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IMPACT OF SOME ROOTSTOCKS ON PERFORMANCE OF SUPERIOR GRAPE CULTIVAR

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ABSTRACT

The present investigation was conducted during the period from 2001 to 2006, to study the influence of some grape rootstocks on Superior cultivar. Two stages were involved in this study; the first included bench grafting of Superior cultivar on Dogridge, Salt creek, Freedom, Harmony, SO4, Teleki 5C, Paulsen 1103 rootstocks. The following determinations were carried out: percentage of grafting success, vegetative growth of shoots and roots, fresh and dry weight, relative water content, chlorophyll and cation exchange capacity as compared to own-rooted plants. The second stage included the performance of Superior on different rootstocks to study their influence on yield, physical characteristics of bunch & berries, TSS & acidity and morphological characteristics of vegetative growth, coefficient of wood ripening, weight of prunings, trunk volume, leaf content of mineral elements, cane content of total carbohydrates and coefficient of bud fertility.

The results showed that the percentage of grafting success was around (66.7-86.5%) according to rootstocks in all seasons. All rootstocks under study increased the vegetative growth, root length, fresh and dry weight, relative water content, chlorophyll and cation exchange capacity in grafted plants as compared to own-rooted ones. The increase in yield and improvement of grapes in grafted vines ranged between (14.2–36.8%) as compared with those of own-rooted plants according to rootstocks and seasons. Moreover, all rootstocks under study improved the characteristics of vegetative growth, coefficient of wood ripening, weight of prunings, trunk volume, leaf content of mineral elements, cane content of total carbohydrates and coefficient of bud fertility especially Dogridge, Salt creek, Paulsen 1103 and Freedom rootstocks compared to non grafted vines.

INTRODUCTION

Grape is easily propagated by cuttings and grown through a wide range of soils. The major reason to use rootstocks lies in their resistance to some adverse conditions. Reynolds and Wordle (2001) outlined seven major criteria for rootstocks choice in the order of their importance as phylloxera resistance, nematode resistance, adoptability to high pH soils, saline soils, low pH soils, wet or poorly drained soils and drought. In this respect, *Dogridge* (V. champini) gives a great vigor to its scions. It is good resistant to nematodes and moderately resistant to phylloxera, recommended for use in lighter, less fertile sandy soils and high lime soils. *Salt creek* (V. champini) gives a great vigor to its scions. It is quite resistant to nematodes and moderately resistant to phylloxera, it has performed well in light sandy soils of low fertility, it has good tolerance to salt, perform well in slightly acid and calcareous soils. *Freedom* (1613C x V. champini) is highly resistant to phylloxera and nematodes, it renders scions more vigorous but less than Salt creek or Dogridge, it is highly resistant to drought, well adapted to acidic soils and moderate resistant to salinity. *Harmony* (1613C x V. champini), it is moderate in vigor, moderate resistant to phylloxera and highly resistant to nematodes, well adapted to acidic soils, moderate resistant to salinity and highly resistant to drought. *SO4* (V. berlandieri x V. riparia): it is moderate to vigorous, tolerates high levels of lime in the soil and performs satisfactorily acidic soils, adapted to a wide range of soils, but does well resistant to in light, well drained soils of low fertility, drought tolerant, it is very high phylloxera resistant and resistant to root knot nematodes. *Teleki 5C* (V. berlandieri x V. riparia), it is moderate to vigorous, suitable to well-drained and fertile soils. It represents a good choice for heavy soils, moderate drought resistant and highly tolerant to calcareous soils, good resistant to phylloxera and also to root knot and dagger nematodes. *Paulsen 1103* (V. berlandieri x V. rupestris), it is moderate to vigorous; with high resistant to phylloxera, good resistant to root knot nematodes and moderately resistant to dagger nematodes, high drought tolerant, moderately tolerant of salt and it does well in acidic soils (Galet, 1979; Wolpert et al, 1994; McCarthy and Cirami, 1990; Mullins et al. 1992; Southey, 1992; Gao et al., 1993; Lider et al. 1995; Kocsis et al. (1998); Schmid et al., 1998; Sule, 1999 and Walker et al., 2002).

