Response of Early Sweet Grapevines to Foliar Spray Algae Extract and Selenium

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Abstract: This study was carried out during 2017 and 2018 seasons to examine the effect of spraying Algae extract at 0.05 to 0.2% and / or selenium at 125 to 500 ppm on all growth aspects, pigments and nutrients in the leaf, yield and berries quality of Early sweet grapevines grown in sandy soil. Berry setting, yield and both physical and chemical parameters of quality were remarkably improved due to using Algae extract at 0.05 to 0.2% and/ or selenium at 125 to 500 ppm compared to the control treatment. Nanoconsiderable effect was observed on the investigated characteristics due to increasing Algae extract concentrations from 0.1 to 0.2% and selenium from 250 to 500 ppm. The best results with regard to all growth aspects, pigments and nutrients in the leaf, yield and berries quality of Early sweet grapevines grown under sandy soil conditions were observed due to treating the vines three times with a mixture of Algae extract at 0.1% and selenium at 250 ppm.
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1. Introduction

An outstanding effect on growth and vine nutritional status was noticed in different grapevines cvs grown under sandy soil due to using Algae extract and selenium.

This is due to the positive effect of both Algae extract and selenium on alleviating the adverse effects of salinity and drought on growth and vine nutritional status.

Algae extract have higher C, N, P, K, K, Mg, Ca, Fe, Mn, Zn, Cu and Mo (**Tung- Yuan *et al.*, (2003)**.

The use of Algae extract is suggested to be one possibility to restore the natural conditions. Algae extract have long been recognized as excellent natural fertilizers and sources of organic matter amino acids, natural hormones, B vitamins and different essential nutrients.

Their positive effects as a soil conditions and slow release fertilizer did not neglect (**Planes- Leyva *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. (**Seppanen *et al.*, 2003; Noewak- Barbara, 2008 and Jakovljevic *et al.*, 2011**).

2. Material Ad Methods

Table (1): Analysis of the tested soil:

Constituents	Values
Sand %	81.0
Silt %	10.5
Clay %	8.5
Texture	Sandy
pH (1: 2.5 extract)	7.7
E.C. (1: 2.5 extract) (mmhos /cm/25^{o}C)	0.89
O.M. %	0.15
$CaCO_3$%	2.5
Total N%	0.1
Available P (olsen method, ppm)	2.2
Available K (ammonium acetate, ppm)	45.0

This study was carried out during 2017 and 2018 seasons, on thirty uniform in vigour 10- years old Early sweet grapevines. The selected vines are grown in a private vineyard located at El- Tode village- Luxor district, Luxor Governorate where the texture of the soil is sandy (Table 1). Soil analysis was done according to the procedures that outlined by **(Piper (1950)** and **Black (1965)**. the selected vines are planted at 3x 2 meters apart (700 vines/ fed.) The chosen vines were trained by spur pruning system leaving 72 eyes/ vine (15 fruiting spurs x four eyes) + (6 replacement spurs x two eyes).

Using gable supporting method. Winter pruning was carried out at the first week of January during both seasons.

Drip irrigation system was followed using Nile water.

Common horticultural practices such as fertilization twice hoeings, irrigation pinching and pest management were carried out as usual.

This study consisted from the following ten treatment:

1- Control.
2- Spraying Algae extract at 0.05 % (0.5 ml / L)
3- Spraying Algae extract at 0.1 % (1 ml / L)
4- Spraying Algae extract at 0.2 % (2 ml / L)
5- Spraying Selenium 125 ppm (0.125 g. / L)
6- Spraying Selenium 250 ppm (0.25 g. / L)
7- Spraying Selenium 500 ppm (0.5 g. / L)
8- Spraying Algae extract 0.05 % plus Selenium 125 ppm.
9- Spraying Algae extract 0.1 % plus Selenium 250 ppm.
10-Spraying Algae extract 0.2 % plus Selenium 500 ppm.

Each treatment was replicated three times on vine per each. Both Algae extract and selenium were sprayed three times at growth start (1st week par Mar.) just after berry setting (1st week per April) and one month (1st week of May). Triton B as a wetting agent was added to all spraying solutions at 0.05 % spraying was done till run off (1-2 L/ vine according to the date of spraying.

Randomized complete block design (RCBD) was adopted for carrying out statistical analysis of this study.

During both seasons, the following measurements were recorded:

1- Vegetative growth characteristics namely main shoot length (cm), number of leaves/ shoot, leaf area (cm^2). (**Ahmed and Morsy, (1999**), wood ripening coefficient. (**Bouard (1966)** and cane thickness (cm)

2- Leaf chemical pigments namely chlorophyll a and b, (mg / 100 g F.W.) (**Von –Wettstein, 1957**) and N, P and K (as %) (**Cottenie *et al.*, 1982**).

