Trials for All Alleviating the Adverse Effects of Soil and Water Irrigation Salinity on Fruiting Of Early Sweet Grapevines

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Abstract: During 2016 and 2017 seasons, nine materials namely ethrel, gibberellic acid, abscisic acid, manitol, chitosan salicylic acid, silicon, selenium and proline each at 50 ppm were tested for their effects on counteracting the adverse effects of soil and irrigation water salinity on fruiting of Early sweet grapevines grown under Minia region conditions. The vines received three sprays, the first spray at growth start, the second one was performed just after berry setting and the third one was conducted at one month later. Treating the vines with any one of the nine materials namely ethrel, gibberellic acid, abscisic acid, manitol, chitosan salicylic acid, silicon, selenium and proline each at 50 ppm was responsible for enhancing all growth aspects, photosynthetic pigments, N, P, K and Mg, proline, yield and both physical and chemical characteristics of the berries compared to the control treatment. An obvious differences were recorded on the investigated parameters among the nine tested materials. The effectiveness of these materials on controlling salinity could be arranged on follows, in ascending order ethrel, gibberellic acid, abscisic acid, manitol, chitosan, salicylic acid, silicon, selenium and proline. For counteracting the harmful effects of soil and water salinity on growth, vine nutritional status, yield and fruit quality of Early sweet grapevines grown in saline stress, it is recommended to spray the vines three times with proline or selenium acid each at 50 ppm.
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Keywords: Early sweet grapevines, ethrel, gibberellic acid, abscisic acid, manitol, chitosan, salicylic acid, silicon, selenium and proline, soil and water salinity, growth, vine nutritional status, yield and berries quality.

1. Introduction

Salinity is an environment stress, mainly occurs in arid and semiarid conditions where rain precipitation is not enough to leach the excess soluble salts from the root zone, as well as, it can occur in irrigated agriculture cultivations particularity when water or poor quality issued for irrigation. **Cho and Park (2000)** worked on tomato seedling, pointed out that the biochemical change occurring in plants subjected to environmental stress conditions is the production of reactive oxygen species, which can damage essential membrane lipids proteins nucleic acid (**Inze and Van Montague, 1995; and Garratt *et al.,* 2002**). The inferior effects of salinity on plants was explained by **Munnus and Tomeat, 1986 and Jacoby, 1994**).

Furthermore, the use of special management practice to minimize and counteract salinity effect appears is very important. Many investigators reported that growth promoters such as GA_3 are very effective in increasing salt tolerance of plants (**Taiz and Zeiger, 2002**)

Antioxidants (such as salicylic acid) have catch all free radicals produced during plant metabolism, hence increasing plant resistance to stress. Moreover, they provide adequate protection against the deleterious effects of activated oxygen species (**Nicholas, 1996; and Alscher *et al.,* 1997**). Also, salicylic acid has an auxinic action and synergistic effect on flowering and fruiting of fruit trees as well as, salicylic acid is a natural and safety used instead of synthetic auxins. **Shalata and Peter (2001)** and **Khan (2006**) stated that ascorbic acid as an antioxidant could be used as a potential growth regulator improved salinity stress resistance in several species.

Salinity in the soil and irrigation water had an obvious depression on growth, vine nutritional status, yield and berries quality of different grapevine cvs (**Ali- Mervat *et al.,* 2013)**

The results of **Abdel- Kader *et al.,* (2002) and El- Sabagh *et al.,* (2011)** emphasized the adverse effects of salinity on growth and fruiting of fruit crops.

Previous studies showed that using selenium (**Seppanen *et al.,* 2003; Uwakiem, 2015; Akl *et al.,* 2017a and 2017b; Abo El- Fadle, 2017 and Rizk and Radwan, 2018**), salicylic acid (**Leslie and Romani, 1988, Raskin, 1992, Delaney, 2004, Joseph *et al.,* 2010; Mohamed, 2014, Akl *et al.,* 2014; Amiri *et al.,* 2014; Mohamed- Attiat, 2016; Abd El- Rady, 2015 and El- Sayed- Eman, 2017, and Rizk and Radwan, 2018**), chitosan (**Ozeker, 2005, Hadwiger, 2013; Ali *et al.,* 2017; Khafagy,**

2018; El- Sayed *et al.*, 2018 a and 2018b, Ayed, 2018 and Rizk and Radwan, 2018), Abscisic acid (**Swamy and Smith, 1999 and Rizk and Radwan, 2018; Taylor *et al.*, 2000, Taiz and Zeigler, 2002; Tutega, 2007 and Gill and Titeja, 2010**) manitol, (**Taylor *et al.*, 2000; Cha- Mm *et al.*, 2010; Gill and Titeja, 2010 and Kaya *et al.*, 2013**) silicon (**Ayed, 2018; El- Sayed *et al.*, 2018a and 2018b**); Ethrel (**Winkler *et al.*, 1974, Taylor *et al.*, 2000; Taiz and Zeigler, 2002 and Tutega, 2007**), GA_3 (**Weaver, 1976; Ahmed and El- Sese, 2004, Wassel *et al.*, 2007 and Forcat *et al.*, 2008**) and proline (**Ezz, 1999; Mansour, 2000, Talkeuchi *et al.*, 2008; Caronia *et al.*, 2010 and El- Sayed – Omima *et al.*, 2014**).