The use of grafted vines led to an increase in the cost of vineyard establishment. It can be anticipated that the added cost of establishment will be offset by an increase in vine productivity.

Many investigations proved that rootstocks affect vine growth, yield, fruit quality through the interactions between the environmental factors and the physiology of scions and rootstock cultivars employed. In this respect, Hedberg (1980) found that yields of all grafted cultivars were much higher than those of own-rooted vines, especially those grafted on Ramsey and Dogridge rootstocks. Fardossi et al (1995) found that shoot growth of "Gruner veltline" was slower on "5C" and "Fercal" but more rapid on "P1103", "725P" and "125AA". Ripening of grapes occurred earlier on "1103P", "G1" and Riparia Sirbu" than on other rootstocks. Bunch quality, bunch weight, berry size and soluble solids content were affected by rootstocks (Zhiyuan 2003). The level of mineral uptake differed according to the rootstocks (Grant & Matthews 1996, Ruhl 2000 and Kocsis & Lehoczky 2002).

The aim of the present investigation was to study the impact of seven rootstocks; Dogridge, Salt creek, Freedom, Harmony, SO4, Teleki 5C and Paulsen 1103 on compatibility and performance of vegetative and productivity of Superior grape cultivar.

MATERIALS AND METHODS

This investigation was carried out during the period from 2001 to 2006 in a private vineyard located at Cairo-Alexandria road, Giza governorate, Egypt to study grafting Superior cultivar on some rootstocks; Dogridge, Salt creek, Freedom, Harmony, SO4, Teleki 5C and Paulsen 1103 in addition to own-rooted plants including two stages:-

A) **First stage:** Bench grafting of Superior cultivar on some rootstocks.

The present stage of the investigation was carried out during the two successive seasons of 2001 and 2002 to study bench grafting of Superior cultivar on some rootstocks namely: Dogridge, Salt creek, Freedom, Harmony, SO4, Teleki 5c, Paulson 1103. The own-rooted plants represented the control.

Preparation for bench grafting:-

In December (during winter dormancy) one-year-old canes of each rootstock and scion were cut into pieces 30-35 cm with 8-12 mm diameter and soaked overnight in clean water. In the following day the cuttings were left in a sheltered area and covered with a wet tarp to be keep from drying and packed in polyethylene lined bags with peat moss and sealed for keeping moisture in the cuttings (stocks and scions were labeled) and placed in a cold storage unit at 0-1^{o}C.

Grafting:

Grafting was done in January. Before grafting pieces of the rootstocks were disbudded with a sharp knife, leaving the bottom bud unremoved. Scion wood was cut into pieces 4-5 cm long with one compound bud/each. The rootstock and scion were cut separately with Omega machine, then joined together and tying with poly-ethelene. The bases of the grafted cuttings were dipped for 10 Sec. in indole-buteric acid (ABA) at a concentration of 1000 ppm and placed in callus box with moistured medium consisting of peat moss and rice hay (1:1) and filled 3 cm to below the graft cutting.

Callusing:-

The callusing box was placed in the callusing room at a humidity of 85-90% and temperature of 25-28 ^{o}C day and night during the callusing period. Grafts were checked for the formation callus, when 75% of the grafting cuttings showed good callus covering grafting unions. For hardening was made the boxes were placed outdoors in a protected area for 3-4 days and watering with a solution of soluble plant food.

Adaptation:

After hardening, in February, the grafted plants were cultivated in planting poly-ethelene bags 15x15x30 cm3 with a medium consisting of peat moss: Sand: Rice hay (1:1:1). The plants were protracted, misted to keep humidity at keep 80% and at 23-25 ^{o}C. After four weeks a fertilizer program started and the plants were pinched after four leaves top growths.