3- Percentage of berry setting; yield / vine (kg) number of clusters as well as weight (g).

4- Physical and chemical characteristics of the berries namely berry weight (g.); longitudinal and equatorial of (cm); T.S.S. % and total acidity % as g tartaric acid /100 ml juice) **(A.O.A.C. (2002).**

Statistical analysis was done. treatment means were compared using new L.S.D. at 5 % **(Mead *et al.*, (1993).**

3. Results

1- Vegetative growth characteristics:

It is clear from the obtained date in Table (2) that single and combined applications of Algae extract at 0.05 to 0.2 % and selenium at 125 to 500 ppm significantly were accompanied with stimulating the five growth characteristics namely main shoot length, number of leaves shoot, leaf area, wood ripening coefficient and cane thickness relative to the check treatment.

The stimulation on these growth traits was associated with increasing concentrations of Algae extract from 0.05 to 0.2% and selenium from 125 to 500 ppm.

Unsignificant promotion on these growth aspects was observed among the higher two concentrations of Algae extract namely 0.1 and 0.2 % and selenium namely 250 and 500 ppm.

Combined applications of Algae extract and selenium significantly was superior than using each alone in enhancing these growth aspects.

Using algae extract at 0.05 to 0.2% was superior to using selenium at 125 to 500 ppm in this connection.

The maximum values of shoot length (137.4 & 139.7 cm) number of leaves/ shoot (26.0 & 27.0) leaf area (106.0 & 107.0 cm^2), wood ripening coefficient (0.95 & 0.96) and cane thickness (1.37 & 1.39 cm) during both seasons, respectively were observed on the vines that received three sprays of Algae extract at 0.2% and selenium at 500 ppm the lowest values were recorded on untreated vines. These results were true during both seasons.

Table (2): Effect of spraying Algae extract and selenium on shoot length, no. of leaves/ shoot, leaf area, wood ripening coefficient and cane thickness of early Sweet grapevine grown in sandy soil during 2017 and 2018 seasons.

Treatments	Main shoot length (cm)		No. of leaves shoot		Leaf area (cm^2)		Wood ripening coefficient		Cane thickness (cm)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	119.3	120.1	14.0	15.0	93.3	94.0	0.66	0.67	0.99	1.00
Spraying Algae extract at 0.05%	127.0	128.0	20.0	21.0	100.8	101.5	0.81	0.82	1.14	1.15
Spraying Algae extract at 0.1 %	130.0	131.9	22.0	23.0	101.9	102.6	0.86	0.87	1.19	1.20
Spraying Algae extract at 0.2 %	130.6	132.0	22.0	24.0	102.0	102.8	0.86	0.88	1.20	1.21
Spraying Selenium at 125 ppm	121.7	122.3	16.0	17.0	95.0	95.7	0.71	0.72	1.04	1.05
Spraying Selenium at 250 ppm	124.0	124.3	18.0	19.0	96.9	97.6	0.75	0.76	1.08	1.10
Spraying Selenium at 500 ppm	124.7	125.0	18.0	19.0	97.0	97.7	0.76	0.77	1.09	1.11
Spraying Algae extract at 0.05 % and selenium at 125 ppm	133.9	135.0	24.0	25.0	104.0	104.7	0.91	0.92	1.28	1.30
Spraying Algae extract at 0.1 % and selenium at 250 ppm	137.0	139.0	26.0	27.0	105.9	106.6	0.95	0.95	1.36	1.38
Spraying Algae extract at 0.2 % and selenium at 500 ppm	137.4	139.7	26.0	27.0	106.0	107.0	0.95	0.96	1.37	1.39
New L.S.D. at 5%	1.7	1.4	1.0	1.0	1.1	1.4	0.03	0.05	0.03	0.03

2- Leaf chemical composition:

It is evident from the obtained data in Table (3) that the twelve leaf chemical components namely chlorophylls a, b, N, P and K were significantly varied among the nine Algae extract and selenium treatments. They were significantly enhanced with using Algae, extract and / or selenium relative to the control treatment. There was a gradual promotion on these leaf chemical components with increasing concentrations of Algae extract and selenium.

Increasing concentrations of Algae extract from 0.1 to 0.2% and selenium from 250 to 500 pp, failed to show significant promotion on these chemical constituents.

Using Algae extract was significantly superior to using selenium in enhancing these chemical components. Combined applications of Algae extract and selenium were significantly favorable for enhancing these chemical components relative to using each alone. The maximum values of chlorophyll a (9.0 & 9.1 mg/ 100 g F.W.), chlorophyll b (3.2 & 3.3 mg/ 100 g F.W.), N (2.02 & 2.08 %), P (0.34 & 0.36 %) and K (1.61 & 1.67 %) during both seasons respectively were observed on the vines that received a mixture of Algae extract at 0.2 % and selenium at 500 ppm. The untreated vines produced the minimum values. These results were true during both seasons.

