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## PERFORMANCE OF SOME GRAPE CULTIVARS GRAFTED ON DIFFERENT ROOTSTOCKS AND SOME FACTORS AFFECTING GRAFTING SUCCESS.

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### ABSTRACT

This study was carried out throughout two successive seasons of 2006-2007 & 2007-2008 in the nursery of Viticulture Department in Hort. Rec. Inst., Agric. Rec. Cent. at Giza Governorate. Three grape cultivars i.e. Flame Seedless, Thompson Seedless and Superior Seedless, (*Vitis Vinifera*, L) were grafted by cleft grafting on the 1<sup>st</sup> week of January on three rootstocks i.e. Dog Ridge (*V.champini*), Freedom (1613 x *V.champini*) and St.Geroge (*V.rupestris*) or self-grafted (control) using two diameters (A: 8-12 mm & B: 4-8 mm) to study the performance of these cultivars on these rootstocks concerning growth vigour parameters and macro-nutrients accumulation in the grafted seedlings. Success percentage in relation to both grafting combinations and grafting diameter was also assessed. Results show that the percentage of grafting success depended on both the grafting combination and the diameter used. The highest percentage was recorded in general by grafting on Freedom rootstock. Results of using diameter (A) were higher with both Thompson Seedless and Superior Seedless cvs whereas, the opposite was true for Flame Seedless cv. In general growth vigor parameters were higher when grafted on both Freedom and Dog Ridge rootstocks than grafting on St. George or self grafting this was associated with higher contents of both N and K in scion leaf petioles grafted on former rootstocks. This high absorption efficiency of both nitrogen and potassium are high importance for growers to decrease fertilization doses and thus improve the economic return and decrease health and

environmental hazards. Absorption in our opinion may be the leading factor for increasing growth.

## INTRODUCTION

Grapes are of the most important fruit nationally and internationally. Egypt grows 167048 feddans with a production of 1531418 tons (Egyptian Ministry of Agriculture statistics, 2008). Nowadays expanding grape cultivation in new reclaimed areas is of great interest due to its high return for local market and exportation. Grapes in Egypt are conventionally propagated by cuttings, but many vineyards faces a lot of problems concerning vegetative growth vigour, salinity, drought, high pH, calcareous soils and nematodes. This led to a great increase of grafting usage to benefit from a specific character acquired by the rootstock or effects on the scion. Grafting success was found to be affected by the combination between the rootstock and scion (Gaser 2007; Cangi *et al.*, 2000). Rootstock and scion diameter was also important for vegetative growth (Kassem 1983). Scion growth vigour was affected by the used rootstock (Gaser 2007; Tambe and Gawade 2004 Abo El-wafa 2003). Several investigators pointed out that the scion's content of macro nutrients depended on the rootstock for nitrogen (Mandeep and Sharma 2005; Abo El-wafa 2003) for phosphorus (Mandeep and Sharma 2005; Abo El-wafa 2003) and for potassium (Mandeep and Sharma 2005; Abo El-wafa 2003). The scope of this investigation is to assess the comparative effects of grafting on three rootstocks and the diameter of grafting on the percentage of success and performance of transplant.

## MATERIALS AND METHODS

The present study was carried out during two successive seasons of 2006-2007 and 2007-2008 in the nursery of Viticulture Department in Hort. Rec. Inst., Agric. Rec. Cent. at Giza Governorate. In this study three cultivars i.e. Superior Seedless, Flame Seedless and Thompson Seedless. (*Vitis Vinifera*, L) were grafted on three rootstocks i.e. Dog Ridge (*V.champini*), Freedom (1613 x *V.champini*) and St.Geroge (*V.rupestris*) rootstocks or self-grafted (control). Two diameters for both rootstocks cuttings and scions were considered (diameter A: 8-12 mm & diameter B: 4-8 mm). Cleft grafting was carried out in the 1<sup>st</sup> week of January. Each grafting combination with each used diameter was presented by 30 grafted cuttings (each ten of

them act as a replicate). Bases of rootstocks were dipped in 500 p.p.m IBA for 5 seconds. Grafted cuttings were kept in moist peat moss at 25-28°C for callusing till 20<sup>th</sup> February at which they were planted in plastic bags full with a 2:1 mixture of peat moss: sand and irrigated immediately. Plastic bags were then placed under plastic tunnels till end of April after which covers were removed. Grafted seedlings were subjected to normal management practices.