The following parameters were estimated:-

- Percentage success of grafts.
- Vegetative growth parameters of shoots and roots.

1-Plant height (cm) and number of leaves/plant were recorded monthly from May to November in both seasons.

2-Shoot diameter (cm).

3-Total Leaf area/rooting (cm^2) was determined by multiplying average number of leaves/shoot by average leaf area (cm^2) which was recorded by a Planimeter.

4-Coefficient of wood ripening: this was calculated by dividing length of the ripened part of the shoot by the total length of the shoot according to Bouard (1966).

5-Total root lengths (cm): This was estimated by using the gird intersection method (Tennant, 1975). The following formula was used:

Root length (R.L.) = 11/14X number of intercepts (N) X Gird unit.

- Fresh and dry weight of leaves, shoots and roots (g).
- Relative water content of leaves:-

  Relative water content in leaves (RWC) method (Boyer, 1969) was calculated as follows:

  $$RWC = \frac{\text{Field weight} - \text{Oven dry weight}}{\text{Turgid weight} - \text{Oven dry weight}} \times 100$$
- Cation exchange capacity (C.E.C.):

  C.E.C. of the roots was estimated according to the procedure recommended by Helmy & El-Gabaly (1958). The C.E.C. was expressed as me/100 grams of dry root material.
- Chlorophyll content:

  Leaf content of total chlorophyll was determined through the use of the nondestructive chlorophyll-meter (Minolta SPAD 502).

B) Second stage: Compatibility and performance of Superior cultivar on some rootstocks.

In 2002 season, one-year-old Superior cuttings grafted on the rootstocks; Dogridge, Salt creek, Freedom, Harmony, SO4, Teleki 5C and Paulsen 1103 in addition to own-rooted plants were planted in a sandy loam soil, spaced 2.5 X 3 meters apart, irrigated by the drip irrigation system and supported by the Spanish Parron System. The vines were trained during seasons (2002 and 2003). In 2004, 2005 and 2006 seasons, the vines were cane pruned (12 canes/vine X 14 buds/cane). Vines of Superior cultivar were treated according to the recommended export procedures (bunch thinning, berry thinning by GA_3 or manual). Uniform vines were chosen. Each twelve vines acted as a replicate and each three replicates were used for each rootstock under study.

***The following parameters were determined to evaluate the performance of different rootstocks:-**

At veraison stage, two vines were specified for sampling. A representative sample of 20 berries from the apical, middle and basal portions of the bunch was picked from each vine every week. Total soluble solids % (TSS) by means of a hand refractometer and total titratable acidity % as tartaric acid according to the (AOAC 1985) were determined in berry juice. Sampling continued for each treatment till TSS reached about 16-17% according to Tourky *et al*. (1995).

1. Yield and physical characteristics of bunches:

Yield/vine was determined by multiplying average number of bunches/vine by average bunch weight.

Representative random samples of six bunches/vine were taken at harvest. Average bunch weight (g), length (cm), width (cm) and weight of berries were determined.

2. Physical and chemical characteristics of berries:

Berry weight (g), size (cm^3), length (cm) and diameter (cm) were measured. Percentage of total soluble solids in berry juice (TSS) was recorded using a hand refractometer and total titratable acidity as tartaric acid (%) was also determined (AOAC 1985). TSS/acid ratio was thus calculated.

At growth cessation, the following morphological and chemical determinations were carried out on 4 shoots / the considered vine:

3-Morphological characteristics of vegetative growth:

1- Average shoot diameter (cm).
2- Average shoot length (cm).
3- Average number of leaves/shoot.
4- Total leaf area/vine (m^2) was determined by multiplying average number of leaves/shoot by average leaf area (cm^2) using an Area-meter then by the number of shoots per vine.
5-Coefficient of wood ripening: this was calculated by dividing length of the ripened part of the shoot by the total length of the shoot according to Bouard (1966).
6- Weight of prunings (Kg) at dormancy period.
7- Size of old wood (cm^3)

It was estimated just before defoliation. The trunks were divided into cylindrical sections and the divided trunks into (n) sections. To compute trunk volume, the following formula was used:

$$V = \Sigma^{n} ({}^{di}/_{2})^{2}.\ \text{n}.\ L_i$$

Where (di) is the diameter of the trunk section with length L_i.