The target of this study was elucidating the effect of some materials namely ethrel, GA_3, Abscisic acid, manitol, chitosan, salicylic acid, silicon, selenium and proline on counteracting the adverse effects of soil and water irrigation salinity on fruiting of Early sweet grapevines.

2. Materials and methods

This study was carried out during the two consecutive seasons of 2016 and 2017 on 60 uniform in vigour (10 years old Early Sweet grafted on harmony grape rootstock grown in a private vineyard located at West Matay, Matay district, Minia Governorate, where the soil texture is sandy and well drained water since water table depth is not less than two meters. The chosen vines are planted at 2 x 3 meters apart. Spur pruning system was followed at the first week of Jan. during both seasons leaving 66 eyes per vine (on the basis of 16 fruiting spurs x 3 eyes plus six replacement spurs x two eyes). The vines were irrigated through drip irrigation system.

Except those dealing with the present treatments (application of boron), all the selected vines (vines) received the usual horticultural practices that are commonly applied in the vineyard including the application of 10 tons F.Y.M. and 120 kg ammonium nitrate, 50 kg potassium, sulphate (48 % K_2O).25 kg magnesium sulphate (9.6 % Mg) as well as chelated Zn (21% Zn) and Mn (13% Mn) each at 25 kg and 2 kg chelated Fe (4.6 % Fe) per one fed. annually for both seasons. All macro and micro nutrient fertilizers were added via fertigation. F.Y.M. was added once just after winter pruning (3rd week of January). Another horticultural practices such as twice hoeings, irrigation, pinching and pest management were carried out as usual.

Soil is classified as sandy in texture. The results of orchard soil analysis according to **Wilde *et al.*, (1985)** are given in Table (1)

This study included the following ten treatments:

This experiment included the following ten treatments:

1- Control.
2- Spraying ethrel at 50 ppm.
3- Spraying GA_3 at 50 ppm.
4- Spraying Abscisic acid at 50 ppm
5- Spraying manitol at 50 ppm
6- Spraying chitosan at 50 ppm
7- Spraying salicylic acid at 50 ppm
8- Spraying potassium silicate at 50 ppm
9- Spraying selenium at 50 ppm
10- Spraying proline at 50 ppm

Table (1): Mechanical, physical and chemical analysis of the tested orchard soil:

Parameters	Values
Particle size distribution	
Sand %	76.2
Silt %	13.8
Clay %	10.0
Texture grade	Sandy
pH (1:2.5 extract)	8.00
E.C. (1: 2.5 extract) (mmhos/ 1cm/ 25°C)	1.22
O.M. %	0.25
CaCO%	2.89
Macronutrients values	
Total N%	0.009
P (olsen method, ppm)	1.1
K (ammonium acetate, ppm)	119.0
Mg (ppm)	4.0
S (ppm)	1.1
B (hot water extractable) (ppm)	0.15
EDTA extractable micronutrients (ppm)	
Zn	1.31
Fe	1.09
Mn	1.10
Cu	0.29

Each treatment replicated three times two vines per each. Spraying of the nine materials was done three times, the first at growth start (1st week of Mar.), the second one just after berry setting (middle of Apr.) and the third one at one month later (middle of May). Triton B as a wetting agent was applied at 0.5%. Spraying was done till runoff.

A randomized complete block design (RCBD) was followed where this experiment included ten treatments each replicated three time two vines per each.

At the last week of May during both seasons, twenty mature leaves from the opposite side to the basal clusters on the shoots were picked for calculating the leaf area using the following equation outlined by **Ahmed and Morsy (1999)**

Leaf area (cm^2) = 0.45 (0.79 x diameter ^{2}) + 17.77.

The average leaf area was recorded. Average main shoot length (cm) was recorded as a result of measuring the length of ten shoots per vine (cm) and the average shoot length was recorded. Number of leaves per shoot was also recorded Dynamic of wood ripening coefficient was calculated by dividing the length of the ripened part of shoot that had brownished colour by the total length of the shoots (green colour) in the ten shoots/ vine (middle of Oct.) according to **Bouard (1966)**. Weight of pruning (kg.) / vine was recorded just after carrying out pruning by weighing the removal one year old wood (1st week of Jan.). Average cane thickness (cm) was estimated in the five basal internodes of ten canes per vine by using a Vernier caliper.

Fresh leaves of each vine were cut into small pieces and a known sample (0.5 g) from each sample was taken, homogenized and extracted using 25% acetone with the assistance of little amounts of Na_2CO_3 and clean sand. Filtration was washed several times with acetone till the filtrate was colorless. Acetone was used as a blank. In the filtrates, the optical density was determined using spectrophotometer at the leave length of 662 and 644 mm to determine chlorophylls a and b, respectively. The following equations were used for determination of these plant pigments according to **Von- Wettstein (1975)**

Ck.1= (9.784- E 622) – 0.99 - E 644) = mg/1

Ch.b = (21.246- E 644) – (4.65- E 662) + mg/l

Total chl.= ch.A + Ch.B

where E= optical density at a given wave length. Calculations were estimated as mg/ 100 g F.W.

