

Trials for Solving the Problem of Poor Berries Colouration and Improving Yield of Crimson Seedless Grapevines

Ahmed, M. K. Abdel Aal¹; Mohamed A.M. Abada² and Hesham, A. E. Mohamed²

¹Hort. Dept., Fac. of Agric., Minia Univ., Egypt.

²Viticulture Res. Dept., Hort. Res. Instit. ARC, Giza, Egypt
faissalfadel@yahoo.com

Abstract: During 2015 and 2016 seasons Crimson seedless grapevines were subjected to ethrel at 125-250 ppm, proton at 100 ppm, selenium at 25 ppm, potassium silicate at 0.1%, potassium silicate at 0.1% + selenium at 25 ppm, turmeric extract at 0.1%, garlic oil at 1.0 %, onion oil at 1.0, N at 25g/vine/year and boric acid at 0.025 %. Nitrogen was added at three unequal batches at growth start, just after berry setting and one month later. Ethrel and proton were sprayed once at veraison stage. Silicon, selenium, plant extracts and boron were sprayed three times at growth start, just after berry setting and veraison stage. The merit was improving berries colouration, yield and quality of berries. All growth aspects, leaf chemical components, yield and physical characteristics of the berries were unaffected by spraying ethrel and/or proton. Berries colouration % and chemical characteristics of the berries were positively affected by treating the clusters with ethrel and or proton. Growth aspects, leaf chemical components, yield, berries colouration % and berries quality were materially enhanced with using silicon and/or selenium, boric acid, plant extracts and N. The best results with regard to all parameters except berries colouration and chemical characteristics were obtained due to using silicon plus selenium. According to the obtained data, it is preferable to spray potassium silicate at 0.1% + selenium at 25 ppm three times at growth start, just after berry setting and at veraison stage for improving the yield of Crimson seedless grapevines. For improving quality of the berries, it is suggested to spray ethrel at 125 ppm+ proton at 50 ppm once at veraison stage.

[Ahmed, M. K. Abdel Aal; Mohamed A.M. Abada and Hesham, A. E. Mohamed. **Trials for Solving the Problem of Poor Berries Colouration and Improving Yield of Crimson Seedless Grapevines.** *N Y Sci J* 2017;10(12):91-103]. ISSN 1554-0200 (print); ISSN 2375-723X (online). <http://www.sciencepub.net/newyork>. 11. doi:[10.7537/marsnys101217.11](https://doi.org/10.7537/marsnys101217.11).

Keywords: Crimson seedless, poor berries colouration, yield, growth aspects, quality parameters, ethrel, proton, Silicon, Selenium, plant extract, boric acid, N.

Introduction:

Uneven and poor berries colouration as well as the decline of the yield of Crimson seedless grapevines grown under sandy soil are serious problems facing marketing of such grapevine cv. Using untraditional methods such as adjustment of N levels, spraying boron, plant extracts, silicon, selenium, ethrel and proton were arised for overcoming these problems.

Using ethrel (Amutha and Rajendra, 2001; Al-Maisary, 2002; Fawzi and Abd El-Moniem, 2003; Lombar *et al.*, 2004; Ahmad and Zargar 2005; Omar and Girgis, 2005; El- Halaby, 2006 and El- Sayed, 2007) and proton Gens *et al.*, 2006; Amiri *et al.*, 2010; Koyama *et al.*, 2010; Bahar *et al.*, (2012); Strydom *et al.*, 2014 and Aly, 2017) was very effective in enhancing berries colouration, maturation and chemical characteristics of berries in various grapevine cvs. Plant extract (Irasema *et al.*, 2008; El- Helw- Hanna *et al.*, 2011; Larissa *et al.*, 2013; Abdelaal and Aly, 2013; Gad El- Kareem and Abd El- Rahman, 2013; Melgarejo *et al.*, 2013; Abada, 2014; Uwakiem, 2014 and Ibrahiem 2017), boron (El- Kady- Hanaa, 2011; Mohamed-

Ebtesam 2012; Akl *et al.*, 2014; Mohamed 2014 and Abdelaal, *et al.*, 2017), silicon (Abd El-Hameed, 2012; Al-Wasfy, 2014; El-Khawaga, 2014; Uwakiem, 2015; Wassel *et al.*, 2015; Nagy-Dina, 2016; and Farahat *et al.*, 2017), selenium (Gad El-Kareem *et al.*, 2014; Uwakiem, 2015 and Masoud, 2017) and low N (Abd El-Aziz, 2011; El-Khafagy, 2013; Abd El- Kareem, 2014 and Ahmed *et al.*, 2017) were responsible for promoting growth vine nutritional status, yield and fruit quality in different fruit crops.