4-Chemical characteristics of vegetative growth:

1- Mineral content:

Petioles of leaves were collected from the leaf opposite to the bunch at full bloom stage and dried at 70 °C till a constant weight for the determination of N, P, K, Ca and Mg.

Nitrogen was determined by the modified micro-Kieldahl method as described by Pregl (1945).

Phosphorus was determined using Spekol Spectrophotometer (Jackson, 1958).

Potassium was determined by Flame photometer (Brown & Lilleland, 1946).

Calcium and Magnesium were determined by Atomic Absorption Spectro Photometer according to (Chapman & Pratt, 1961).

2- Cane content of total carbohydrates (%) (Smith *et al*., 1956).

5- Coefficient of bud fertility:

This was calculated by dividing average number of bunches per vine by the total number of buds/vine left at pruning time according to (Prasad & Pandev, 1969).

6- Statistical analysis:

The complete randomized blocks design was adopted for the experiment. The statistical analysis of the present data was carried out according to the methods described by Snedecor & Cochran (1972). Averages were compared using the new LSD method at 5% level of significance.

RESULTS AND DISCUSSION

A) First stage: Bench grafting of Superior cultivar on some rootstocks.

- **Percentage of successful grafts:**

The results presented in (Table 1) indicate that the percentage of successful grafts ranged between (66.7-86.5%) according to rootstocks and seasons. Freedom and Harmony rootstocks recorded the highest percentage while, Teleki 5C rootstocks recorded that the lowest percentage in both seasons.

*** Dynamics of shoot length and number of leaves/plant :**

Fig (1 and 2) show that the main shoot length and number of leaves/plant increased gradually throughout the considered sampling dates. Own-rooted vines resulted in the shortest main shoot length (115.5 & 122.0 cm) and number of leaves/rooting (29.7 & 30.5) on October for both seasons, respectively throughout the course of this study as compared with those grafted on all rootstocks. Dogridge and Salt creek recorded the highest values of shoot length and number of leaves/plant in both seasons.

- **Vegetative growth parameters of shoots and roots:**

Data in Table (1) cleared out that the most vegetative growth parameters (expressed as shoot diameter, shoot length, number of leaves/plant, total leaf area, coefficient of wood ripening and total root lengths) responded positively to the impact of rootstocks. Dogridge and Salt creek rootstocks significantly increased these parameters as compared with other rootstocks. On the contrary, Control (Own-rooted) was the lowest one in this respect in the both seasons under study.

The results in this connection are in line with those of Colldecarrera et al. (1997) who reported that rootstocks ‘110 R’, ‘SO4’ and ‘140 Ruggeri’ had the most vigorous scions while ‘110 R’ and ‘140 Ruggeri’ had the most productive scions. Ezzahouani & Larry (1997) found that the scion cultivar ‘Italia’ was most vigorous on rootstocks ‘101-14’ and ‘*Rupestris* de Lot’.

- **Fresh and dry weight of leaves, shoots and roots:**

Data in Table (2) indicate that all rootstocks significantly increased the tested weights. Grafted vines on Dogridge, Salt creek and Paulsen 1103 rootstocks recorded the highest values of the above weights as compared to own-rooted vines in both seasons.

- **Relative water content of leaves:**

Data concerning relative water content in the leaves are presented in Table (3). It is clear that scion relative water content was different from rootstocks. Dogridge, Salt creek and Paulsen 1103 rootstocks recorded the highest values as compared with other rootstocks, while, Control (Own-rooted) gave the lowest values in both seasons.

