvs.). Every experimental unit contained three plants, (14 treatments of three replicates were

Table (a) Physical and Chemical properties of growing medium (sand /clay 1:1, v/v).

pH	Ec mhos/cm ²	Anions(meq/L)			Cations (meq/L)			
		HCO ₃ ⁻	Cl ⁻	SO ₄ ⁻	Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺
7.81	1.84	3.88	4.38	3.56	3.35	1.53	4.69	2.02
N		P		K	Fe	Zn	Mn	Cu
(ppm)								
130.7		23.4		380	6.15	5.70	9.40	3.68
Physical analysis (%)				Fine sand=22.6		Coarse sand =1.2		Silt=21.7 Clay=54.5

carried out in the two successive seasons, 9 plants for every treatment).

The plants were left to grow for three months, under open field conditions till July 1st in both seasons, and then the survival percentages of the different treatments were recorded. After 6 months from grafting the following data were recorded: the length/scion, number of main branches/scion, stem diameter above 1cm. from site emergence of newly established plants and fresh weight of newly established plants. Moreover, chemical analysis of the leaves was also conducted to determine their contents of total chlorophylls mg./g. F.W. (according to Saric *et al.*, 1967), total carbohydrates (%), (according to Herbert *et al.*, 1971), and total phenols mg./100g F.W. (according to Daniel and George, 1972).

Regular agricultural practices such as weeding, watering, chemical fertilization were carried out whenever needed.

Data were statistically analyzed and means were compared by L.S.D. at 5% according to Snedecor and Cochran (1980).

3. RESULTS AND DISCUSSION

3.1. Grafting success

3.1.1. Survival percentage

Using cv. Fire Truck as a rootstock for cleft grafting in both seasons resulted in the highest survival percentages (Table 1). In the same parameter considerably varied according to the different scion cvs. used. In this connection, cv. Cooperi followed by 'Fire Truck' proved their superiority in elevating the scored values in both seasons. However, 'Charles September' scion occupied the third position in this concern. In contrast, both cvs. Syriacus Alba or Syriacus Blue failed in this respect. Meanwhile, 'Miss Kitty' or 'Cane Fire' scions showed an intermediate survival percentage in both seasons.

Considerable variations, on the other hand, were observed on data recorded for the interaction between the different rootstock and scion cvs. in both seasons. Highest values were registered due to the combined effect between "Cooperi" scion and either 'Fire Truck' or 'Apple Blossom' stock in both seasons. However, this superiority was also observed in the first season when "Fire Truck" scions were grafted on 'Fire Truck' stock.

The best results of some treatments mentioned above 'Cooperi' scions with either 'Fire Truck' or 'Apple Blossom' stocks in both seasons might be attributed to the compatibility between scion and rootstock cvs. in some successful treatments.

3.1.2. The length/scion

Data presented in Table (2) indicate the superiority of 'Fire Truck' rootstock in increasing

the length/scion when compared with the other stock 'Apple Blossom' in the two seasons. Also, it is clear that "Fire Truck" and 'Cooperi' scion cultivars had a great influence on increasing the length/scion, followed by "Charles September" scion in both seasons. In contrast, both 'Miss Kitty' and 'Cane Fire' scion recorded the lowest means in this respect in the two experimental seasons.

Concerning the interaction, data given in Table (2) show clearly that using 'Fire Truck' as a rootstock, combined with using the same cv. (Fire Truck) or 'Cooperi' as the scion in grafting considerably increased the length/scion in both seasons. However, using 'Charles September' scion for grafting the above mentioned rootstock revealed also a favourable effect in this regard. On the other hand, the shortest scions were recorded as a result of using 'Fire Truck' rootstock and 'Miss Kitty' scion in grafting in both seasons.

3.1.3. Number of main branches/scion

Insignificant effects were recorded on number of main branches/scion due to 'Fire Truck' or 'Apple Blossom' as a rootstock in both seasons Table (3). On the other hand, the different scion cvs. gave significantly different numbers of branches. 'Cooperi' scion proved its superiority in promoting branching, compared to the other scions, whereas 'Miss Kitty' recorded the lowest means in this concern.

The interaction between the two rootstocks and different scion cvs. had no significant effect on the scored values in both seasons.

3.1.4. Stem diameter (cm.)

Stem diameter significantly increased in response to using 'Fire Truck' as a rootstock, compared to Apple Blossom in both seasons (Table 4). Similarly, scion cvs. showed also clear differences in their effect on the same parameter. It could be concluded that 'Cooperi' scion occupied the first position in elevating stem diameter followed by 'Fire Truck' and 'Charles September' scion which occupied the second and third positions in this concern, whereas 'Miss Kitty' registered the lowest values in the two seasons.