The present study aimed to throw some lights on the effect of foliar application of ethrel, proton, N, oils of garlic and onion, turmeric extract, boric acid, silicon and selenium on some growth aspects, vine nutritional status, berry setting %, yield, berries colouration % and berries quality of Crimson seedless grapevines growing under sandy soil. Also, the effect of these substances on solving the problems of inferior quality and uneven colouration of berries which reflected in facilitating the possibility of marketing such grapevine cv. to local and foreign markets also concerned.

Material and Methods

This study was carried out during 2015 and 2016 seasons on 36 uniform in vigour 5-years old Crimson seedless grapevines. The selected vines are grown in a private vineyard located at Awlad Gebreel Village, El-Hammam district, Marsa Matroh Governorate, where the texture of the soil is sandy (Table 1). Soil analysis was done according to the procedures that outlined by **Piper (1950)**.

The selected vines are planted at 2 x 3 meters apart (700 vines). The chosen vines were trained by cane pruning method leaving 92 eyes/ vine (12 fruiting canes x 7 eyes plus 4 renewal spurs/ two eyes) using Baroon supporting system. Winter pruning was carried out at the first week of Jan. during both seasons. Drip irrigation system was followed using Nile water.

Table (1): Analysis of the tested soil

constituent	Values
Sand %	76.2
Silt %	12.1
Clay %	11.7
Texture	Sandy
O.M. %	0.11
pH (1: 2.5 extract)	7.69
EC (1:2.5 extract) (mmhos/cm/25°C)	1.01
CaCO ₃ %	3.00
Total N %	0.005
Available P (Olsen method, ppm)	1.1
Available K (ammonium acetate, ppm)	31.0

Except those dealing with the present treatments (application of ethrel, proton, N, oils of garlic and onion, turmeric extract, boric acid, silicon and selenium) the selected vines (36 vines) received the usual horticultural practices that are commonly applied in the vineyard such as twice hoeing's,

irrigation, pinching and pest management were carried out as usual.

This study consisted from the following twelve treatments:

- 1- Control treatment.
- 2- Spraying ethrel (48%) at 250 ppm.
- 3- Spraying proton (10% ABA) at 100 ppm.
- 4- Spraying ethrel at 125 ppm+ proton at 50 ppm.
- 5- Soil addition of nitrogen at 25g N/vine/year.
- 6- Spraying potassium silicate at 0.1% (1g/l).
- 7- Spraying selenium at 25 ppm (25mg/l).
- 8- Spraying potassium silicate at 0.1% + selenium at 25 ppm.
- 9- Spraying turmeric extract at 0.1%.
- 10- Spraying garlic oil at 1%.
- 11- Spraying onion oil at 1%.
- 12- Spraying boric acid at 0.025%.

Each treatment was replicated three times, one vine per each. The total vines selected for achieving of this experiment were 36 vines. Ethrel and proton were sprayed once at veraison stage (when 5 % of berries were coloured in 50% of number of clusters) (last week of August). Nitrogen was added via soil at three unequal patches as 40% at growth start (middle of April), 40% just after berry setting (last week of June) and 20% at one month later (last week of July). Plant extracts (oils of garlic and onion and turmeric extract), potassium silicate (25% Si+ 10% K₂O), selenium (100%) and boric acid (17%B) were sprayed three times at growth start (middle of April), just after berry setting (last week of June) and at veraison stage (last week of August). Triton B as a wetting agent at 0.05% was added to all spraying solutions and spraying was done till runoff.

Chemical composition of two oils namely garlic and onion as well as turmeric extract are shown in Tables (2 to 4).

Table (2): Chemical composition of garlic oils (according to Mnayer *et al.*, 2014)

Compounds	Values (mg/100g D.W)
Dipropyl disulfide	0.25
Diallyl disulfide	37.90
Dimethyl trisulfide	0.33
Dimethyl thiophene ^a	0.08
Allyl methyl disulfide	3.69
Methyl propyl disulfide	0.25
Methyl 1-propenyl disulfide ^a	0.46
Allyl propyl sulfide	0.09
Bis-(1-propenyl)-sulfide ^a	0.08
Diallyl sulfide	6.59
Dimethyl disulfide	0.15
Allyl methyl tetrosulfide	1.07
Allyl propyl trisulfide	0.23
Diallyl trisulfide	28.06
Eugenal	0.23

Table (3): Chemical composition of onion oil (Mnayer *et al.*, 2014)

Compounds	Values (mg/100g D.W)
1-Propenyl propyl disulfide ^a	7.26
Methyl propyl trisulfide	5.2
Menthone	0.34
Methyl propyl trisulfide	0.47
Dimethyl tetrasulfide	0.15
Dipropyl trisulfide	17.10
Eugenol	3.07
2-Methyl-3,4-dithiaheptane	6.48
Dipropyl tetrasulfide	0.55
Dipropyl disulfide	30.92
Allyl propyl sulfide	0.42
Dimethyl trisulfide	0.30

Table (4): Chemical composition of Turmeric (according to Shiyou *et al.*, 2011)