The following parameters were measured: Percentage of grafting success (%) in May, average shoot length (cm) at growth cessation, average leaf area (cm<sup>2</sup>) of the 5<sup>th</sup> and 6<sup>th</sup> apical leaves using a CI-203 laser Area meter made by CID, inc, Vancouver, Washington state USA. Macro nutrients content in petioles of 5<sup>th</sup> and 6<sup>th</sup> leaves were determined after six months of planting. Nitrogen percentage was determined using the method described by Pregl (1945), Phosphorus was determined using the method described by Jackson (1967) and Potassium by Brown & Lilleland (1946).

#### **Statistical analysis:**

The complete randomized blocks design was adopted for the experiment according to Snedecor and Cochran (1989). Means separation using the least significant difference (LSD) at 5% level according to Steel and Torrie (1980).

## **RESULTS AND DISCUSSION**

#### **Grafting success percentage (%):**

On the average Flame Seedless cv. was found to give the highest significant percentage when grafted on Freedom rootstock in both considered seasons (63.55% & 51.60%), respectively, (Table1). As for the diameter effect, data show that diameter B gave highest significant percentage in both seasons (59.48% & 48.15%). Concerning the interaction, data of grafting on both St. George and Freedom rootstocks using diameter B recorded the highest percentages (68.30 & 54.00 & 69.30 & 56.60%) in both seasons respectively. Also, grafting on Dog Ridge with diameter A gave a comparable percentage in the first season only (67.27%).

As for Thompson Seedless cv. it is evident from the data that on the average, the percentage of success was significantly the highest when using Freedom rootstock in both seasons (63.61% & 56.72%), respectively. As for the diameter effect on the average data clarify that

**Table (1): Effect of rootstock and used diameter on percentage Success % in different grape Cultivars:**

Diameter	Flame Seedless						Thompson Seedless						Superior Seedless					
	2006			2007			2006			2007			2006			2007		
Rootstock	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN
<b>Dog Ridge</b>	67.27	54.60	60.93	43.30	40.00	41.65	74.00	44.64	59.32	53.33	36.67	45.00	63.50	55.30	59.40	43.40	33.00	38.15
<b>St. George</b>	52.80	68.30	60.55	40.00	54.00	47.00	49.00	37.66	43.33	23.33	20.00	21.67	68.80	54.20	61.50	46.60	33.30	39.95
<b>Freedom</b>	57.80	69.30	63.55	46.60	56.60	51.60	73.77	53.46	63.61	63.88	49.55	56.72	74.80	65.70	70.25	56.60	46.60	51.60
<b>Self-grafted</b>	40.90	45.70	43.30	40.00	42.00	41.00	43.50	41.10	42.30	40.00	39.30	39.65	44.20	46.80	45.50	42.50	43.40	42.95
MEAN	54.69	59.48		42.47	48.15		60.07	44.22		45.14	36.38		62.83	55.50		47.25	39.08	
LSD A	2.52			3.31			0.64			2.76			0.92			2.56		
B	1.78			2.34			0.45			1.95			0.65			1.81		
AB	3.57			4.67			0.91			3.91			1.30			3.31		

using diameter A resulted in significantly higher percentage in both seasons. Concerning the interaction results, data show that highest percentage of success was attributed to grafting on Freedom rootstock using diameter A in both seasons (73.77% & 63.88%), respectively and on Dog Ridge rootstock using diameter A in the second season of the investigation only (74.00%).

As for Superior Seedless cv. average results revealed that percentage of success was significantly the highest when using Freedom rootstock in both seasons (70.25% & 51.60%), respectively. As for the average diameter effect, data show that using diameter A resulted in significantly higher percentage in both seasons. Concerning the interaction, data show that highest percentage of success was attained by grafting on Freedom rootstock using diameter A in both seasons (74.80% & 56.60%), respectively.

#### **Shoot length (cm):**

On the average grafting Flame Seedless cv. on Dog Ridge (45.70 & 43.90 cm) or Freedom (44.60 & 42.80 cm) rootstocks resulted in significantly the longest shoots in both seasons of the investigation respectively, (Table 2). On the average, insignificant effects were attributed to diameter of the scion or the rootstock. Concerning the interaction, data reveal that longest shoots were attained by grafting Flame Seedless Cv. on Dog Ridge rootstock and using diameter A in both seasons of the investigation (47.3 & 47.20 cm.), respectively. Also Freedom rootstocks with diameter B resulted in highest significance (47.40 cm) in the first season only.