The highest results, on the other hand, were scored as a result of using 'Cooperi' scion for grafting 'Fire Truck' rootstock, followed by using 'Fire Truck' and 'Charles September' scions. for grafting 'Fire Truck' rootstock (in both seasons).

3.1.5. Fresh weight of newly established plants

Data Table (5) show clearly that 'Fire Truck' rootstock was the best in elevating fresh weight in both seasons when compared with the other rootstock used 'Apple Blossom'. It was also observed that the different scion cvs. had a

Table (1): Effect of different rootstocks, scion cultivars and the interaction on the survival percentage (%) after three months from grafting throughout two successive seasons (2007/2008 and 2008/2009).

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean (B)	Fire Truck	Apple Blossom	Mean (B)
	First season			Second season		
Fire truck	100.00	85.71	92.86	85.71	85.71	85.71
Charles September	85.71	71.42	78.57	85.71	71.42	78.57
Miss Kitty	71.42	57.14	64.28	57.14	42.86	50.00
Cane Fire	85.71	42.86	64.29	71.24	57.14	64.19
Cooperi	100.00	100.00	100.00	100.00	100.00	100.00
Syriacus Alba	00.00	00.00	00.00	00.00	00.00	00.00
Syriacus Blue	00.00	00.00	00.00	00.00	00.00	00.00
Mean(A)	63.26	51.02		57.14	51.02	
						00.00
						00.00

Table (2): Effect of different rootstocks, scion cultivars and their interaction on the length/ scion (cm.) after 6 months from grafting in the two successive seasons (2007/2008 and 2008/2009).

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean (B)	Fire Truck	Apple Blossom	Mean (B)
	First season			Second season		
Fire Truck	33.91	24.57	29.24	31.70	21.45	26.58
Charles September	31.63	22.70	27.17	25.33	18.11	21.72
Miss Kitty	10.29	14.92	12.61	8.75	15.43	12.09
Cane Fire	19.83	11.91	15.87	16.65	10.00	13.32
Cooperi	34.48	23.33	28.91	32.85	20.65	26.75
Mean(A)	26.03	19.49		23.06	17.13	
L.S.D. at 5%	A=2.09			A=1.76		
	B=3.32			B=2.77		
	A*B=4.69			A*B=3.92		

Table (3): Effect of different rootstocks, scion cultivars and their interaction on the number of main branches/scion after 6 months from grafting in the two successive seasons (2007/2008 and 2008/2009).

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean (B)	Fire Truck	Apple Blossom	Mean (B)
	First season			Second season		
Fire Truck	2.66	2.00	2.33	2.33	2.00	2.17
Charles September	2.00	2.00	2.00	2.00	1.67	1.83
Miss Kitty	1.67	2.00	1.83	1.33	2.00	1.67
Cane Fire	2.33	2.33	2.33	2.67	2.00	2.33
Cooperi	3.67	3.00	3.33	3.33	3.00	3.17
Mean(A)	2.47	2.27		2.33	2.13	
L.S.D. at 5%	A=N.S.			A=N.S.		
	B=0.58			B=0.94		
	A*B=N.S.			A*B= N.S		

Table (4): Effect of different rootstocks, scion cultivars and their interaction on stem diameter(cm.)of after 6 months from grafting in the two successive seasons (2007/2008 and 2008/2009).

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean (B)	Fire Truck	Apple Blossom	Mean (B)
	First season			Second season		
Fire Truck	0.57	0.42	0.50	0.48	0.48	0.48
Charles September	0.51	0.49	0.50	0.52	0.39	0.46
Miss Kitty	0.33	0.38	0.36	0.33	0.36	0.35
Cane Fire	0.44	0.35	0.40	0.40	0.37	0.39
Cooperi	0.68	0.54	0.61	0.57	0.51	0.54
Mean(A)	0.51	0.44		0.46	0.42	
L.S.D. at 5%	A= 0.05			A= 0.04		
	B=0.08			B=0.06		
	A*B=N.S.			A*B= N.S		

A = Rootstocks

B = Scion cultivars

A*B = Interaction

Table (5): Effect of different rootstocks, scion cultivars and their interaction on the fresh weight(g.) of newly established plants after 6 months from grafting in the two successive seasons (2007/2008 and 2008/2009).