Compounds	Values
β- Bisabolene %	1.3
1.8-Cineol %	2.4
p-Cymene %	3.0
p-Cymen-8-ol %	0.3
Tr-Curcumin%	6.3
Curone %	10.6
Dehydrocurcumin %	2.2
Myrcene	0.1
α-Phellandrene %	0.1
β- Phellandrene %	Tr
α- Pinene %	0.1
β -Pinene%	Tr
Terpinolene %	0.3
Tr-Turmerone %	31.1
Turmerone %	10.0
Ascorbic acid (mg)	50.0
ASH (g)	6.8
Calcium (g)	0.2
Carbohydrate (g)	69.9
Fat (g)	8.9
Food energy (k Cal)	390.0
Iron (g)	47.5
Niacin (mg)	4.8
Potassium (mg)	200.0
Phosphorus (mg)	260.0
Protein (g)	8.5
Riboflavin (mg)	0.19
Sodium (mg)	30.0
Thiamine (mg)	0.09
Water (g)	6.0

Randomized complete block design (RCBD) was adopted for carrying out statistical analysis of this study (Rao, 2007).

During both seasons, the following measurements were recorded:

1. Vegetative growth characteristics namely leaf area (cm²) (Ahmed and Morsy, 1999), wood ripening coefficient (Bourad, 1966), pruning wood weight (kg.) and cane thickness (cm).

2. Leaf pigments namely chlorophylls a & b, total chlorophylls, total carotenoids (mg/ 100 g

F.W.), (Hiscox and Isralastam, 1979 and Von-Wettstein, 1957).

3. Leaf chemical components namely N, P, K and Mg (as %), (Peach and Tracy, 1968; Evenhuis and Deward, 1980; Cottenie *et al.*, 1982 and Summer, 1985).

4. Percentage of berry setting, harvesting date and yield expressed in weight (Kg) and number of clusters/ vine.

5. Weight (g), length and shoulder (cm) of cluster.

6. Percentage of berries colouration.

7. Physical characteristics of the berries namely weight (g) and dimensions (longitudinal and equatorial) (cm),

8. Chemical characteristics of the berries namely T.S.S. %, total acidity % (as g tartaric acid/100 ml juice) (A.O.A.C, 2000), T.S.S/acid, reducing sugars % (Lane and Eynon, 1965) and total anthocyanins in the berries (mg/ 100 g F.W.) (Fulcki and Francis, 1968).

Statistical analysis was done using new L.S.D. at 5% (Snedecor and Cochran, 1990 and Mead *et al.*, 1993).

Results and Discussion:

1- Vegetative growth characteristics:

It is clear from the obtained data in Table (5) that treating the vines with ethrel at 250 ppm, proton at 100 ppm and ethrel at 125 ppm + proton at 50 ppm had no significant effect on the four growth parameters namely leaf area, wood ripening coefficient, cane thickness and pruning wood weight/ vine compared to the control treatment. However, these growth aspects were significantly enhanced due to supplying the vines with potassium silicate (Si) at 0.1% + Selenium (Se) at 25 ppm, Si, boric acid (B) at 0.025%, Se, garlic oil at 1.0%, onion oil at 1%, turmeric extract at 0.1 % and nitrogen (N) at 25 g/vine/year relative to the control treatment as well as ethrel and proton. Significant differences on these growth characteristics were observed among the eight treatments. Using Si + Se, Si, B, Se, garlic oil, onion oil, turmeric extract and N, in descending order had an obvious stimulation on these growth traits. Using Se+ Si was significantly superior than using B in enhancing these growth aspects. Using garlic oil significantly surpassed the application of onion oil and turmeric extract in this respect. Using Si was significantly favourable than using Se in enhancing these growth aspects. The maximum values of leaf area (1.21 & 122.7 cm²), wood ripening coefficient (0.98 & 0.96), cane thickness (1.68 & 1.68 cm) and pruning wood weight (2.92 & 2.80 kg/vine) were recorded on the vines that received three sprays of potassium silicate at 0.1 %

plus selenium at 25 ppm during both seasons respectively. Using Si alone ranked the second position in this respect. Using N at 25 g/vine/year occupied the last position. The untreated vines produced the minimum values. These results were true during both seasons.

2- Leaf chemical composition:

It is noticed from the obtained data in Tables (6 & 7) that chlorophylls a & b, total chlorophylls, total carotenoids, N, P, K and Mg in the leaves of Crimson seedless grapevines were unaffected significantly by ethrel and proton treatments. Supplying the vines with Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and nitrogen (N) was significantly promoted these leaf component's relative to the control treatment as well as ethrel and proton treatments. Using Si+ Se was significantly superior than using each alone in enhancing these chemical components. Using Si+ Se, Si and Se significantly increased these chemical components than using plant extracts. These chemical components were significantly enhanced due to using B than using plant extracts. Using N alone gave the minimum values than using Si and Se treatments as well as plant extracts. Garlic oil was favourable than using onion oil and turmeric extract. The application of turmeric extract occupied the last position in this respect among the three plant extracts. Significant differences were observed on these leaf components among B, N, Si, Se and plant extract treatments. These sprays of a mixture of Si and Se gave the maximum values of chlorophyll a (4.14 & 4.03 mg/1g FW), chlorophyll b (1.80 & 1.72 mg/1g FW), total chlorophylls (5.94 & 5.75 mg/1g FW), total carotenoids (1.60 & 1.61 mg/1g FW), N (2.43 & 2.39 %), P (0.231 & 0.240 %), K (1.80 & 1.78 %) and Mg (0.98 & 0.96 %) during the two seasons, respectively. Untreated vines produced the minimum values. These results were true during both seasons.