As for Thompson Seedless cv. average data show that shoot length was significantly the tallest when grafted on Dog Ridge rootstock in both seasons (49.73 & 37.56 cm), respectively. Also, using Freedom rootstock lead to statistically equal results. As for the diameter effect, in the first season results show that using diameter A gave the highest significant effect but in the second season there was no significant effect attributed to this parameter. Concerning the interaction it is clear that grafting on Dog Ridge rootstock using diameter A was highly significant in both seasons (56.63 & 47.83 cm), respectively. Also grafting on Freedom rootstock with diameter B gave comparable high length in second season only (50.88 cm).

As for Superior Seedless cv., data on the average effect of rootstock revealed that shoot length recorded the significant highest

Table (2): Effect of rootstock and used diameter on Shoot length (cm) in different grape cultivars:

Diameter	Flame Seedless						Thompson Seedless						Superior Seedless					
	2006			2007			2006			2007			2006			2007		
Rootstock	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN
<b>Dog Ridge</b>	47.20	44.20	45.70	47.30	40.50	43.90	56.63	42.83	49.73	47.84	37.56	42.70	60.30	52.40	56.35	58.10	48.10	53.10
<b>St. George</b>	30.70	35.90	33.30	25.90	30.60	28.25	38.47	35.78	37.13	32.34	30.50	31.42	37.80	42.50	40.15	35.30	39.60	37.45
<b>Freedom</b>	41.80	47.40	44.6	40.00	45.60	42.80	42.60	53.90	48.25	37.00	50.88	43.94	47.20	56.30	51.75	45.60	53.50	49.55
<b>Self-grafted</b>	43.87	35.40	39.63	34.90	33.50	34.20	34.60	30.10	32.35	32.80	30.90	31.85	36.70	38.00	37.35	34.00	35.60	34.80
<b>MEAN</b>	40.89	40.73		37.03	37.55		43.08	40.65		37.49	37.46		45.50	47.30		43.25	44.20	
LSD A	5.49			4.18			0.89			2.89			0.89			2.39		
B	3.88			2.96			0.63			2.04			0.62			1.69		
AB	7.76			5.92			1.26			4.08			1.24			3.38		

shoots length when grafting on Dog Ridge rootstock in both seasons (56.35 & 53.10cm), respectively. As for the diameter effect, on the average shoot length was significantly the highest when using diameter B in first season only (47.30cm) but in the second season this relation was reversed. Concerning the interaction, data reveal that grafting on Dog Ridge rootstock using diameter A record the highest shoot length in both seasons (60.30& 58.10cm), respectively.

### **Leaf area (cm<sup>2</sup>):**

On the average, grafting Flame Seedless cv., on Freedom or Dog Ridge rootstocks resulted in significantly the largest average leaf area in both seasons of the investigation amounting to (128.3&125.7 cm<sup>2</sup>), (125.6&124.3 cm<sup>2</sup>), respectively,(Table 3). Insignificant effects were attributed to the average diameter length. Concerning the interaction, data show that grafting on both Dog Ridge and Freedom rootstocks with both diameters recorded the largest leaf area in the first season (128.0&123.0 cm<sup>2</sup>), (126.5&130.1 cm<sup>2</sup>), respectively. Whereas, in the second season grafting on Dog Ridge rootstock using diameter A and Freedom rootstock using diameter B gave the largest leaf area (128.6&127.4 cm<sup>2</sup>), respectively.

As for Thompson Seedless cv. recorded data show that grafting on Dog Ridge rootstock gave the largest leaf area in both seasons (130.6 &124.5 cm<sup>2</sup>), respectively. As for the diameter effect, results clearly show that in first season, using diameter A resulted in significantly the largest area but in the second season insignificant differences were detected. Concerning the interaction, data reveal that grafting on Dog Ridge rootstock using diameter A gave high significant area in both seasons (132.3&126.0 cm<sup>2</sup>), respectively.

As for Superior Seedless cv. results clarify that grafting on Dog Ridge rootstock in both seasons (131.3&127.3 cm<sup>2</sup>), or on Freedom rootstock in second season only (126.3cm<sup>2</sup>) recorded significantly the highest leaf area. As for the average diameter effect, results show that using diameter A resulted in significantly larger areas in both seasons. Data of the interaction revealed that grafting on Dog Ridge rootstock using diameter A gave the highest significant area in both seasons (137.0&134.2 cm<sup>2</sup>), respectively.