Petioles of the same leaves that were taken for measuring the leaf area according to **Balo *et al.*, (1988)** were washed several times with water and distilled water and then oven dried at 70^{o}C and grounded, then 0.5 g weight of each sample was digested using H_2SO_4 and H_2O_2 until clear solution (**Chapman and Pratt, 1965**). In the digesterd solutions, the following nutrients were determined:

1- N % by the modified micro Kejdahl method as described by (**Peach and Tracey, 1968**)

2- P % by using Olsen method as reported by **Wilde *et al.*, (1985)**.

3- K % by using flame photometer as outlined by (**Wilde *et al.*, 1985**).

4- Mg as ppm by titration against EDTA (versene method) (**Peach and Tracey, 1968**).

5- Proline amino acid was determined using that procedure that outlined by **(Bailery, 1967)**

When T.S.S./ acid in the control treatment reached 25:1, clusters were harvested of (2nd week of June). The yield of each vine was recorded in terms of weight (kg.) and number of clusters/ vine. Five clusters per each vines were taken for determination of the following physical and chemical characteristics of the berries.

1- Average cluster weight (g.) and average cluster compactness (number of berries / cluster length)

2- Percentage of shot berries by dividing number of small berries by total number of berries and multiplying the product by 100.

3- Average berry weight (g.) and dimensions (longitudinal and equatorial (in cm)

4- Percentage of total soluble solids in the juice by using handy refractometer.

5- Percentage of total acidity in the juice (as a tartaric acid/ 100 ml juice) by titration against 0.1 N NaOH using phenolphthalein indicator (**A.O.A.C., 2000**).

6- The ratio between T.S.S. and acid.

7- The percentage of reducing sugars in the juice (**Lane and Eynon, 1965**) as described by **A.O.A.C. (2000)**.

Statistical analysis was done and the different treatment means were compared using new L.S.D. at 5% (**Snedecor and Cochran, 1980 and Steel and Torrie, 1980**).

3. Results a & discussion

1- Vegetative growth aspects:

It is clear from the data in Table (2) that subjecting Early sweet grapevines three times with any material (ethrel, GA_3, ABA, manitol, chitosan, SA, Si, Se and proline) each at 50 ppm significantly stimulated the six growth aspects namely main shoot length, number of leaves / shoot, leaf area, wood ripening coefficient, cane thickness and pruning wood weight relative to the control. Significant differences on these growth aspects were observed among the investigated nine treatments. The best materials in enhancing these growth aspects, in descending order were proline, selenium, silicon, salicylic acid, chitosan, manitol, abscisic acid, GA_3 and ethrel. The maximum values were recorded on the vines that treated with proline at 50 ppm three times. The untreated vines produced the minimum values. These results were true during both seasons.

2- Leaf chemical components:

Data in Tables (2 & 3) clearly show that proline, chlorophylls a & b, total chlorophylls, N, P, K and Mg in the leaves were significantly enhanced in response to treating the vines three times with any one of the nine materials each at 50 ppm over the control treatment. Varying materials had significant differences on these chemical components. The best materials were proline, selenium and silicon.

Materials namely ethrel, GA_3 and ABA ranked the last position in this respect. Treating the vines with proline at 50 gave the greatest values. The material namely ethrel gave the lowest values. Treating the vines with water gave the lowest values. Similar results were announced during both seasons.

3- Yield and cluster aspects:

It is clear from the data in Table (4) that treating the vines three times with any one of the nine materials each at 50 ppm significantly improved the yield expressed in weight and number of clusters/ vine as well as weight and compactness of cluster relative to the control. Significant differences on the yield and cluster aspects were observed among the nine materials. The best materials in improving the yield and luster aspects were arranged as follows, in ascending order Ethrel, GA_3, ABA, manitol, chitosan, SA, silicon, selenium and proline. The maximum yield (13.9 & 18.9 kg) were recorded on the vines that treated with proline at 50 ppm during both seasons, respectively. The untreated vines produced the minimum values (10.8 & 10.4 kg) during both seasons, respectively. Number of clusters in the first season of study was significantly unaffected by the present treatments. These results were true during both seasons.

4- Physical and chemical characteristics of the berries

Data in Tables (4 & 5) show that subjecting the vines to any one of the nine materials (ethrel, GA_3, ABA, manitol, chitosan, SA, Si, Se and proline) each at 50 ppm was significantly very effective in improving berries quality in terms of increasing weight, longitudinal and equatorial of berry, T.S.S., reducing sugars and T.S.S./ acid and decreasing total acidity over the control. The promotion on quality of the berries was significantly associated with using ethrel, GA_3, ABA, manitol, chitosane, SA; Si, Se and proline, in ascending order. Significant differences on these quality parameters were observed among the previous nine materials. The best results with regard to quality of the berries were obtained when the vines treated with proline or selenium each at 50 ppm. the untreated vines produced unfavourable effects on fruit quality. These results were true during both seasons.

Table (2): Effect of some alleviating the adverse effects of salinity materials on some vegetative growth characteristics of Early Sweet grapevines during 2016 and 2017 seasons.