3- Percentage of berry setting and yield/vine:

It can be stated from the obtained data in Table (8) that berry setting % and yield expressed in weight and number of clusters/vine were unaffected significantly by ethrel and proton treatments. Treating the vines three times with Si+ Se, Si, B, Se, plant extracts (oils of garlic and onion and turmeric extract) and nitrogen (N) significantly was followed by improving berry setting% and yield/vine. The promotion was significantly related to the application of Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and N, in descending order. Using Se+ Si or Si was significantly superior than using B, plant extracts and N in this connection. Using Si+ Se was significantly preferable than using each alone in this respect Using Si+ Se, Si, Se and B were significantly

favourable than using plant extracts. The promotive effect on berry setting % and yield was attributed to using Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and N, in descending order. The best plant extracts in enhancing berry set and yield were garlic oil, onion oil and turmeric extract, in descending order. The maximum values of berry setting (**15.7 & 15.5%**) and yield expressed in weight (**10.4 & 16.2 kg**) were recorded on the vines that treated with both Si and Se together. The untreated vines produced **7.9 kg/ vine** during both seasons. The percentage of increment on the yield due to using the previous promised treatment over the check treatment reached **31.6 & 105.1%** during both season, respectively. Number of clusters/ vine in the first season of study was significantly unaffected by the present treatments. Similar trend was observed during both seasons.

4- Harvesting date:

From the obtained data in **Table (8)** date of harvesting of Crimson seedless grapevines was ranked from 3 to 27 Sept in the first season and from 6 Sept. to 3 Oct. in the second one. Great hastening on harvesting date was observed in the eleven investigated treatments compared to the control treatment. Treating the vines once with ethrel at 250 ppm, proton at 100 ppm or ethrel at 125 ppm+ proton at 50 ppm resulted in an obvious advancement in harvesting date allover all Si, Se, B, N and plant extracts treatment. The best treatment in advancing harvesting date was the application of ethrel at 125 ppm+ proton at 50 ppm, followed by ethrel at 250 ppm and using proton at 100 ppm occupied the last position among these treatments. Most B, Si, Se and plant extract treatments reached harvesting date nearly at the same date. The delay in harvesting was noticed in the vines treated with N and turmeric extract. Date of harvesting of the vines exposed to ethrel+ proton was 3 and 6 Sept. during 2015 and 2016 seasons, respectively. Vines subjected to ethrel alone at 250 ppm harvested on 10 and 14 Sept. during both seasons, respectively. Proton treatment vines harvested on 14 and 18 Sept. during 2014 and 2015 seasons, respectively. Harvesting date of N treated vines was 25 and 28 Sept. during both seasons, respectively. Vines treated with turmeric extract harvested on 25 and 27 Sept. during 2015 and 2016 seasons, respectively. The untreated vines harvested on 27 Sept. and 3 Oct. during both seasons, respectively. Vines treated with ethrel+ proton harvested earlier than the control vines with 24 and 27 days during both seasons, respectively. The same trend was noticed during both seasons.

5- Cluster weight and dimensions:

It is evident from the obtained data in **Table (9)** that weight, length and shoulder of cluster were unaffected significantly by using ethrel and/or proton relative to the control treatment. A significant promotion of these parameters was observed due to supplying the vines with Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and nitrogen (N) relative to the check treatment. The promotion effect of these treatments on clusters characteristics was significantly related to the application of Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and N, in descending order. Using Se+ Si and Si was significantly favourable than using plant extracts and B. Using B significantly was preferable than using plant extracts in this connection. Garlic oil was significantly superior than using onion oil. Turmeric extract ranked the last position among the three plant extracts. The maximum values of weight (**430 & 451g**), length (**15.67 & 15.78 cm**) and shoulder (**9.80 & 9.92 cm**) of cluster were noticed on the vines that treated with Si+ Se during both season, respectively. The lowest values were recorded in untreated vines. Similar trend was observed during both seasons.