Table (3): Effect of spraying Algae extract and selenium on chlorophyll a, b and the percentages of N, P and K on the leaves of early Sweet grapevine grown in sandy soil during 2017 and 2018 seasons.

Treatments	Chlorophyll a (mg/ 100 g F.W.)		Chlorophyll b (mg/ 100 g F.W.)		Leaf N %		Leaf P %		Leaf K %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	4.0	4.1	1.1	1.2	1.61	1.59	0.16	0.15	1.14	1.17
Spraying Algae extract at 0.05%	5.9	6.0	1.9	2.1	1.80	1.84	0.25	0.25	1.31	1.35
Spraying Algae extract at 0.1 %	6.9	7.0	2.3	2.4	1.85	1.89	0.28	0.29	1.36	1.40
Spraying Algae extract at 0.2 %	7.0	7.1	2.3	2.4	1.86	1.90	0.28	0.30	1.37	1.41
Spraying Selenium at 125 ppm	4.5	4.6	1.4	1.4	1.66	1.71	0.18	0.18	1.18	1.22
Spraying Selenium at 250 ppm	5.0	5.1	1.6	1.6	1.74	1.79	0.21	0.21	1.23	1.27
Spraying Selenium at 500 ppm	5.1	5.2	1.7	1.7	1.76	1.80	0.22	0.22	1.24	1.29
Spraying Algae extract at 0.05 % and selenium at 125 ppm	7.9	7.9	2.8	3.0	1.95	2.00	0.31	0.33	1.53	1.58
Spraying Algae extract at 0.1 % and selenium at 250 ppm	8.9	9.0	3.1	3.2	2.01	2.07	0.33	0.33	1.60	1.66
Spraying Algae extract at 0.2 % and selenium at 500 ppm	9.0	9.1	3.2	3.3	2.02	2.08	0.34	0.36	1.61	1.67
New L.S.D. at 5%	0.4	0.5	0.2	0.2	0.05	0.04	0.02	0.03	0.04	0.03

3- Percentage of berry setting, yield and cluster aspects:

It is evident from the obtained data in Table (4) that treating Early sweet grapevines three times with Algae extract and / or selenium significantly improved the percentage of berry setting, yield expressed in weight and number of clusters / vine relative to the check treatment.

There was a gradual promotion on these parameters with increasing concentrations of Algae extract and selenium. Increasing concentrations of Algae extract from 0.05 to 0.2% had no significant promotion on the percentage of berry setting, yield, number of clusters/ vine and weight cluster.

Application of Algae extract was significantly preferable in improving these measurements than using selenium. Combined applications significantly were accompanied with improving these parameter relative to using each material alone.

From economical point of view, the best results with regard to berry setting, yield and cluster aspects were obtained due to treating the vines three times with a medium concentration of Algae extract 0.1 % and selenium at 250 ppm. Under such promised treatment, yield per vines reached 12.71 and 16.03 kg during both seasons respectively.

The untreated vines produced yield per vine reached 9.86 and 10.23 during both seasons, respectively. The percentage of increment of the yield / vine in the promised treatment over the control treatment reached 28.91 and 56.70 % during both seasons respectively. Similar trend as noticed during both seasons. number of clusters vine in the first season was unsignificantly affected.

4- Physical and chemical characteristics of the berries

Data in Table (5) clearly show that supplying the vines with Algae extract and / or selenium significantly was responsible for improving quality of the berries in terms of increasing berry weight, longitudinal and equatorial, T.S.S. and reducing total acidity % relative to the control treatment.

The promotion on both physical and chemical characteristics was related to the increase in concentrations of Algae extract and selenium negligible promotion on quality of the berries was observed among the higher two concentrations of both Algae extract and selenium.

Using Algae extract was significantly preferable than using selenium in this connection combined application were significantly superior than using each material alone in this respect.

Table (4): Effect of spraying Algae extract and selenium on the percentage of berry setting yield as well as cluster weight of early Sweet grapevine grown in sandy soil during 2017 and 2018 seasons.