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean (B)	Fire Truck	Apple Blossom	Mean (B)
	First season			Second season		
Fire Truck	30.91	20.59	25.75	25.80	19.53	22.67
Charles September	22.73	17.72	20.23	19.13	16.49	17.81
Miss Kitty	8.39	11.07	9.73	8.23	12.12	10.18
Cane Fire	13.65	9.92	11.78	12.69	7.78	10.24
Cooperi	26.56	18.83	22.69	21.13	16.95	19.04
Mean(A)	20.45	15.65		17.40	14.57	
L.S.D. at 5%	A=1.28			A=1.15		
	B=2.03			B=1.83		
	A*B=2.87			A*B=2.58		

pronounced significant effect on the same parameter. Using either ‘Fire Truck’ or ‘Cooperi’ scion in grafting had a great influence on the scored values in both seasons. In contrast, using ‘Miss Kitty’ as a scion considerably decreased the registered values in both seasons.

Concerning the interaction, using ‘Fire Truck’ scions for grafting on rootstocks of the same cv. in increasing fresh weight of the newly established plants in both seasons. However, using either ‘Cooperi’ for grafting ‘Fire Truck’ rootstock cv. or using ‘Fire Truck’ scions for grafting ‘Apple Blossom’ rootstock occupied the second category in elevating the values in both seasons. In contrast, the lowest means were obtained due to using ‘Fire Truck’ rootstock cv. with ‘Miss Kitty’ scions or using ‘Apple Blossom’ rootstock with ‘Cane Fire’ scions (in both seasons).

3.2. Chemical constituents

3.2.1. Total chlorophylls in the leaves (mg. /g. F.W.)

Data in Table (6) show that ‘Fire Truck’ significantly showed the highest total chlorophyll

content in the leaves, compared to the other rootstock ‘Apple Blossom’ in both seasons. Also, marked differences were observed on the same constituent due to using the different scion cvs. in grafting. In this connection, a great influence on the obtained values was detected as a result of using either ‘Fire Truck’ or ‘Charles September’ scion.

They gave similar effect on the accumulation of total chlorophyll content in the two seasons. Meanwhile, using ‘Miss Kitty’ and ‘Cooperi’ cvs. as scions caused reductions in the total chlorophyll content.

Different trends were observed on total chlorophyll content in the leaves as a result of the interaction between the different rootstock and scion cvs. Receiving ‘Fire Truck’ either the same scion ‘Fire Truck’ or ‘Charles September’ in grafting revealed their mastery in elevating the registered values in the two seasons. In contrast, the worst results (*i.e.*, the lowest chlorophyll content) were obtained as a result of using the above mentioned rootstock ‘Apple Blossom’ with

Table (6): Effect of different rootstocks, scion cultivars and their interaction on the total chlorophylls mg./g F.W.) in leaves after 6 months from grafting in the two successive seasons (2007/2008 and 2008/2009).

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean (B)	Fire Truck	Apple Blossom	Mean (B)
	First season			Second season		
Fire Truck	1.66	1.30	1.48	1.62	1.16	1.39
Charles September	1.54	1.27	1.41	1.60	1.20	1.40
Miss Kitty	0.96	1.33	1.15	0.83	1.05	0.94
Cane Fire	1.80	0.97	1.39	1.19	0.93	1.06
Cooperi	1.15	0.98	1.06	1.16	0.98	1.07
Mean(A)	1.43	1.17		1.28	1.06	
L.S.D. at 5%	A=0.08			A=0.07		
	B=0.13			B=0.12		
	A*B=0.18			A*B=0.17		

A = Rootstocks

B = Scion cultivars

A*B = Interaction

either ‘Cane Fire’ or ‘Cooperi’ as scions in grafting in both seasons. Both of these combinations revealed a clear decrement on the scored values whereas, the other treatments gave an intermediate effect in this respect.

3.2.2. Total carbohydrate content in the leaves (D.W. %)

Data Table (7) show the superiority of using ‘Fire Truck’ rootstock in elevating total carbohydrates content in the leaves in the two seasons. Also, the total carbohydrate content differed according to the scion cvs. used in the current study. ‘Fire Truck’ scion was the best in increasing the values in both seasons, followed by ‘Charles September’ and ‘Cooperi’ scion which revealed about similar effect on the scored values in both seasons. Meanwhile, the other two scion cvs. had intermediate effects in this regard.