6- Percentage of berries colouration

It is obvious from the obtained data in **Table (9)** that berries colouration % was significantly varied among the twelve treatments. It was ranged 70% in the control to 90% in the vines treated with ethrel+ proton in the first season and from 69.9% in the untreated vines to 90.9% in the vines exposed to ethrel+ proton in the second season. All treatments significantly hastened berries colouration % above the control treatment. The best treatments were the application of ethrel+ proton, ethrel, proton, Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and N, in descending order. Using Se+ Si and Si was significantly preferable than using B and plant extracts in enhancing berries colouration. Using N gave 71.0 & 70.9 berries colouration % during both seasons, respectively. The best plant extracts were oils of garlic and onion and turmeric extract, respectively. The maximum berries colouration (**90.0 & 90.9%**) was recorded on the vines that exposed to ethrel at 125 ppm+ proton at 50 ppm during both season, respectively. The lowest values (**70.0 & 69.9%**) were recorded on the vines that did not receive any treatment (control). Percentages of berries colouration in the vines exposed to ethrel at 250 ppm were **85.9 & 86.0 %** during 2015 and 2016 seasons, respectively. These results were true during both seasons.

7- Physical characteristics of the berries

It is clear from the obtained data in **Table (10)** that berry weight and dimensions were unaffected significantly with using ethrel and/or proton relative to the control treatment. Using Si+ Se, Si, B, Se,

garlic oil, onion oil, turmeric extract and nitrogen (N) had significant effect on weight, longitudinal and equatorial of berry relative to the check treatment. The promotion was significantly associated with using Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and N, in descending order. Using Si and/or Se was significantly superior than using plant extracts in improving such physical characteristics. Using B surpassed the application of plant extracts in this connection. The best results were obtained due to treating the vines with Si+ Se. The lowest values were recorded on untreated vines. Similar trend was observed during both seasons.

8- Chemical characteristics of the berries

It is clear from the obtained data in **Tables (10 & 11)** that using ethrel and/or proton Si and/or Se, oils of garlic and onion, turmeric extract, B and nitrogen (N) significantly was very effective in enhancing T.S.S%, reducing sugars%, T.S.S/acid

and total anthocyanins and reducing total acidity% relative to the check treatment.

The promotion on chemical characteristics was significantly associated with using ethrel+ proton, ethrel, proton, Si+ Se, Si, B, Se, garlic oil, onion oil, turmeric extract and N, in descending order. Using ethrel and/or proton was significantly preferable than using plant extracts, Si and/or Se, B and N in improving chemical characteristics. Using B significantly was superior than using plant extracts in this connection. Using Si and/or Se significantly enhanced chemical characteristics than using B. The maximum values of T.S.S. (23.6 & 23.8), reducing sugars (22.11 & 22.20), T.S.S (49.2 & 50.5) and total anthocyanins (44.0 & 44.9 mg/100 g/FW) and the lowest total acidity was recorded on the vines that received ethrel at 125 ppm+ proton at 50 ppm during both seasons, respectively. Unfavourable effects on chemical characteristics were recorded on untreated vines. These results were true during both seasons.

Table (5): Effect of ethrel, proton, N, potassium silicate, selenium and some plant extracts on some vegetative growth aspects of Crimson seedless grapevines during 2015 and 2016 seasons

Treatments	Leaf area (cm ²)		Wood ripening coefficient		Cane thickness (cm)		Pruning wood weight / vine (kg.)	
	2015	2016	2015	2016	2015	2016	2015	2016
Control	103.1	104.0	0.69	0.67	0.89	0.83	1.91	1.87
Ethrel at 250 ppm	103.2	104.5	0.70	0.68	0.90	0.84	1.91	1.88
Proton at 100 ppm	103.2	104.7	0.70	0.68	0.89	0.84	1.91	1.89
Ethrel at 125 ppm+ Proton at 50 ppm	103.3	105.0	0.70	0.68	0.90	0.84	1.91	1.89
N at 25 g/vine/year	105.0	106.6	0.76	0.74	1.00	0.96	2.03	1.99
K- silicate at 0.1 %	118.9	120.5	0.97	0.95	1.59	1.53	2.82	2.66
Selenium at 25 ppm	113.1	115.1	0.94	0.92	1.41	1.35	2.47	2.41
K-silicate at 0.1 %+ Selenium at 25 ppm	121.1	122.7	0.98	0.96	1.68	1.62	2.92	2.80
Turmeric extract at 0.1 %.	109.3	109.0	0.82	0.80	1.10	1.04	2.14	2.09
Garlic oil at 1 %	112.0	113.7	0.89	0.85	1.30	1.24	2.36	2.29
Onion oil at 1 %	110.0	111.6	0.88	0.85	1.20	1.14	2.25	2.19
Boric acid at 0.025 %	115.0	116.6	0.96	0.94	1.50	1.46	2.64	2.52
New L.S.D. at 5%	1.1	1.4	0.05	0.06	0.09	0.10	0.10	0.10

Table (6): Effect of ethrel, proton, N, potassium silicate, selenium and some plant extracts on some leaf pigments (mg/1g F.W) of Crimson seedless grapevines during 2015 and 2016 seasons