The above results are in line with those of Richards, 1983 who explained that the primary change after grafting is the direct replacement of the root system. Root anatomy and morphology, development and distribution may be different among rootstock species, the replaced roots will directly affect water and mineral absorption, which eventually affect growth of the shoot system and modify vine physiology.

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In addition, Prakash et al 2001 recorded that the main tenancy of turgidity in rootstocks as indicated by lesser reduction in relative water content can be attributed to better osmotic adjustment under moisture stress.

- **Cation exchange capacity (C.E.C.):**

It is obvious from the data shown in Table (3) that grafting vines on Dogridge and Salt creek rootstocks recorded the highest values concerning in the Cation exchange capacity as compared with the other rootstocks, while, Control (Own-rooted) gave the lowest values in both seasons. These results referd to the ability of the stock to absorb and accumulate cations at higher rates which finally helps in enhancing plant growth and development. The above results are in agreement with Richards, 1983.

- **Chlorophyll content of leaves:**

Data concerning total chlorophylls in the leaves are presented in Table (3). It is apparent that total chlorophylls were different according to rootstocks. Dogridge, Salt creek and Paulsen 1103 rootstocks resulted in the highest values in the total chlorophylls in the leaves as compared with other rootstocks, while, Control (Own-rooted) gave the lowest values in both seasons under study.

The results in this respect are in line with Bica et al. (2000) who found that the effect of rootstocks was significant on leaf area, chlorophyll content, stomatal conductance and quantum yield. ‘Chardonnay’ vines grafted on ‘SO4’ showed lower photosynthesis, quantum yield, stomatal conductance and chlorophyll content those on ‘1103P’. ‘Pinot noir’ plants grafted on ‘SO4’ and ‘1103P’ showed similar rates of assimilation. ‘K5BB’ rootstock improved leaf area, stomatal conductance and transpiration in comparison with ‘SO4’. Recently, Keller et al. (2001) found that chlorophyll content (which influences photosynthesis) was the highest for vines grafted on ‘K5BB’ and the lowest for ‘3309C’. Differences due to rootstocks were mostly unaffected by soil nitrogen level except for vines grafted on ‘SO4’.

B) Second stage: Compatibility and performance of Superior cultivar on some rootstocks.

For a better understanding of the results obtained in this investigation, it was found more convenient to report the findings under the following main topics:

- **Dynamics of maturity indices at various dates:-**

Harvesting indices (TSS% and acidity%) were weekly monitored from veraison till June 5th in the first season, 9th in the second one and 11th in the third one.

TSS %

Juice TSS % (Figure 3) increased steadily by time elapse throughout the considered sampling dates to reach its peak on Jun 5th, Jun 9th and Jun 11th for the three seasons respectively. Control (own-rooted) and vines grafted on all rootstocks reached or approached a TSS % of 15-16% (maturity index as described by Tourky *et al*., (1995) the last sampling date in both seasons.

Acidity %

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Juice acidity % (Figure 3) decreased gradually throughout the period beginning from veraison stage for vines grafted on all rootstocks. Control (own-rooted) resulted in the least juice acidity as compared with the grafted vines.

1. Yield and physical characteristics of bunches:

Data in Table (4) show a significant increase in the yield per vine of Dogridge and Salt creek rootstocks as compared with the other rootstocks, while, Control (Own-rooted) gave the lowest values in the three seasons under study. The percentage of the increase in yield ranged from 27 to 36% in the first and second seasons and from 19 to 29% in the third season.

Similar results were obtained for physical characteristics of bunches; bunch weight, length, width and weight of berries which were appreciably increased in vines grafted on Dogridge and Salt creek rootstocks (Fig. 4).

Adjusting the number of bunches per vine made it logic to explain that the increase or decrease of the observed yield/vine could be ascribed only to the change of the bunch weight.