Treatments	Main shoot length (cm)		Number of leaves / shoot		Leaf area (cm)2		Wood ripening coefficient		Cane thickness (cm)		Pruning wood weight / vine (kg.)		Proline (mg/ g F.W.)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	108.1	109.0	14.0	12.0	109.2	110.0	0.64	0.61	0.94	0.90	1.89	1.90	50.2	51.0
Ethrel at 50 ppm	110.0	110.7	16.0	14.0	110.7	111.5	0.70	0.66	1.00	0.95	2.00	1.99	51.3	52.0
GA_3 at 50 ppm	112.2	113.0	18.0	15.0	112.0	112.9	0.76	0.71	1.05	1.00	2.11	2.09	52.9	53.6
ABA at 50 ppm	113.9	114.6	20.0	17.0	113.9	115.0	0.77	0.76	1.10	1.05	2.24	2.19	54.0	54.8
Manitol at 50 ppm	115.0	115.5	21.0	19.0	115.2	116.3	0.80	0.81	1.16	1.10	2.35	2.29	55.9	56.7
Chitosan at 50 ppm	116.4	118.6	23.0	21.0	117.0	117.7	0.81	0.83	1.22	1.15	2.46	2.40	57.0	57.7
SA at 50 ppm	118.0	118.7	24.0	22.0	118.2	119.0	0.82	0.86	1.30	1.20	2.58	2.51	57.9	58.6
Silicon at 50 ppm	120.0	120.9	26.0	24.0	120.0	120.3	0./86	0.88	1.35	1.26	2.69	2.61	59.0	59.7
Selenium at 50 ppm	122.3	123.0	28.0	26.0	121.3	122.0	0.87	0.90	1.40	1.32	2.81	2.71	61.3	62.0
Proline at 50 ppm	124.1	125.0	29.0	28.0	123.9	124.1	0.91	0.94	1.46	1.38	2.92	2.81	64.0	65.9
New L.S.D. at 5%	1.0	1.2	2.0	1.9	1.1	1.0	0.06	0.05	0.05	0.05	0.10	0.08	0.9	1.0

Table (3): Effect of some alleviating the adverse effects of salinity materials on some materials on photosynthetic pigments and percentages of N, P, K and Mg in the leaves of Early Sweet grapevines during 2016 and 2017 seasons.

Treatments	Chlorophyll a (mg/ g F.W.)		Chlorophyll b (mg/ g F.W.)		Total chlorophylls (mg/ g F.W.)		Leaf N %		Leaf P %		Leaf K %		Leaf Mg %	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	4.1	3.9	1.0	0.8	5.1	4.7	1.49	1.50	0.161	0.160	1.11	1.07	0.59	0.61
Ethrel at 50 ppm	4.3	4.2	1.2	1.0	5.5	5.2	1.55	1.57	0.171	0.169	1.16	1.14	0.64	0.65
GA_3 at 50 ppm	4.5	4.5	1.4	1.2	5.9	5.7	1.62	1.64	0.182	0.179	1.22	1.20	0.70	0.70
ABA at 50 ppm	4.8	4.8	1.6	1.4	6.4	6.2	1.70	1.70	0.193	0.190	1.29	1.27	0.75	0.75
Manitol at 50 ppm	5.0	5.1	1.8	1.6	6.8	6.7	1.76	1.76	0.204	0.199	1.35	1.33	0.80	0.80
Chitosan at 50 ppm	5.3	5.3	2.0	1.8	7.3	7.1	1.82	1.82	0.215	0.210	1.41	1.39	0.85	0.86
SA at 50 ppm	5.6	5.5	2.2	2.0	7.8	7.5	1.88	1.88	0.227	0.220	1.46	1.44	0.90	0.92
Silicon at 50 ppm	5.9	5.7	2.4	2.2	8.3	7.9	1.93	1.95	0.237	0.231	1.52	1.50	0.99	0.98
Selenium at 50 ppm	6.1	6.0	2.6	2.5	8.7	8.5	2.00	2.02	0.250	0.241	1.57	1.55	1.03	1.05
Proline at 50 ppm	6.3	6.2	2.8	2.8	9.1	9.0	2.05	2.10	0.261	0.251	1.62	1.59	1.10	1.11
New L.S.D. at 5%	0.2	0.2	0.2	0.2	0.4	0.4	0.05	0.06	0.009	0.007	0.04	0.03	0.04	0.03

Table (4): Effect of some alleviating the adverse effects of salinity materials on yield, weight and compactness of cluster and berry weight and longitudinal of Early Sweet grapevines during 2016 and 2017 seasons.

Treatments	N. of clusters/ vine		Yield/ vine (kg.)		Cluster weight (g.)		Cluster compactness		Av. Berry weight (g.)		Av. Berry longitudinal (cm)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	24.0	23.0	10.8	10.4	450.0	451	4.11	4.05	3.55	3.50	1.94	1.92
Ethrel at 50 ppm	24.0	25.0	11.3	11.5	461.0	461	4.23	4.20	3.61	3.55	2.00	1.97
GA_3 at 50 ppm	24.0	27.0	11.6	12.7	472	472	4.35	4.32	3.68	3.60	2.04	2.05
ABA at 50 ppm	24.0	29.0	11.6	14.0	483	483	4.47	4.44	3.75	3.66	2.08	2.10
Manitol at 50 ppm	24.0	30.0	11.9	14.8	496	494	4.60	4.57	3.82	3.72	2.13	2.14
Chitosan at 50 ppm	25.0	32.0	12.8	16.3	510	509	4.71	4.67	3.90	3.80	2.18	2.19
SA at 50 ppm	25.0	33.0	13.0	17.2	521	520	4.82	4.80	4.00	3.86	2.23	2.25
Silicon at 50 ppm	25.0	34.0	13.3	18.0	533	530	4.95	4.94	4.07	3.92	2.27	2.30
Selenium at 50 ppm	25.0	35.0	13.6	18.9	545	540	5.07	5.05	4.14	3.97	2.31	2.35
Proline at 50 ppm	25.0	35.0	13.9	18.9	557	541	5.20	5.19	4.20	4.06	2.34	2.40
New L.S.D. at 5%	NS	2.0	0.3	0.8	10.1	9.4	0.11	0.09	0.06	0.04	0.04	0.05