Treatments	Chlorophyll a (mg/1g F.W.)		Chlorophyll b (mg/1g F.W.)		Total chlorophylls (mg/1g F.W.)		Total carotenoids (mg/1g F.W.)	
	2015	2016	2015	2016	2015	2016	2015	2016
Control	3.11	3.00	1.12	1.05	4.23	4.05	1.00	1.01
Ethrel at 250 ppm	3.13	3.02	1.12	1.05	4.25	4.07	1.00	1.00
Proton at 100 ppm	3.14	3.02	1.12	1.05	4.26	4.07	0.99	1.00
Ethrel at 125 ppm+ Proton at 50 ppm	3.15	3.02	1.12	1.05	4.27	4.07	0.99	1.00
N at 25 g/vine/year	3.24	3.13	1.20	1.12	4.44	4.25	1.05	1.06
K- silicate at 0.1 %	4.00	3.89	1.69	1.62	5.69	5.51	1.51	1.52
Selenium at 25 ppm	3.74	3.63	1.53	1.47	5.27	5.10	1.33	1.34
K-silicate at 0.1 %+ Selenium at 25 ppm	4.14	4.03	1.80	1.72	5.94	5.75	1.60	1.61
Turmeric extract at 0.1 %.	3.31	3.20	1.26	1.18	4.57	4.38	1.10	1.11
Garlic oil at 1 %	3.53	3.42	1.41	1.34	4.94	4.76	1.25	1.26
Onion oil at 1 %	3.43	3.32	1.33	1.26	4.76	4.58	1.17	1.18
Boric acid at 0.025 %	3.84	3.73	1.60	1.53	5.44	5.26	1.41	1.41
New L.S.D. at 5%	0.06	0.08	0.05	0.04	0.06	0.07	0.04	0.04

Table (7): Effect of ethrel, proton, N, potassium silicate, selenium and some plant extracts on percentages of N, P, K and Mg in the leaves of Crimson seedless grapevines during 2015 and 2016 seasons

Treatments	Leaf N%		Leaf P%		Leaf K%		Leaf Mg%	
	2015	2016	2015	2016	2015	2016	2015	2016
Control	1.61	1.57	0.141	0.150	1.11	1.09	0.57	0.55
Ethrel at 250 ppm	1.60	1.59	0.142	0.150	1.12	1.10	0.58	0.55
Proton at 100 ppm	1.60	1.59	0.143	0.150	1.12	1.10	0.59	0.55
Ethrel at 125 ppm+ Proton at 50 ppm	1.60	1.60	0.143	0.150	1.13	1.10	0.60	0.55
N at 25 g/vine/year	1.70	1.66	0.151	0.160	1.17	1.17	0.62	0.60
K- silicate at 0.1 %	2.33	2.29	0.221	0.230	1.71	1.69	0.95	0.93
Selenium at 25 ppm	2.11	2.07	0.201	0.210	1.51	1.49	0.85	0.83
K-silicate at 0.1 %+ Selenium at 25 ppm	2.43	2.39	0.231	0.240	1.80	1.78	0.98	0.96
Turmeric extract at 0.1 %.	1.77	1.73	0.161	0.170	1.25	1.23	0.67	0.65
Garlic oil at 1 %	1.99	1.95	0.191	0.200	1.41	1.39	0.80	0.78
Onion oil at 1 %	1.90	1.86	0.171	0.180	1.31	1.31	0.75	0.73
Boric acid at 0.025 %	2.22	2.18	0.211	0.220	1.61	1.61	0.92	0.89
New L.S.D. at 5%	0.06	0.05	0.006	0.008	0.04	0.05	0.03	0.04

Table (8): Effect of ethrel, proton, N, potassium silicate, selenium and some plant extracts on the percentage of berry setting, yield and date of harvesting of Crimson seedless grapevines during 2015 and 2016 seasons

Treatments	Berry setting %		No. of clusters/vine		Yield/vine (kg)		Date of harvesting	
	2015	2016	2015	2016	2015	2016	2015	2016
Control	8.1	7.9	22.0	22.0	7.9	7.9	27 Sep.	3Oct.
Ethrel at 250 ppm	8.0	7.7	22.0	22.0	7.8	7.9	10 Sep.	14 Sep.
Proton at 100 ppm	8.0	7.7	22.0	22.0	7.8	7.9	14 Sep.	18 Sep.
Ethrel at 125 ppm+ Proton at 50 ppm	8.0	7.7	22.0	22.0	7.9	7.9	3 Sep.	6 Sep.
N at 25 g/vine/year	8.9	8.5	22.0	24.0	8.2	8.9	25 Sep.	28 Sep.
K- silicate at 0.1 %	15.0	13.9	23.0	35.0	10.0	15.3	21 Sep.	24 Sep.
Selenium at 25 ppm	13.1	10.9	23.0	32.0	9.6	13.3	21 Sep.	22 Sep.
K-silicate at 0.1 %+ Selenium at 25 ppm	15.7	15.5	23.0	36.0	10.4	16.2	20 Sep.	23 Sep.
Turmeric extract at 0.1 %.	9.9	9.3	23.0	26.0	8.2	10.0	25 Sep.	27 Sep.
Garlic oil at 1 %	11.9	10.7	23.0	30.0	9.3	12.2	21 Sep.	23 Sep.
Onion oil at 1 %	10.9	10.0	23.0	28.0	9.1	11.0	23 Sep.	25 Sep.
Boric acid at 0.025 %	13.9	12.3	23.0	34.0	9.8	14.5	20 Sep.	22 Sep.
New L.S.D. at 5%	0.6	0.5	NS	2.0				