The obtained results are nearly similar to those achieved by Hedberg (1980) who found that yields of all grafted cultivars were much higher than those of the own-rooted vines, especially on ‘Ramsey’ and ‘Dogridge’ rootstocks. Ferree et al. (1996) reported that an increase in the yield was obtained in grafted ‘Cabernet Franc’and ‘White Riesling’ than the own-rooted vines. Wunderer et al. (1999) mentioned that ‘Gruner Veltliner’ grape had a higher wood productivity when grafted on the three rootstocks tested (‘SO4’, ‘K5BB’ and ‘5C’) than that of the own-rooted vines.

2. Physical and chemical characteristics of berries:

As shown in (Table 5) the rootstocks variably affected physical characteristics of berries i.e. berry weight, size, length and diameter. Dogridge and Salt creek rootstocks significantly increased these parameters as compared with the other rootstocks. On the contrary, Control (Own-rooted) was the lowest one in this respect in the three seasons under study.

The increment which occurred in these parameters in Dogridge and Salt creek rootstocks could be ascribed to the parallel increment noticed in the total leaf area the result of which photosynthesis activity of the leaves was increased.

With regard to the chemical characteristics of berries i.e. TSS, acidity and TSS/acid ratio (Table 5), they were significantly affected by the kind of rootstock. Control (own-rooted) and some rootstocks except for Dogridge and Salt creek rootstocks generally resulted in higher percentages of TSS, TSS/acid ratio and lower acidity of the juice, while, Dogridge and Salt creek rootstocks was shown to have the lowest values in this respect in the three seasons of the study.

The superiority of control (own-rooted) along with some rootstocks except Dogridge and Salt creek rootstocks in enhancing bunch maturity may be attributed to the decrease of bunch weight.

The obtained results are in accordance with those obtained by Cirami et al. (1984) who found that the fruit juice of the own-rooted vines had lower pH than that of grafted vines. Higher pH in grafted ‘Shiraz’ over that own-rooted was also found by Walker et al. (1998 &2000).

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3-Morphological characteristics of vegetative growth

Data in (Table 6) show significant differences between the rootstocks concerning the parameters of vine vigor (expressed as shoot diameter, shoot length, number of leaves/shoot and total leaf area/vine) in the three seasons of the study. Dogridge and Salt creek rootstocks significantly increased those parameters as compared with the other rootstocks. On the contrary, Control (Own-rooted) was the lowest one in this respect.

Similar results were obtained concerning coefficient of wood ripening, weight of prunings and size of old wood (Table 6). These parameters were significantly increased in Dogridge and Salt creek rootstocks as compared to the other rootstocks. The above results could be attributed to the total biomass produced in Dogridge and Salt creek rootstocks which provided the frame work for total leaf area which by its turn was reflected on the amount of old wood retained on the grapevine which may have positively affected the yield and bunch quality.

The results in this respect are in line with those of Fardossi et al. (1995) who found that shoot growth of ‘Gruner Veltliner’ was slower on ‘5C’ and ‘Fercal’, but more rapid on ‘1103P’, ‘725P’ and ‘125AA’; ripening occurred earlier on ‘1103P’, ‘G1’ and ‘*Riparia* Sirbu’ than on other rootstocks. Colldecarrera et al. (1997) reported that rootstocks ‘110 R’, ‘SO4’ and ‘140 Ruggeri’ had the most vigorous scions while ‘110 R’ and ‘140 Ruggeri’ had the most productive scions. Ezzahouani & Larry (1997) found that the scion cultivar ‘Italia’ was most vigorous on rootstocks ‘101-14’ and ‘*Rupestris* du Lot’.

4-Chemical characteristics of vegetative growth

Ungrafted vines showed lower efficiency than grafted vines in assimilating the mineral content. Dogridge, Salt creek and Paulsen 1103 rootstocks ranked among the most efficient in nitrogen, phosphorous, calcium and Magnesium uptake but had an intermediate performance in the uptake of Potassium. Compared to the other rootstocks, SO4 and Freedom ranked among the highest efficient stocks in potassium uptake (Table, 7).

