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Performance of Summer grafted Superior Seedless Grape Grafts on Different Rootstocks

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Abstract: The present study was carried out during the two successive seasons of 2007 and 2008 in the nursery of Sids Horticulture Research Station at Beni Suef Governorate to study the performance of summer grafts of Superior Seedless grape cultivar on Paulsen 1103, Salt creek and Freedom rootstocks in addition to the local Romi Ahmar cultivar compared with own rooted cutlings of same cultivar. Parameters studied were percentage of survival, vegetative growth parameters of scion and bud union zone content of total indoles and phenols. The results showed that, Superior Seedless cutlings attained significantly the highest percentage of survival. With respect to vegetative growth parameters grafts onto Romi Ahmar, were superior in this respect. In addition scions of Superior seedless attained significantly the highest content of macro-nutrients. Total indoles were significantly the highest while total phenols were significantly the lowest in union zones of grafts onto Romi Ahmar when compared to grafts on remaining rootstocks.

Key words: Grape · Superior Seedless · Grafting · Paulsen 1103 · Salt creek · Freedom

INTRODUCTION

Grape is considered one of the major fruit crops grown world wide with respect to the acreage and productivity. In Egypt, grape ranks second after citrus with regards to both the acreage and productivity. The total acreage of grape in Egypt exhibited an obvious increase in the recent few years to reach 167.048 feddans with a production of 1.531.418 tons according to the latest statistics of Ministry of Agriculture [1].

Rootstocks have recently gained great importance as the only consistently effective and successful strategy in major viticultural countries worldwide [2, 3]. The importance of rootstocks in viticulture is well documented as an effective tool in enhancing performance of vines in terms of better capabilities of mineral absorption, vegetative growth and cropping in addition to their induced effects on overcoming several biotic and abiotic stresses [4-6].

Summer grafting was proposed as an effective technique used to enhance success and survival percentages.

The scope of the present investigation is to test the performance of summer grafts Superior Seedless grape cultivar on various rootstocks; Paulsen 1103 (*V. berlandieri* X *V. rupestris*), Salt creek (*V. champini*), Freedom (1613C X *V. champini*) and local rootstock; Romi Ahmar (*Vitis vinifera*) cultivar in relation to cutlings of Superior Seedless cultivar.

MATERIALS AND METHODS

The present study was carried out during the two successive seasons of 2007 and 2008 in the nursery of Sids Horticulture Research Station Beni-Suef Governorate. For this study sixty cutlings of the currant season of each of Paulsen 1103, Salt creek and Freedom in addition the local Romi Ahmar cultivar were considered.. They were summer top grafted in the first week of June. In addition sixty currant year cutlings of Superior Seedless cultivar (the conventional method of propagation) were considered for comparison. Prepared grafts and cutlings were placed in a seran green house. Each twenty grafts or cutlings represented a replicate i.e. ten for morphological determinations and ten for chemical analysis.

The Following Parameters Were Determined

Percentage of Survival: Was calculated at the end of November by using the following equation:

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$$\text{Percentage of survival} = \frac{\text{Survived cutlings or grafts}}{\text{Total number of cutlings or grafts}} \times 100$$

Vegetative Growth Parameters: These parameters were measured on main sprouting shoots emerging (after removing any other if sprouted) on scions at the end of November they were: shoot length (cm): by a ruler, shoot diameter (cm): average internode diameter of the second and third internodes measured by a vernier caliper and leaf area (cm^2): average of the fifth and sixth leaves were transferred to the laboratory and measured by using a CI -203 laser Area meter made by CID, inc, Vancouver, Washington state USA.

Chemical Analysis:

Macro Nutrients Contents: Samples of petioles of the fifth and sixth apical leaves were taken at end of November they were washed in distilled water and dried in the oven for 48 h at 70°C and the following constituents were determined: Nitrogen (%): by the modified micro-Kieldahl method as described by Pregl [7] and Plumer [8]; Phosphorous (%): determined in the acid digest; calorimetrically using Spectrophotometer using the chlorostomanous reduces molybodophsphoric blue color according to the method of Jackson [9] and Champman and Pratt [10] and Potassium (%): determined against a standard by using Flame photometer according to the method of Brown and Lilleland [11] and Piper [12].