Table (3): Effect of rootstock and used diameter on Leaf area (cm<sup>2</sup>) in different grape cultivars:

Diameter	Flame Seedless						Thompson Seedless						Superior Seedless					
	2006			2007			2006			2007			2006			2007		
Rootstock	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN
<b>Dog Ridge</b>	128.0	123.2	125.6	128.6	120.0	124.3	132.3	128.8	130.6	126.0	123.0	124.5	137.0	125.6	131.3	134.2	120.3	127.3
<b>St. George</b>	100.4	109.5	104.9	95.60	103.1	99.35	111.8	109.1	110.4	105.0	102.0	103.5	112.0	114.9	113.4	110.4	113.1	111.8
<b>Freedom</b>	126.5	130.1	128.3	124.0	127.4	125.7	118.1	121.5	119.8	113.0	117.5	115.3	129.0	127.1	128.1	126.7	126.0	126.3
<b>Self-grafted</b>	110.3	106.1	108.2	107.0	104.0	105.5	108.0	101.9	104.9	105.4	103.1	104.3	109.4	111.6	110.5	107.0	110.3	108.7
<b>MEAN</b>	116.3	117.2		113.8	113.6		117.6	115.3		112.3	111.4		121.8	119.8		119.6	117.4	
LSD A	7.59			1.93			0.88			1.92			0.64			0.92		
B	5.37			1.37			0.62			1.36			0.45			0.65		
AB	10.73			2.73			1.24			2.72			0.90			1.30		



**Leaf content of macro-Nutrients:****Nitrogen %**

On the average grafting Flame Seedless cv., on both Dog Ridge (1.225&1.205%) and Freedom (1.230&1.200%) rootstocks resulted in significantly the highest N content in leaf petioles in both seasons respectively,(Table 4) . As for the diameter effect, data show insignificant results in both seasons. Concerning the interaction, in the first season the highest percentage of N was recorded by grafting on Dog Ridge rootstock with diameter A and Freedom rootstock with diameter B (1.25&1.26%), respectively. Whereas, in the second season the highest significant percentage of N was recorded by grafting on both Dog Ridge and Freedom rootstocks with both diameters (1.23&1.18%),(1.18&1.22%), respectively.

As for Thompson Seedless cv., results show that grafting on Freedom rootstock on both seasons and Dog Ridge in the second season only led to significantly the highest N% in leaf petioles (1.24 &1.21%), (1.19%), respectively. As for the diameter effect, data show insignificant effect attributed to these two parameters in both seasons. As for the interaction, data clear that grafting on Freedom rootstock with both diameters led to the highest significant effect in first season (1.22 &1.26%), respectively. Comparable results were attained by grafting on Dog Ridge using diameter A in both seasons (1.27&1.19%), respectively, in addition to St.George rootstock using diameter A (1.20%). Whereas, in second season Dog Ridge rootstock with diameter A and Freedom rootstock with diameter B recorded the highest significant effect (1.24%)(1.23%), respectively.

As for Superior Seedless cv., Data concerning N% show that grafting on any of the considered rootstocks in both seasons except St.George resulted in significantly higher percentage compared with control. The diameter had no significant effect concerning this parameter. The interaction results clarify that in the first season using any of the considered rootstocks at with any of the considered diameters resulted in statistically equal N percentages. In the second season however; grafting on both Dog Ridge or Freedom rootstocks using diameter A resulted in significantly the N percentage in the petioles (1.30 &1.25%), respectively.

Table (4): Effect of rootstock and used diameter on Nitrogen % in different grape cultivars:

Diameter	Flame Seedless						Thompson Seedless						Superior Seedless						
	2006			2007			2006			2007			2006			2007			
	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	
Rootstock																			
<b>Dog Ridge</b>	1.25	1.20	1.22	1.23	1.18	1.20	1.27	1.19	1.23	1.24	1.15	1.19	1.33	1.22	1.27	1.30	1.20	1.25	
<b>St. George</b>	0.94	0.96	0.95	0.91	0.93	0.92	1.20	0.99	1.09	1.01	0.98	0.99	1.20	1.23	1.21	1.18	1.21	1.19	
<b>Freedom</b>	1.20	1.26	1.23	1.18	1.22	1.20	1.22	1.26	1.24	1.20	1.23	1.21	1.27	1.24	1.25	1.25	1.23	1.24	
<b>Self-grafted</b>	0.91	0.87	0.89	0.88	0.86	0.87	0.90	0.91	0.90	0.88	0.89	0.89	0.91	0.92	0.92	0.90	0.91	0.90	
<b>MEAN</b>	1.07	1.07		1.05	1.04		1.14	1.09		1.08	1.06		1.17	1.15		1.15	1.13		
LSD A	0.39			0.56			0.14			0.04			0.10			0.04			
B	0.28			0.39			1.00			0.03			0.10			0.04			
AB	0.056			0.78			0.2			0.06			0.14			0.06			