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. The obtained results are in agreement with those obtained by Cook & Lider (1964) who reported that rootstocks had no effects on foliage Ca^{2+} and Mg^{2+}; but contents of nitrate, K^+, and total P were higher in petioles on ‘St. George’ than on ‘99-R’. Tangolar & Ergenoglu (1989) grafted ‘Gruner Veltliner’ onto 10 rootstocks and concluded that leaf N and Fe levels were similar for scions on all rootstocks. The leaf K^+ was highest on ‘*Rupestris* du Lot’ and ‘110 R’, leaf P was highest on ‘110 R’, leaf Ca^{2+} was highest on ‘420A’, and Mg^{2+}, Mn^{2+} and Zn^{2+} were highest on ‘41A’. Fardossi et al. (1995) used the same scion and rootstocks and confirmed that leaf mineral concentrations could be influenced by rootstock, but the changes were in the normal range.

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They also tested ‘Neuburger’ grape on 12 different rootstocks to determine the micro- and macronutrients in leaf blades and found that vines on the Euro-American hybrid rootstocks ‘26G’ and ‘333 EM’ showed the lowest K+ but the highest Ca2+ concentrations (Fardossi et al., 1992). There were considerable differences among the rootstocks tested for K+ and Ca2+ concentrations. Brancadoro & Valenti (1995) grafted ‘Croatina’ onto 20 different rootstocks and found that K+ content of must and leaves was affected significantly by rootstocks. They suggested that K+ deficiency should be improved by choosing an appropriate rootstock. Ruhl (1991) also suggested that K+ accumulation in scions is affected by rootstock genotype.

The differences in nutrient uptake and distribution can also be interpreted in different ways. First, rootstocks may have different absorption capability or tendency for some specific minerals. For example, Bavaresco et al. (1991) pointed out that rootstocks with lime resistance have a ‘strategy’ to overcome chlorosis with high root iron uptake and reducing capacity. Grant & Matthews (1996) thought that different rootstocks might have different ability to absorb phosphorus. Ruhl (2000) also found a high K+ absorbing mechanism in some rootstocks, which would affect pH of fruit and wines. Second, translocation and distribution of nutrients may differ among rootstocks. Bavaresco & Lovisolo (2000) confirmed that the chlorosis should be attributed to the different hydraulic conductivities between the rootstocks and the own-rooted vines for iron. Giorgessi et al. (1997) found differences in number and size of the xylem vessels between rootstocks and own-rooted vines. Third, hormone synthesis of rootstock roots and their translocation may be different. Skene & Antcliff (1972) found different levels of cytokinins in bleeding sap of rootstocks. For instance, rootstock ‘1613’ contained less cytokinins in the sap, both on a concentration basis and in terms of the total amount passing to the shoot each day. Fourth, some nutrients might be assimilated mostly by roots, thus reducing the amount translocated to the shoots. Keller et al. (2001) discovered that over 85% of nitrogen was assimilated by way of vine root metabolism.

As for the percentages of total carbohydrates of the cane, it can be noticed that Dogridge, Salt creek and Paulsen 1103 rootstocks resulted in the highest significant increase as compared to control (own-rooted) which resulted in the lowest values in the three seasons of the study (Table, 7).

5- Coefficient of bud fertility:

Data presented in Table (7) and illustrated in Fig. (5) clearly show the differences between all rootstocks in the three seasons; it is evident that Dogridge, Salt creek, Paulsen 1103 and Freedom rootstocks gave the highest values of coefficient of bud fertility as compared to the control (own-rooted) which had the lowest values.