Table (5): Effect of some alleviating the adverse effects of salinity materials on some physical and chemical characteristics of the berries of Early Sweet grapevines during 2016 and 2017 seasons.

Treatments	Av. Berry equatorial (cm)		T.S.S. %		Reducing sugars %		Total acidity %		T.S.S./acid	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	1.79	1.80	17.1	17.0	15.1	14.9	0.679	0.677	25.2	25.1
Ethrel at 50 ppm	1.84	1.85	17.5	17.4	15.4	15.3	0.660	0.658	26.5	26.4
GA_3 at 50 ppm	1.87	1.90	18.0	17.8	15.8	15.7	0.645	0.643	27.9	27.7
ABA at 50 ppm	1.91	1.95	18.5	18.3	16.1	16.1	0.630	0.628	29.4	29.1
Manitol at 50 ppm	1.95	2.01	19.0	18.7	16.4	16.4	0.615	0.613	30.9	30.5
Chitosan at 50 ppm	2.00	2.04	19.4	19.1	16.8	16.8	0.600	0.598	32.3	31.9
SA at 50 ppm	2.04	2.08	19.8	19.5	17.2	17.2	0.585	0.584	33.8	33.4
Silicon at 50 ppm	2.08	2.12	20.2	20.0	17.5	17.6	0.571	0.570	35.4	35.1
Selenium at 50 ppm	2.12	2.16	20.6	20.5	18.0	18.0	0.560	0.559	36.7	36.7
Proline at 50 ppm	2.16	2.20	21.0	21.0	18.5	18.3	0.540	0.539	38.9	39.0
New L.S.D. at 5%	0.03	0.04	0.4	0.4	0.3	0.3	0.011	0.012	0.8	1.0

4. Discussion:

The inferior effects of salinity on growth and fruiting of Early sweet grapevines might be attributed to its negative effects on cell division, plant pigments, plant metabolism, cytoplasm, respiration, photosynthesis pigments, uptake of water and nutrients (**Jacoby, 1994; Munns and Tomeat, 1986 and Tylor, 1996**).

The beneficial effects of salicylic acid on counteracting the adverse effects of salinity on growth, nutritional status, yield and fruit quality of Early sweet grapevines might be attributed to its positive action on enhancing cell division and the biosynthesis of plant pigments and organic foods as well as reducing reactive oxygen species (ROS) and oxidative stress besides increasing the tolerance of trees to abiotic and biotic stresses and the defense resistance system and stimulating antioxidant enzymes (**Raskin, 1992; Ozeker, 2005 and Joseph *et al.*, 2010**).

Selenium was found by many authors to retard the reactive oxygen species (ROS) and enhance the tolerance of trees to abitoic and biotic stresses and enzymes activity (**Seppanen *et al.*, 2003**).

Selenium was found by many authors to enhance the activities of enzymes such as glutathione peroxidase, the tolerance of trees to abiotic and biotic stresses and the biosynthesis of carbohydrates and proteins. It also reduces reactive oxygen species (ROS) and protects plant cells from aging and death (**Taiz and Zeigler, 2002**).

The beneficial effects of manitol on retarding the adverse effects of salinity on growth and fruiting of Early sweet grapevines was mainly attributed to its effects on enhancing osmotic pressure of plant tissues and the biosynthesis of proline (**Cha-Mm *et al.*, 2010; Gill and Tuteja, 2010 and Kaya *et al.*, 2013**).

According to **Swamy and Smith (1999)** absicic acid is responsible for closing stomata and preventing transpiration rate and this results in enhancing the tolerance of trees to abiotic stress.

The counteracting effect of chitosan on the adverse effects of salinity on development of the trees could be attributed to its effect in retarding the

reactive oxygen species and protecting plant cells from destroying as well as its effect in increasing lignification of plant cells consequently reduced transpiration rate (**Hadwiger, 2013**).

The outstanding effect of GA_3 on decreasing the inferior effects of salinity on fruiting of Early sweet grapevines might be attributed to its positive action on enhancing the elongation of cells and enhancing all growth aspects (**Forcat *et al.*, 2004**).

The retarding effect of ethrel on transpiration rate surely reflected on saving water and enhancing cell division and the tolerance of the plants to salinity stress (**Winkler *et al.*, 1974 ad Taiz an Zeigler, 2002**).