Concerning the interactions, a marked increase in total carbohydrate content in the leaves was detected due to using ‘Fire Truck’ rootstock with scions of the same cultivar (Fire Truck), or of cvs. ‘Charles September’ or ‘Cooperi’ (in the two seasons). Moreover, it could be concluded that using ‘Apple Blossom’ rootstock with ‘Fire Truck’ scions also had a favorable effect on the registered values. In contrast, grafting ‘Apple Blossom’ rootstock with ‘Cane Fire’ scions recorded the lowest means in the two seasons. In this respect, Shaban (2005) on mango reported that the lowest grafting success was that of scions containing the lowest total sugar content.

3.2.3. Total phenol content in the leaves (mg./100g. F.W.)

Data presented in Table (8) show a significant influence on phenol content in the leaves due to using ‘Apple Blossom’ cv. as a rootstock in both seasons. The increment of phenols as a result of using this rootstock in grafting is in line with the reduction recorded in most of the morphological

traits as a result of using the previous rootstock in grafting.

Referring to the effect of scion cvs., marked differences were scored on the total phenol content in leaves due to using the various scion cvs. in grafting. The highest phenol contents were recorded as a result of using either "Miss Kitty" or ‘Cane Fire’ scions in grafting in the two seasons, whereas ‘Cooperi’ scion followed by ‘Fire Truck’ and then ‘Charles September’ caused an opposite effect as they decreased the registered values in both seasons. The low total phenol contents that were scored as a result of using the above mentioned scion ‘Cooperi, Fire Truck and Charles September’ confirmed the favorable results obtained as a result of using such scions in both seasons on the morphological traits of the plants in both seasons.

The interactions revealed a clear increment in total phenol content in leaves as a result of using ‘Miss Kitty’ or ‘Cane Fire’ scions in grafting ‘Apple Blossom’ rootstock, as well as grafting ‘Fire Truck’ rootstock with ‘Miss Kitty’ scions in both seasons. In contrast, the lowest phenol contents were obtained as a result of using ‘Cooperi’ scions for grafting either ‘Fire Truck’ or ‘Apple Blossom’ rootstocks in the two seasons. In this connection, Shaban (2005) on mango reported that the highest grafting success was obtained with scions containing the lowest phenol contents, whereas the lowest grafting success was obtained with scions giving the largest phenols and having the lowest total sugar contents.

From the aforementioned results, it is clear that the studied characteristics differed considerably according to the different rootstock and scion cvs. used as well as the combination of these two factors.

The differences resulting from either rootstock or scions cvs. Could be attributed to

Table (7): Effect of different rootstocks, scion cultivars and their interaction on the total carbohydrate (D.W. %) in the leaves after 6 months from grafting in the two successive seasons (2007/2008 and 2008/2009).

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean(B)	Fire Truck	Apple Blossom	Mean(B)
	First season			Second season		
Fire Truck	20.19	16.98	18.58	16.86	17.32	17.09
Charles September	15.64	14.32	14.98	17.55	13.00	15.27
Miss Kitty	10.88	14.28	12.58	11.97	12.26	12.11
Cane Fire	14.09	12.19	13.14	12.78	10.58	11.68
Cooperi	17.36	13.42	15.39	15.89	14.17	15.03
Mean(A)	15.63	14.23		15.01	13.46	
L.S.D. at 5%	A=0.84			A=0.76		
	B=1.33			B=1.21		
	A*B=1.88			A*B=1.72		

Table (8): Effect of different rootstocks, scion cultivars and their interaction on the total phenols in the leaves (mg./100g F.W.) after 6 months from grafting in the two successive seasons (2007 and 2008)

Scion cultivars	Rootstock cultivars					
	Fire Truck	Apple Blossom	Mean(B)	Fire Truck	Apple Blossom	Mean(B)
	First season			Second season		
Fire Truck	0.22	0.27	0.25	0.26	0.26	0.26
Charles September	0.23	0.29	0.26	0.22	0.30	0.26
Miss Kitty	0.35	0.38	0.37	0.34	0.33	0.34
Cane Fire	0.34	0.37	0.36	0.26	0.36	0.31
Cooperi	0.18	0.22	0.20	0.19	0.22	0.21
Mean(A)	0.26	0.31		0.25	0.29	
L.S.D. at 5%	A=0.024			A=0.025		
	B=0.038			B=0.039		
	A*B=0.053			A*B=0.056		

A = Rootstocks

B = Scion cultivars

A*B = Interaction

some genetic factors, whereas the differences resulting from the combined effect of rootstock and scion cvs. may be related to the compatibility or incompatibility between rootstocks and scions after grafting. However, the mechanism of graft incompatibility is not yet fully understood and many reports focus on this problem in order to understand the mechanisms of graft development. These reports refer to both histological and biochemical responses occurring at an early phase in response to grafting, as well as the consequences of these events on the future graft response. In this connection, cell necrosis and vascular connection discontinuity at the unions are reported to be the main indicators of graft incompatibility (Ermel *et al.*, 1997).