Data illustrated in Figures (6 & 7 & 8) indicated the presence of a positive correlation, between the total leaf area (m^2) and yield (kg), between the weight of prunings (kg) and yield (kg) and between the trunk volume (cm^3) and yield (kg) in the three seasons of this study.

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6. Economical justification of the contribution of some rootstocks in raising vine productivity compared with control (Own-rooted) (The lowest in productivity):

It can be shown from the data presented in (Table 8) that Dogridge, Salt creek, Paulsen 1103 and Freedom rootstocks (as the best rootstocks) gave the maximum net profit compared with the control (Own-rooted) (The lowest of productivity) in the three seasons. Used of the study rootstocks were found to increase the cost of vineyard establishment. However, it can be anticipated that the added cost of establishment will be offset by an increase in vine productivity.

In spite of the high costs of grafted plants compared with ungrafted ones, there is an increase in the crop by 30% on grafted vines against a decline in the crop by 10-30% in ungrafted vines as a result of the effect of insects and diseases or nematodes or the repair of damage resulting from soil salt or lime etc. Moreover, in the long run, the continuous use of pesticides well have adverse effect on human health, in addition to the high prices of chemical used in the resistance of nematodes give an evidence of the importance of using grafting.

In conclusion, it can be said that Dogridge, Salt creek, Paulsen 1103 and Freedom rootstocks, they have achieved a higher percentage of survival, improved the morphological and chemical characteristics of rooting, achieved the best yield and its components as well as the best physical properties of bunches, improved the physical characteristics of berries, ensure of the best vegetative growth parameters, improved the uptake efficiency of nutrients and increased total carbohydrates of canes and coefficient of bud fertility in comparison with the ungrafted vines.

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تأثير بعض الأصول على سلوك صنف العنب السوبيريور

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أجرى هذا البحث خلال الفترة من سنة 2001 حتى سنة 2006 وكان الهدف من البحث دراسة تأثير بعض أصول العنب على صنف العنب السوبيريور وقد شملت الدراسة مرحلتين هما:-

المرحلة الأولى: التطعيم المنضدى لعنب السوبيريور على أصول دوج ريدج، سولت كريك، فريدم، هارمونى، SO4، تلكى 5 س، بولسن 1103 مقارنة بالغير مطعوم لدراسة نسبة نجاح التطعيم والنمو الخضرى وأطوال الجذور والوزن الطازج والجاف ومحتوى الماء النسبى للأوراق والسعة التبادلية الكاتيونية للجذور والكلوروفيل.

المرحلة الثانية: دراسة سلوك أشجار صنف السوبيريور المطعوم على أصول مختلفة مقارنة بالغير مطعومة لمعرفة تأثير ذلك على المحصول وجودة الثمار والصفات الطبيعية للعنقود والحبات والمواد الصلبة الذائبة والحموضة كما شملت المرحلة أيضا بعض الدراسات المورفولوجية على النمو الخضرى وامتصاص العناصر وخصوبة البراعم.

وقد أظهرت النتائج أن نسبة نجاح التطعيم المنضدى تتراوح بين (66.7-86.5%) تبعا لاختلاف الأصل وموسم التطعيم. كما أن جميع الأصول تحت الدراسة أدت إلى زيادة النمو الخضرى وطول الجذر ومحتوى الأوراق من الماء النسبى والسعة التبادلية الكاتيونية والكلورفيل مقارنة بالنباتات الغير مطعومة كما أظهرت الأشجار المطعومة زيادة واضحة فى المحصول من (14.2-36.8%) باختلاف الأصل والموسم مقارنة بالأشجار الغير مطعومة، كما أدت إلى تحسين جودة الثمار ومواصفات العنقود والحبات بالاضافة إلى تحسين النمو الخضرى وامتصاص العناصر ومحتوى القصبات من الكربوهيدرات وخصوبة البراعم وخصوصا على الأصول: دوج ريدج، سولت كريك، فريدم، بولسن 1103 مقارنة بالأشجار الغير مطعومة.