Total Indoles and Phenols: Samples of grafting union zone were taken for determining: Total indoles (µg/100 g fresh weight) as described by Larsen *et al.* [13] and total phenols (µg/100 g fresh weight) as described by Malik and Singh [14].

Statistical Analysis and Experiential Design: The completely randomized design was adopted for the experiment. The statistical analysis of the present data was carried out according to Snedecor and Chocran [15]. Means were compared using the new L.S.D. values at 5% level.

RESULTS AND DISCUSSION

Percentage of Survival and Vegetative Growth Parameters: Data in Table (1) presents the comparative effect of used scion on the percentage of survival and vegetative growth of grafts in relation to own rooted cutlings of Superior grapes.

The percentage of survival of grafts varied according to the used rootstock (Table 1). Superior cutlings attained significantly the highest percentage of survival in both seasons of the investigation amounting to 88.89 and 94.44% for both seasons respectively. Comparable results were attributed to grafts on Romi Ahmar in the first season only. All grafts were statistically equal in this parameter except for those on Salt Creek which significantly lower. Previous results by Lu and Ren [16] and Stino *et al.* [5] were in agreement. All emphasized variation in percentage success and survival of grape grafts due to the used rootstock.

In addition the attained survival percentages for these summer grafts are rather high compared with percentages attained for same combinations in winter grafts (unpublished data) and this might due to the active growing merstmatic stage exhibited by both the rootstock and scion which facilitates callus formation and thereby enhance grafting success.

With respect to shoot length data illustrate that, shoot length was significantly the least in the case of own rooted cutlings. Insignificant differences were detected in the case of grafts on Salt Creek rootstock. Whereas, longest shoots were born on grafts using Romi Ahmar as a rootstock (106.95 and 114.76 cm for both seasons respectively).

Least shoot diameter was measured on Superior cutlings with insignificant differences from that on grafts on Salt Creek rootstock. Whereas significantly the widest diameter was measured on grafts on Romi Ahmar as a rootstock (0.87 and 0.93 cm for both seasons respectively).

On the average leaves of significantly the highest leaf area were born on grafts on Romi Ahmar as a rootstock (88.6 and 92.1 cm2). Whereas the least significant leaf area was measured on the average in the case of leaves born on Superior Seedless cutlings.

In general vegetative growth parameters were enhanced due grafting on the considered rootstocks when compared with cutlings of the considered cultivar with most pronounced effect due to using Romi Ahmar as a rootstock.

Previous reports by Fardossi *et al.* [17], Colldecarrera *et al.* [18], Ezzahouani and Larry [19] and Stino *et al.* [5] were in parallel all pointing out the variability in scion vegetative growth response with respect to the used rootstock

Chemical Analysis: Effect of used rootstock on scion's leaf content of macro nutrients and grafting union zone content of total indoles and phenols is presented in Table (2).

Table 1: Percentage of survival and vegetative growth parameters (2007 and 2008 seasons)

	Survival (%)		Shoot length (cm)		Shoot diameter (cm)		Leaf area (cm^2)	
Rootstocks	2007 season	2008 season	2007 season	2008 season	2007 season	2008 season	2007 season	2008 season
Paulsen 1103	72.22	77.78	91.32	95.02	0.74	0.77	82.2	84.2
Salt creek,	61.11	66.67	82.68	81.44	0.67	0.66	72.5	77.1
Romi Ahmar	83.33	83.33	106.95	114.76	0.87	0.93	88.6	92.1
Freedom	72.22	76.67	93.78	96.25	0.76	0.78	85.3	88.7
Superior (On rooted)	88.89	94.44	74.04	78.15	0.60	0.63	64.8	67.5
New L.S.D. at 0.05	9.36	7.02	12.09	16.23	0.08	0.09	3.1	3.4

Table 2: Chemical content of vegetative growth (2007 and 2008 seasons)