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استجابته نبات الهيبسكس *Hibiscus* sp. لأنماط متباينه من التطعيم بالشق القمي

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ملخص

أجريت هذه الدراسة بمشغل معهد بحوث البساتين خلال موسمين متتاليين (2007/2008 و2008/2009) لدراسة مدى إمكانية الحصول على نباتات عالية الجودة من *Hibiscus rosa-sinensis* L. أو *Hibiscus syriacus* L. ذات صفات مورفولوجية متباينة.

تم استخدام أصليين من صنفى نبات *Hibiscus rosa-sinensis* 'and 'Fire Apple Blossom' Truck مع استعمال أصناف متباينة تم استخدامها كطعوم بالشق لتلك الأصول شملت أصناف 'Alba and Blue' و *H. syriacus* 'Cooperi'، 'Cane Fire'، 'Miss Kitty'، 'Charles September' Fire Truck، في كل من موسمى الزراعة وقد أوضحت النتائج ما يلي:

- أظهر استخدام الصنف 'Fire Truck' تفوقاً واضحاً في تحسين معظم خصائص النباتات الناتجة في كل من موسمى الزراعة بالمقارنة بما تم الحصول عليه من الأصل الآخر 'Apple Blossom' حيث أدى إلى زيادة نسبة البقاء للنباتات الناتجة، طول الطعم، سمك الساق، وكذلك الوزن الغض للنباتات الجديدة الناتجة بالإضافة إلى تحسين بعض الصفات الكيميائية للنباتات الجديدة الناتجة حيث أدى إلى زيادة محتوى الأوراق من الكلورفيلات والكربوهيدرات الكلية مع خفض محتواها من الفينولات.

- كذلك أظهرت الطعوم المستخدمة لأصناف نباتية من نبات الهيبسكس تأثيرات متباينة على الخصائص السالفة الذكر حيث تم الحصول على أفضل التأثيرات على خصائص النبات في معظم الحالات نتيجة لاستخدام صنفى 'Cooperi' و 'Fire Truck' كطعوم حيث أدت إلى زيادة نسبة البقاء، طول البرعم، سمك الساق وكذا الوزن الغض للنباتات الجديدة الناتجة

وفي نفس الوقت إزداد عدد الفروع الرئيسية الناتجة للطعم نتيجة لاستخدام طعم صنف 'Cooperi' في التطعيم ، بينما تم ملاحظة انخفاض القيم المتحصل عليها في معظم الحالات نتيجة لاستخدام طعم 'Miss Kitty'. بالإضافة الى ذلك فقد تم تسجيل تحسن واضح في المحتوى الكيميائي للنبات نتيجة استخدام طعم صنف 'Fire Truck' وتلى ذلك التأثير الجيد استخدام طعم صنف 'Charles September' أو طعم صنف 'Cooperi' حيث كانت الزيادة في محتوى الأوراق من الكلورفيلات والكربوهيدرات الكلية. بالإضافة الى نقص في محتواها من الفينولات وعلى النقيض من ذلك ظهرت نتائج غير مستحبة في معظم الحالات في المحتوى الكيميائي للنبات الناتجة لاستخدام طعم صنف 'Miss Kitty' في التطعيم. هذا وقد أظهرت التفاعلات ما بين الأصل والطعم التفوق الواضح للتأثير المتجمع ما بين استخدام صنف Fire Truck كأصل واستخدام صنف 'Fire Truck' أو 'Cooperi' كطعوم في تحسين معظم خصائص النبات الجديدة الناتجة التي تم دراستها. بالإضافة الى التأثير الجيد لإستخدام الصنف 'Fire Truck' كأصل مع استخدام نفس الصنف أو صنف 'Charles September' كطعوم في زيادة محتوى الأوراق من الكلورفيلات والكربوهيدرات الكلية. يمكن من النتائج المتحصل عليها النصح باستخدام الصنف 'Fire Truck' كأصل مع استخدام نفس الصنف أو الصنف 'Cooperi' كطعوم لتطعيم هذا الصنف 'Fire Truck'.

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