**Phosphorous %:**

On the average Flame Seedless cv. when grafted on St. George rootstock attained the highest percentage of P in petioles in both considered seasons (0.27&0.26%), respectively, (Table 5). Used diameters had insignificant effects in this respect. Concerning the interaction, results clear that grafting on St. George rootstock with both diameters gave the highest significant content in both seasons (0.27&0.23%), (0.27&0.25%), respectively.

As for Thompson Seedless Cv., insignificant results were attained concerning both the rootstock and the diameter effect or their interaction.

As for Superior Seedless Cv., data show insignificant effects attributed to the studied factors or their interaction in the first season. In the second season however, insignificant effects were attributed to the main factors.

**Potassium%:**

On the average neither the rootstock nor the diameter used had a significant effect concerning the K content in petioles of Flame Seedless cv. petioles. (Table 6). Their interaction had insignificant effects also. In the second season however, both Dog Ridge and Freedom rootstocks increased this percentage significantly compared with control and St. George rootstock (2.83&2.83%), respectively. Diameter was found to have insignificant results. As for the interaction, results clarify that both Dog Ridge and Freedom rootstocks at both diameters resulted in highest K% in petioles of Flame Seedless cv (2.87&2.80%)(2.82&2.85%), respectively.

As for Thompson Seedless cv., results show that highest K% was attained when grafting on Dog Ridge and Freedom rootstocks in both seasons (2.88&2.85%) (2.86&2.83%), respectively, As for the diameter effect, data show that there was insignificant effect concerning this parameter. Concerning the interaction, data show that grafting this cultivar on both Dog Ridge and Freedom rootstocks resulted in significantly the highest percentage of potassium (2.96&2.80%)(2.94%)(2.84, &2.89) % (2.80&2.87%), respectively. This was not true when grafting on Dog Ridge using diameter B in the second season only (2.77%).

As for Superior Seedless cv., results show that K% was significantly higher in leaf petioles when grafted on Dog Ridge

**Table (5): Effect of rootstock and used diameter on Phosphorus % in different grape cultivars:**

Diameter	Flame Seedless						Thompson Seedless						Superior Seedless						
	2006			2007			2006			2007			2006			2007			
	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	
Rootstock																			
<b>Dog Ridge</b>	0.22	0.18	0.20	0.21	0.17	0.19	0.25	0.20	0.22	0.22	0.17	0.19	0.33	0.24	0.28	0.29	0.22	0.25	
<b>St. George</b>	0.27	0.23	0.27	0.25	0.27	0.26	0.34	0.28	0.31	0.30	0.25	0.27	0.21	0.19	0.20	0.17	0.18	0.17	
<b>Freedom</b>	0.19	0.22	0.20	0.17	0.19	0.18	0.21	0.25	0.23	0.17	0.22	0.19	0.27	0.24	0.25	0.24	0.23	0.23	
<b>Self-grafted</b>	0.23	0.22	0.22	0.21	0.21	0.21	0.23	0.20	0.21	0.18	0.21	0.19	0.19	0.23	0.21	0.18	0.20	0.19	
<b>MEAN</b>	0.22	0.22		0.21	0.21		0.25	0.23		0.21	0.21		0.25	0.22		0.22	0.20		
LSD A	0.039		0.392									0.508							
B	0.028		0.028			NS						NS							
AB	0.055		0.554									0.718							