Table (9): Effect of ethrel, proton, N, potassium silicate, selenium and some plant extracts on averages cluster weight and dimensions and berries colouration of Crimson seedless grapevines during 2015 and 2016 seasons.

Treatments	Av. Cluster weight (g)		Av. Cluster length (cm)		Av. Cluster shoulder (cm)		Berries colouration %	
	2015	2016	2015	2016	2015	2016	2015	2016
Control	357.1	360.0	14.71	14.80	9.11	9.20	70.0	69.9
Ethrel at 250 ppm	356.0	358.0	14.69	14.78	9.09	9.18	85.9	86.0
Proton at 100 ppm	356.0	358.0	14.68	14.77	9.07	9.16	83.3	84.0
Ethrel at 125 ppm+ Proton at 50 ppm	357.0	358.0	14.68	14.76	9.08	9.17	90.0	90.9
N at 25 g/vine/year	371.0	371.9	14.80	14.89	9.18	9.30	71.0	70.9
K- silicate at 0.1 %	436.5	437.0	15.52	15.62	9.71	9.83	80.0	79.8
Selenium at 25 ppm	416.0	417.0	15.25	15.35	9.50	9.62	78.0	77.7
K-silicate at 0.1 %+ Selenium at 25 ppm	430.0	451.0	15.67	15.78	9.80	9.92	80.6	79.9
Turmeric extract at 0.1 %.	385.0	384.0	14.91	15.01	9.26	9.38	72.5	72.3
Garlic oil at 1 %	406.0	405.0	15.25	15.35	9.41	9.53	76.0	75.9
Onion oil at 1 %	396.0	395.0	15.11	15.21	9.35	9.47	74.0	73.7
Boric acid at 0.025 %	426.0	425.0	15.40	15.51	9.59	9.72	79.0	78.9
New L.S.D. at 5%	10.0	9.3	0.09	0.10	0.05	0.06	0.5	0.6

Table (10): Effect of ethrel, proton, N, potassium silicate, selenium and some plant extracts on some physical and chemical characteristics of the berries of Crimson seedless grapevines during 2015 and 2016 seasons.

Treatments	Berry weight (g)		Berry longitudinal (cm)		Berry equatorial (cm)		T.S.S.%	
	2015	2016	2015	2016	2015	2016	2015	2016
Control	2.40	2.37	1.60	1.57	1.15	1.14	18.0	18.0
Ethrel at 250 ppm	2.39	2.36	1.59	1.56	1.14	1.13	23.0	23.4
Proton at 100 ppm	2.39	2.36	1.58	1.56	1.13	1.13	21.6	22.0
Ethrel at 125 ppm+ Proton at 50 ppm	2.38	2.35	1.58	1.56	1.13	1.14	23.6	23.8
N at 25 g/vine/year	2.51	2.50	1.68	1.65	1.21	1.22	18.4	18.5
K- silicate at 0.1 %	3.20	3.30	2.14	2.11	1.60	1.61	20.9	21.0
Selenium at 25 ppm	3.00	3.02	2.00	1.98	1.46	1.48	20.4	20.4
K-silicate at 0.1 %+ Selenium at 25 ppm	3.31	3.33	2.21	2.18	1.65	1.67	21.0	21.1
Turmeric extract at 0.1 %.	2.63	2.64	1.77	1.74	1.27	1.29	18.9	19.0
Garlic oil at 1 %	2.89	2.89	1.93	1.90	1.41	1.43	19.9	20.0
Onion oil at 1 %	2.79	2.76	1.85	1.82	1.34	1.35	19.5	19.6
Boric acid at 0.025 %	3.10	3.16	2.06	2.03	1.53	1.55	20.8	20.9
New L.S.D. at 5%	0.10	0.12	0.06	0.05	0.04	0.05	0.4	0.5

Table (11): Effect of ethrel, proton, N, potassium silicate, selenium and some plant extracts on some chemical characteristics of the berries of Crimson seedless grapevines during 2015 and 2016 seasons.