Proline amino acid has been shown to accumulate in plant tissues under various conditions (**Yang *et al.*, 1999; Mansour, 2000**). The proposed function of the accumulated proline is osmosis regulation which has an adaptive mechanism to environmental stress and salinity (**Aspinall and Paleg, 1981**). Also, other proposed function is maintenance of membrane and protein stability, growth and provisions of a store of carbon, nitrogen and energy (**Mansour, 2000**). In this respect, **Ezz (1999)** mentioned that proline foliar application increased fruit juice, ascorbic acid content peel, proline, free amino acids and reducing sugar content of Washington Navel orange and Marsh grape fruit. Furthermore, **Takeuchi *et al.*, (2008)** demonstrated that L- proline treatments caused an increase in sugar content of fruit, glutamic acid content of new leaves, and leaf chlorophyll content of Japanese pear tree grown in containers under greenhouse conditions. Also, **Caronia *et al.*, (2010)** worked on (*Citrus sinensis* L.) indicated that amino acids especially L-proline foliar application improved yield, fruit weight, diameter and T.S.S. content.

On the other hand, proline has been shown to accumulate in plant tissues under various conditions (**Yang *et al.*, 1999; Mansour, 2000**). The proposal functions of accumulated prolien are osmoregluation, maintenance of membrane and prolein stability, growth and provisions of a store of carbon, nitrogen and energy (**Aspinall and Paleg, 1981 and Mansour, 2000**).

These results regarding the effect of salicylic acid are in agreement with those obtained by **Joseph *et al.*, (2010); Mohamed (2014) and Rizk and Radwan (2018)**.

The results concerning the effect of GA_3 (**Ahmed and El- Sese, 2004 and Wassel *et al.*, 2007**), Ethrel (**Tailor, *et al.*, 2000 and Tuteja, 2007**), Abscisic acid (**Swamy and Smith, 1999 and Rizk and Radwan, 2018**), Manitol (**Taylor et al., 2000, and Rizk and Radwan, 2018**), Chitosan (**El-Sayed *et al.*, 2018a and 2018b; Ayed, 2018 and Rizk and Radwan, 2018**) and Silicon (**El- Sayed *et al.*, 2019a and 2018b and Ayed, 2018**) emphasized the present results.

Conclusion

Carrying out three sprays of proline or selenium each at 50 ppm resulted in higher control of salinity and at the same time was responsible for improving yield and quality of the berries of Early sweet grapevines grown under salinity conditions.

References

1. Abdel- Kader, H.M.; Sabbah, S.M. and El- Sayed, A.A. (2002): Effect of salt stress on leaf proline accumulation and chlorophylls content of some fruit species. J. Adv. Agric. Res. 7 (4): 874-884.
2. Abd El- Rady, A.H.E. (2015): Response of Flame seedless grapevines to spraying salicylic acid M. c. Thesis Fac. of Agric. Minia Univ. Egypt.
3. Abo El- Fadle, H.M. (2017): Productive capacity of superior grapevines in relation to spraying selenium with some vitamins. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
4. Ahmed, A.K. and El- Sese, A.M.A. (2004): Effect of some chemical compounds and growth regulators on regularity of bud break, flowering and fruiting of Red Roomy grapevines. Assiut. J. of Agric. Sci. Vol. 35 No.2 pp. 165-181.
5. Ahmed, F.F. and Morsy, M.H. (1999): A new method for measuring leaf area in different fruit species Minia J. of Agric. Res. & Develop. Vol. 19: 97-105.
6. Akl. A.M.M.A.; Abdelaziz, F.H.; El- Sayed, M.A. and Mohamed, T.M.M. (2014): Response of Superior grapevines to spraying salicylic and boric acids. World Rural Observations, 6(4): 1-5.
7. Akl. A.M.M.A.; Ahmed, F.F.; Abada, M.A.M. and Masoud, S.E.Y. (2017a): Effect of spraying silicon and selenium on growth, vine nutritional status, berry setting, yield and berries quality of Superior grapevines grown under sandy soil conditions I- The effect of growth and vine nutritional status,. Fayoum J. Agric. res. & Dev. Vol. 31 No.2. 135-143.
8. Akl. A.M.M.A.; Ahmed, F.F.; Abada, M.A.M. and Masoud, S.E.Y. (2017b): Effect of spraying silicon and selenium on growth, vine nutritional status, berry setting, yield and berries quality of Superior grapevines grown under sandy soil conditions I- The effect of berry setting, yield and berries quality. Fayoum J. Agric. res. & Dev. Vol. 31 No.2. 145-152.
9. Ali, H. Alil; Maher Kh. Uwakiem and Omar M.M. Khafagy (2017): The beneficial effects of using chitosan and glutathione on the fruiting of red Roomy grapevines. N Y Sci. J. 10 (12): 110-119.