**Table (6): Effect of rootstock and used diameter on Potassium % in different grape cultivars:**

Diameter	Flame						Thompson						Superior					
	2006			2007			2006			2007			2006			2007		
	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN	A	B	MEAN
Rootstock																		
<b>Dog Ridge</b>	2.88	2.82	2.85	2.87	2.80	2.83	2.96	2.80	2.88	2.94	2.77	2.85	2.98	2.89	2.93	2.95	2.87	2.91
<b>St. George</b>	2.43	2.47	2.45	2.41	2.44	2.42	2.51	2.45	2.48	2.48	2.40	2.44	2.82	2.85	2.83	2.80	2.83	2.81
<b>Freedom</b>	2.84	2.90	2.87	2.82	2.85	2.83	2.84	2.89	2.86	2.80	2.87	2.83	2.89	2.90	2.89	2.86	2.85	2.85
<b>Self-grafted</b>	2.38	2.35	2.36	2.34	2.31	2.32	2.33	2.31	2.32	2.30	2.80	2.29	2.33	2.38	2.35	2.32	2.35	2.33
<b>MEAN</b>	2.63	2.63		2.61	2.60		2.66	2.61		2.63	2.58		2.75	2.75		2.73	2.72	
LSD A				0.14			0.19			0.12			0.04			0.09		
B		NS		0.10			0.14			0.83			0.03			0.06		
AB				0.20			0.27			0.17			0.55			0.12		

rootstock in both seasons (2.93&2.91%), respectively. As for the diameter effect, results show that it had insignificant effects in both seasons, Concerning the interaction, results clearly identify that highest significant K% was attained with grafting on Dog Ridge rootstock with diameter A in first season (2.98%) and with both diameters in second season (2.95&2.87%), respectively.

The previous data show evidence that the percentage of grafting success depended on both the grafting combination and the diameter used in grafting. Previous findings by Gaser(2007) are in agreement concerning the grafting combination and by Kassem (1983) concerning effect of diameter used. Growth vigour was significantly higher in general when grafting considered cultivars on Freedom or Dog Ridge rootstocks. Petioles of scions grafted on these rootstocks were higher content of both nitrogen and potassium. Gaser (2007), Tambe and Gawade (2004) and Main *et.al*, (2002)clarified the vigorating effect of those rootstocks. Whereas; Sallam (1992) pointed out the high nitrogen content acquired by scions grafted on Dog Ridge and Freedom rootstocks, and potassium content of scions grafted on Dog Ridge and Freedom rootstocks, Ruhl (1991). In our opinion the high efficiency of basically nitrogen absorption is the chief factor for the vigorating effect. Also the high absorption efficiency of both nitrogen and potassium is of high importance for growers to decrease fertilization doses and thus improve the economic return and decrease health and environmental hazards.

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## أداء بعض أصناف العنب المطعومة على أصول مختلفة وبعض العوامل المؤثرة على نجاح التطعيم

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اجريت هذه الدراسة خلال الموسمين 2006-2007 و 2007-2008 فى الصوبة الخاصة بقسم بحوث العنب- معهد بحوث البساتين- مركز البحوث الزراعية بمحافظة الجيزة. وتضمنت هذه الدراسة استخدام التطعيم بالشق اللسانى مع درجات سمك مختلفة للعقل المستخدمة أ ( 8 - 12مم)، ب (4 - 8 مم). لثلاث اصناف مختلفة استخدمت كطعوم وهى الفليم سيدليس، الطومسون سيدليس والسوبريور سيدليس على ثلاث اصول مختلفة وهى دوج ريدج، سان جورج و فريدم مع استخدام التطعيم على نفس الاصناف الثلاثة (كنترول) وذلك لدراسة اداء هذه الاصناف على الاصول المستخدمة من حيث قياسات النمو الخضرى وتراكم العناصر الكبرى فى الشتلات المطعومة.

### واوضحت نتائج الدراسة الأتى:

اعتمدت نسبة النجاح على التركيبات المستخدمة من التطعيم ودرجات السمك المختلفة وبصفة عامة، سجلت اعلى نسبة نجاح بالتطعيم على اصل فريدم وكانت نتائج استخدام السمك (أ) اعلى مع اصناف الطومسون سيدليس والسوبريور سيدليس فى حين وجد العكس مع صنف الفليم سيدليس.

و كانت أعلى القياسات الخضرية فى حالة التطعيم على أصول فريدم ودوج ريدج عن التطعيم على اصل سان جورج و الكنترول، وهذا بالاشتراك مع المحتوى العالى لكل من النيتروجين و البوتاسيوم فى اعناق اوراق الاصناف المطعومة على الاصول السابقة، وهذه الكفاءة العالية لامتصاص كل من النيتروجين و البوتاسيوم لها اهمية عالية للمزارعين لتقليل جرعات التسميد المستخدمة وهذا يزيد من العائد الاقتصادى ويقلل من المخاطر الصحية و البيئية وهذا يفسر ان الامتصاص هو العامل المؤدى لزيادة النمو الخضرى.