	Nitrogen (%)		Phosphorus (%)		Potassium (%)		Total Indoles (mg/100 g F. W.)		Total Phenols (mg/100 g F. W.)	
Rootstock	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Paulsen 1103	1.64	1.63	0.18	0.16	1.72	1.69	0.28	0.26	0.12	0.10
Salt creek,	1.66	1.68	0.23	0.22	1.79	1.75	0.21	0.19	0.16	0.15
Romi Ahmar	1.72	1.71	0.25	0.23	1.82	1.77	0.34	0.31	0.09	0.08
Freedom	1.65	1.63	0.19	0.17	1.75	1.71	0.26	0.25	0.13	0.12
Superior (On rooted)	1.56	1.52	0.14	0.13	1.52	1.55	-------	-------	-------	-------
New L.S.D. at 0.05	0.07	0.04	0.03	0.02	0.04	0.03	0.05	0.04	0.03	0.02

Leaf Content of Macro-Nutrients: Grafting on any of the considered rootstocks significantly increased the scion's leaf nitrogen content compared with leaf nitrogen content of the cutlings. Highest nitrogen content was attributed to grafting on Romi Ahmar. Comparable results were due to grafting on Salt Creek in both seasons and on Freedom in the first one only.

With respect to leaf content of phosphorus, it was evident that that all grafting combinations attained content that was significantly higher than that of ctulings. Highest significant content was due to grafts on Romi Ahmar. Comparable results were dedicated to grafting on Salt Creek in both seasons.

Leaf potassium content was significantly the highest in grafts on Romi Ahmar rootstock. Insignificant differences were attributed to grafting on Salt Creek in both seasons. Whereas, leaf content of seedlings was significantly the least.

Many reports dealt with mineral uptake and distribution of minerals in grapevines; it was noticed that the differences in nutrient uptake and distribution could be attributed to the genotype of rootstock which gives different absorption capability or tendency for some specific minerals [4].

Also Gaser [20] illustrated that grafted vines attained a higher content of macro-nutrients compared with un rooted ones.

Graft Union Zone Content of Total Indoles and Phenols: Graft union zone content of total indoles varied markedly with the used rootstock. This content was significantly the highest when using Romi Ahmar as a rootstock.

As for the effect of graft combination on the union zone of total phenols, data show that, significantly the least content was attributed to grafting on Romi Ahmar. Comparable results were due to grafting on Paulsen 1103 in both seasons. Whereas significantly the highest content was attributed to grafting on Salt Creek in both seasons.

Variability in both total indoles and phenols with regards to grafting on different varies rootstock was previously cited by Mng'omba *et al*. [21].

It was also evident from the study that highest grafting survival percentage attained by grafting. Superior Seedless cv on Romi Ahmar was associated with highest indoles content in the grafting union zone which might be the reason for this high percentage due to its' effect in enhancing cell division i.e. facilitating callus formation which is the first step in union success. This graft combination was also associated with least phenols content which is known to suppress the grafting union formation. The opposite was observed with grafts on Salt Creek which might account for its' low survival percentage.

These results are in harmony with Mng'omba *et al*., (2008) who found that, graft incompatibility in U. kirkiana is attributed to high ferulic and r-coumaric acid concentrations, flavonoids, anthocyanin or their derivates at the union interface. Phenols inhibit callus proliferation and disrupt cell chemical reactions or functions. There was no scion/stock combination with complete graft union in both homograft and heterograft combinations of U. kirkiana. It is concluded that, phenols such as r-coumaric acid, flavonoid and anthocyanin are implicated in graft incompatibility.

In conclusion summer grafts of Superior Seedless cultivar attained in general quite high percentages of survival and this might be due to that both scion and rootstock tissues are still in the merstamatic growth stage which facilitates the callus formation which is considered the primary step of union formation.

Grafts on Romi Ahmar attained the highest percentage of survival which might be dedicated to its' highest graft zone content of indoles or low content of phenols. This grafting combination attained the best performance with respect to vegetative growth parameters and it was associated with highest macro nutrients leaf content indicating highest absorption capabilities which might have lead to this performance.

From this preliminary study we recommend Romi Ahmar as a promising rootstock for Superior Seedless cultivar. Yet further studies are required concerning it's effect on cropping and resistance to biotic and abiotic stresses.

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