10. Ali-Mervat. A.; El- Gendy, R.S. and Ahmed, O.A. (2013): Minimizing adverse effects of salinity in vineyards. J. Hort. Sci. & Ornamen. Plants, 5(1): 12-21.
11. Alscher, R.G.; Donahne, J.L. and Cromer, C.L. (1997): Reactive oxygen species and antioxidants, relationships in green cells. Physio. Plant 100, 224-233.
12. Amiri, K.; Eshghi, S.; Rafazoli, E.; Kholdebarin, B.; and Abbaspour, N. (2014): Ameliorative effects of salicylic acid on mineral concentrations in roots and leaves of two grapevine (*Vitis vinifera* L.) cultivars under salt stress. Vitis –J. Grapevines res. 53(4) 181-188.
13. Association of Official Agricultural Chemists (2000): Official Methods of Analysis (A.O.A.C.), 12th ed., Benjamin Franklin Station, Washington D.Q. U.S.A. pp. 490-510.
14. Aspinall, D. and Paleg, I. (1981): Proline accumulation, physiological aspects. In Paleg, L.G. Aspinalp, D. eds. The physiology and Biochemistry of Drought Resistance in Plants. Academic press Sydney, pp. 205-241.
15. Ayed, S.H.A. (2018): Effect of different sources, concentrations and frequencies of silicon besides chitosan application on fruiting of Zebda mango trees. Ph. D. Thesis Fac. of Agric. Minai Univ. Egypt.
16. Bailey, J.L. (1967): Techniques in protein chemistry. Elsevier publishing Co. London U.K. pp. 190—198.
17. Balo, E.; Prilezky, G.; Happ. I.; Kaholomi, M. and Vega, L. (1988): Soil improvement and the use of leaf analysis for forecasting nutrient requirements of grapes. Potash Review subject 2nd suite No.6.
18. Bouard, J. (1966): Recherches physiologiques sur la vigne et en particulier sur loautment des serments. Thesis Sci. Nat. Bordeux France, P.34.
19. Caronia, A.; Gugliuzza, G. and Inglese, P. (2010): Influence of L. proline on Citrus sinensis L. 1st New Hall and Tarocco Seire, J. Fruit Quality Acta Hort. 884, 423- 426.
20. Cha- Mm, S; Ngayen, T.H.N. and Kirdmance, C. (2010): Effect of manitol and salt induced 150-osmotic stress son proline accumulation, photosynthetic abilitlies and growth characteristics of rice cultivars (oryza satival spp indica) Pakistan J. of Botany 42(2)92-941.
21. Chapman, H.D. and Pratt, P.P. (1965): Method of Analysis for Soils, Plants and water. Univ. of California Division of Agric., Sci. 172-173.
22. Cho, U. and Park, J. (2000): Mercury induced oxidative stress in tomato seedlings. Plant sci. 156:1:9.
23. Delancy, T.P. (2004): Salicylic acid In: Davies, P.J. (Ed.), Plant hormones, Kluwer Academic Press, Dordrecht, pp. 635-653.
24. El-Sabagh, A.S.; Barakat, M.N. and Genaidy, E.E. (2011): Towards in vitro selection studies for salinity tolerance in Canino apricot cultivar. Effect of gomma irradiation on in vitro mutation and selection for salt- tolerance. Advances in Hort. Sci. 260-263.
25. El-Sayed- Eman, M.M.A. (2017): Effect of humic and salicylic acid on the growth, nutritional status and organic composition of apple plants in response to salinity stress. Ph. D. Thesis. Fac. of Agric. Alex. Univ. Egypt.
26. El- Sayed, M.M.; Gobara, A.A.; Abdalla, A.S. and Ayed, S.H.A. (2018a): Effect of silicon and chitosan on growth and nutritional status of Zebda mango trees grown under Minia region conditions. Stem Cell 9(2):23-30.
27. El- Sayed, M.M.; Gobara, A.A.; Abdalla, A.S. and Ayed, S.H.A. (2018b): Effect of silicon and chitosan on fruit setting, yield and fruit quality of Zebda mango trees grown under Minia region conditions. Researcher. 10(6): 23-29.
28. El- Sayed- Omima, M.; El- Gammal, O.H.M. and Salama, A.S.M. (2014): Effect of ascorbic acid, proline and jasmonic acid foliar spraying on fruit set and yield of Manzanillo olive trees under salt stress. Scientia Hort. 176"32-37.
29. Ezz. T.M. (1999): Eliminating chilling injury of citrus fruits by preharvest proline foliar spray. Alex. J. Agric. Res. 44(1): 213-225.
30. Forcat, S.; Bennett, M.H. Mansfield, J.W.; Grant, M.R. (2008): A rapid and robust method for stimulatenously measuring changes in the phytohormonems ABA, GA3 and SA in plants following biotic and abiotic stress. Plant Methods 4: 16-+23.
31. Garratt, L.C.; Janagoudar, B.S.; Lowe, K.C.; Anthony, P.; Power, J.B. and Davey, M.R. (2002): Salinity tolerance and antioxidant status in cotton culture, Free Radic Biol. Med. 33, 502-511.
32. Gill, S.S. and Tuteja, N. (2010): Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. Plant Phyisology and Biochmistry, 48(12):909-930.
33. Hadwiger, L.A. (2013): Multiple effects of chitosan on plant systems: solid science or hype. Plant science 208, 42-49.
34. Inze, D.; Van Montague, M. (1995): Oxidative stress in plants. Curr. Opin Biotechnol. 6, 153-158.
35. Jacoby, B. (1994): Mechanisms involved in salt tolerance by plant. In Pessarakli, M. (5d) Handbook of plant and crop stress, Marcel Dekker, 97-123.
36. Joseph, B.; Jini, D. and Sujatha, S. (2010): Insight into the role of exogenous salicylic acid on plants grown under salt environment. Asian J. Crop. Sci. 2,: 226-235.
37. Kaya, C.; Sonmes, O.; Aydemir, S.; Ashnaf, M. and Dikilitas, M. (2013): Exogenous application of manitol and thiourea regulates plant growth and