Treatments	Berry setting %		No. of cluster /vine		Yield/ vine (kg.)		Cluster weight (g.)	
	2017	2018	2017	2018	2017	2018	2017	2018
Control	7.1	6.8	29.0	30.0	9.86	10.23	340.0	341.0
Spraying Algae extract at 0.05%	10.7	11.0	29.0	34.0	10.87	12.82	375.0	377.0
Spraying Algae extract at 0.1 %	11.8	12.0	30.0	35.0	11.58	13.54	386.0	387.0
Spraying Algae extract at 0.2 %	12.0	12.1	30.0	36.0	11.61	13.93	387.0	387.0
Spraying Selenium at 125 ppm	8.3	8.5	30.0	31.0	10.50	10.91	350.0	352.0
Spraying Selenium at 250 ppm	9.4	9.6	31.0	32.0	11.22	11.65	362.0	364.0
Spraying Selenium at 500 ppm	9.6	9.8	30.0	33.0	10.92	12.08	364.0	366.0
Spraying Algae extract at 0.05 % and selenium at 125 ppm	13.1	13.3	13.0	37.0	11.94	14.80	398.0	400.0
Spraying Algae extract at 0.1 % and selenium at 250 ppm	14.1	14.6	30.0	38.0	12.24	15.58	408.0	410.0
Spraying Algae extract at 0.2 % and selenium at 500 ppm	14.5	14.7	31.0	39.0	12.71	16.03	410.0	411.0
New L.S.D. at 5%	1.0	0.9	NS	2.0	0.72	1.00	10.0	9.9

Table (5): Effect of spraying Algae extract and selenium on cluster shoulder, percentage of shot berries and berry weight and dimensions of early Sweet grapevine grown in sandy soil during 2017 and 2018 seasons.

Treatments	Berry longitudinal (cm)		Berry equatorial (cm)		Berry weight (g.)		T.S.S. %		Total acidity %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	2.18	2.16	1.72	1.70	4.70	4.68	18.0	17.8	0.710	0.706
Spraying Algae extract at 0.05%	2.49	2.50	1.81	1.83	4.91	4.93	19.3	19.2	0.620	0.625
Spraying Algae extract at 0.1 %	2.53	2.55	1.84	1.85	4.93	4.95	19.6	19.5	0.600	0.603
Spraying Algae extract at 0.2 %	2.60	2.63	1.84	1.86	4.94	4.96	20.0	19.8	0.580	0.583
Spraying Selenium at 125 ppm	2.22	2.25	1.74	1.76	4.80	4.83	18.3	18.1	0.690	0.686
Spraying Selenium at 250 ppm	2.33	2.36	1.76	1.77	4.84	4.86	18.6	18.4	0.670	0.666
Spraying Selenium at 500 ppm	2.40	2.48	1.78	1.79	4.89	4.91	18.9	18.7	0.674	0.646
Spraying Algae extract at 0.05 % and selenium at 125 ppm	2.63	2.65	2.12	2.15	5.00	5.03	20.7	19.5	0.540	0.523
Spraying Algae extract at 0.1 % and selenium at 250 ppm	2.65	2.67	2.16	2.19	5.11	5.14	21.0	19.8	0.518	0.503
Spraying Algae extract at 0.2 % and selenium at 500 ppm	2.66	2.68	2.18	2.21	5.15	5.19	21.2	19.0	0.500	0.485
New L.S.D. at 5%	0.05	0.06	0.04	0.05	0.08	0.07	0.3	0.2	0.018	0.017

From economical point of view, the best results with regard to quality of the berries were recorded on the vines that received three sprays of a mixture of Algae extract at 0.2 % and selenium at 500 ppm. low fruit quality indices were observed on untreated vine. These results were true during both seasons.

4. Discussion

The positive action of Algae extract application on growth and fruiting of Early sweet grapevines was attributed to the following reasons.

It has higher content of N, P, K, Mg, Zn, Fe and Mn as well as vitamins B_1, B_2, B_6, B_{12} and natural hormones such as IAA, GA_3 and citokinias, peptides amino acids and antioxidant (**Abd El Hameed (2005); Kannaiyann, (2002) and Irizar- Garza *et al.*, (2003); Abd El Hameed *et al.*, (2010); Ahmed, M.A.M. (2009) and El- Saman (2010).**

The beneficial effects of selenium of Early sweet grapevines be attributed to its positive action on enhancing the tolerance of the trees to biotic and abiotic stresses and biosynthesis of carbohydrate and proteins. It is effective in reducing reactive oxygen species (ROS) since it considered as an important antioxidant protects the plant cells from death. Thereby, it is responsible for producing healthy trees able to produced more fruits (**Nowak- Barbara (2008) and Jakovljevic *et al.*, (2011)**.

These results are in harmony with those obtained by **(Ibrahiem an Al Wasfy (2014); Gad El Kareem *et al.*, (2014); Uwakiem (2015) and Masoud (2017))**.

Conclusion

Carrying out three sprays of a mixture of Algae extract at 0.1% and selenium at 250 ppm gave the best results with regard to yield and berries quality of Early Sweet grapevines grown under Sandy soil.

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