oxidative stress in salt- stressed maiz (200 ma/ sl). J. of Plant. Interactions, Vol. (8), Issu 3-234-241.
38. Khafagy, A.M.M. (2018): The beneficial effects of using chitosan and glutathione on the fruiting of red Roomy grapevines M. Sc. Thesis. Fac. of Agric. Minai Univ. Egypt.
39. Khan, M. (2006): Effect of sea and L-ascorbic acid on the seed germination of halophytes, J. Arid Environ. 67, 535-540.
40. Lane, J.H. and Eynon, L. (1965): Determination of reducing sugars by means of Fehlings solution with methylene bleu as indicator A.O.A.C,. Washington D.C.U.S.A. 100-110.
41. Leslie, C.A. and Romani, R.J. (1988): Inhibition of ethylene biosynthesis by salicylic acid. Plant Physiol. 88: 833-837.
42. Mansour, M.M.F. (2000): Nitrogen containing compound and adaptation of plants to salinity stress. Biol. Plant 43, 491-500.
43. Mohamed, Attiat, A.M. (2016): Trials for alleviating the adverse effects of salinity on some grapevine cv transplants M. Sc. Thesis Fac. of Agric., Minai Univ. Egypt.
44. Mohamed, I.M.M. (2014): Relation of fruiting in Superior grapevines with spraying salicylic acid and boron. M. Sc. Thesis. Thesis Fac. of Agric. Minai UNiv. Egypt.
45. Munns, R. and Tomeat, A. (1986): While plant responses to salinity Aust. J. Plant Physiol. (13): 143-160.
46. Nicholas, S. (1996): The function and metabolism of ascorbic acid in plants. Ann., Bot. 78, 661-669.
47. Ozeker, E. (2005): Salicylic acid and its effects on pkants. EU. Fac. of Agric. J. 42 (10: 213-223.
48. Peach, K. and Tracey, I.M.V. (1968): Modem Methods of Plant Analysis, Vol.11 p. 36-38 Inter Sci. New York.
49. Raskin, I. (1992): Role of salicylic acid in plants An. Rev. Pk. Physiol. Plant Mol. Biol., 43: 439-463.
50. Rizk, M.N.S. and Radwan, E.M. A. (2018): Trials for alleviating the adverse effects of soil and water salinity on fruiting of Ewaise mango trees. 8th Inter. Conf. for sustainable Agric. Develop. 5-7 Mar. 262-272.
51. Seppanen, M.; Turakainen, M.a nd Harikainen, H. (2003): Selenium effects on oxidative stress in potato. Plant Science, 165: 311-319.
52. Shalata, A. and Peter M.N. (2001): Exogenous ascorbic acid (vitamin C) increases resistance to salt stress and reduces lipid peroxidation. J. Exp. Bot. 52, 2207-2211.
53. Swamy, P.M.a nd Smith, B.N. (1999): Role of abscisic acid in plant stress tolerance. Current Sci. Vol. 76 Issue 9: 1220-1227.
54. Taiz, A. and Zeiger, M. (2002): Plant physiology, Third Ed. 306 p. Academic Press, London.
55. Takeuchi, M.; Arakawa, C.; Kuwahara, Y. and Gemma, H. (2008): Effect of L- proline foliar application on the quality of: Kosui" Japanese pear. Acta Hort. 2 (800), 549-554.
56. Taylor, C.B. (1996): Proline and water deficit ups and downs. Plant. Cell (8): 121-1224.
57. Taylor, C.B.; Burbidge, A. and Thompson, A.J. (2000): Control of abscisic acid synthesis. Journal of Experimental; Botany, 51 (350), 1563-1574.
58. Tuteja, N. (2007): Ascisic acid and abiotic stress signaling. Plant signaling and Behavior. Vol.2 Issue 3: 135-138.
59. Uwakiem, M. Kh. (2015): Effect of spraying silicon, selenium and humic acid on fruiting early sweet grapevines. The 2nd Inter. Conf. On Hort. Crops. 15-18 March. Egypt J. Hort. 42(1): pp. 333-343.
60. Von Wettstein, D.V. (1957): Chlorophyll lethale under submikrosh opishe formileshrel der plastidebn cell trop. Res. Amer. Sco. Hort. Scl. 20-427-433.
61. Wassel, H.; Abd El- Hameed, A.; Gobara, A. and Attiat, M. (2007): Effect of some micronutrients, gibberellic acid and ascorbic acid on growth, yield and quality of white Banaty seedless grapevines. Afr. Crop Sci. Conf. proc. 8, 547-553.
62. Weaver, R.J. (1976): Grape Growing. A Wiley Interscience Publication John Wiley & Davis. New York, London, Sydney, Toronto pp. 160-175.
63. Wilde, S.A.; Corey, R.B.; Iyer, I.G. and Voigt, G.K. (1985): Soil and plant analysis for tree culture 3rd Ed. Oxford and IBH publishing co. New Delhi India, pp. 529-546.
64. Winkler, A.J.; Cook, A.J.; Kliewer, W.M. and Lider, L.A. (1974): General viticulture. University of California Press. London, pp. 710.
65. Yang, C.W.; Lin, C.C. and Kao, C.H. (1999): Endogenous ornithine and arginine content and dark induced proline accumulation in detached rice- Leans. J. Plant Phyiol. 155, 665-668.

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