Treatments	Total acidity %		T.S.S./acid		Reducing sugars %		Total anthocyanins (mg/100g FW)	
	2015	2016	2015	2016	2015	2016	2015	2016
Control	0.719	0.725	25.0	24.8	16.81	16.90	22.9	23.0
Ethrel at 250 ppm	0.510	0.509	45.1	46.0	20.01	20.10	39.3	40.0
Proton at 100 ppm	0.540	0.530	40.0	41.5	21.51	21.70	41.9	42.0
Ethrel at 125 ppm+ Proton at 50 ppm	0.480	0.471	49.2	50.5	22.11	22.20	44.0	44.9
N at 25 g/vine/year	0.700	0.704	26.3	26.3	16.94	17.04	24.0	24.1
K- silicate at 0.1 %	0.580	0.582	36.0	36.1	18.05	18.14	35.1	35.2
Selenium at 25 ppm	0.620	0.622	32.9	32.8	17.70	17.79	31.9	32.0
K-silicate at 0.1 %+ Selenium at 25 ppm	0.560	0.561	37.5	37.6	18.20	18.29	36.9	37.0
Turmeric extract at 0.1 %.	0.681	0.680	27.8	27.9	17.15	17.23	25.5	25.6
Garlic oil at 1 %	0.641	0.639	31.0	34.3	17.50	17.60	29.0	29.0
Onion oil at 1 %	0.660	0.658	29.5	29.8	17.30	17.40	27.0	27.0
Boric acid at 0.025 %	0.603	0.601	34.5	34.8	17.90	17.99	34.0	33.9
New L.S.D. at 5%	0.016	0.015	0.8	0.7	0.11	0.09	1.1	1.3

Discussion:**1- Effect of ethrel and ABA**

The acceleration on maturation of Flame seedless grapes due to application of ethrel could be attributed to the breakdown of Ethrel to ethylene which results in activation the hydrolytic and oxidative enzymes involved in maturation, increasing the degradation of chlorophylls and promoting the biosynthesis of plant pigments namely anthocyanins and carotenoids and hastening the compartmentation. In addition, ethrel is effective in

increasing mitochondrial oxidation of malic acid (Thomas, 1979 and Dal *et al.*, 2010).

The effect of ABA in enhancing maturation of the berries might be attributed to its effect as main signal triggering the onset of the secondary metabolism in grape skine as well as enhancing the enzymes especially UPP-Glucose-Flavonic 3-O Glucose-T (Zhang *et al.*, 2009). The beneficial effects of ABA in reaching the plant tissues to senescence could give another explanation (Taiz and Zeiger, 2002).

These results are in agreement with those obtained by **Amutha and Rajendra, (2001)**; **Al-Maisary, (2002)**; **Fawzi and Abd El-Moniem, (2003)**; **Lombar *et al.*, (2004)**; **Ahmed and Zargar (2005)**; **Omar and Girgis, (2005)**; **El-Halaby (2006)** and **El-sayed (2007)** who worked on ethrel and **Amiri *et al.*, (2010)**; **Bahar *et al.*, (2012)** and **Aly (2017)** who worked on ABA.

2- Effect of silicon

Silicon, (Si) has not yet received the title of essential nutrient for higher plants, as its role in plant biology is poorly understood (**Epstein, 1999**). Beneficial effects of Si are more prominent when plants were subjected to multiple stresses including biotic and abiotic stresses (**Tahir, *et al.*, 2006**). Silicon is also known to increase drought tolerance in plants by maintaining plant water balance, photosynthetic activity, erectness of leaves and structure of xylem vessels under high transpiration rates (**Hattori *et al.*, 2005**). Silicon is responsible for improving water economy (**Gang *et al.*, 2003**). The previous authors suggested that a silicon cuticle double layer formed on leaf epidermal tissue is responsible for this higher water potential. The results of **Lux *et al.*, (2003)** suggested that Si plays an important role in water transport and root growth under drought conditions. **Yildirim *et al.*, (2002)** stated that Si inhibit powdery mildew in grapes.

These results are in harmony with those obtained by **Abd El-Hameed (2012)**; **Al-Wasfy (2014)**; **El-Khawaga (2014)**; **Uwakiem (2015)**; **Wassel *et al* (2015)**; **Nagy-Dina (2016)**; **Akl *et al* (2016)** and **Farahat *et al.*, (2017)**.

3- Effect of selenium

The beneficial effects of selenium on fruiting of Crimson grapevines might be attributed to its positive action on enhancing the tolerance of the trees to biotic and abiotic stresses and the biosynthesis of carbohydrates 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 produce more fruits (**Jakovljevic *et al.*, 2011**).

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

4- Effect of Boron

The beneficial effects of boron on stimulating vegetative growth characteristics, chlorophylls, nutrients, berry setting, yield and quality of the berries in grapevines cv. Flame seedless might be attributed to its impact on: (according to **Nijjar, 1985** and **Fraguas and Silva, 1998**).

1- Translocation and adsorption of sugars, since sugars may be moved in the form of borate complexes.

2- Activating the formation of meristems.

3- Preventing the abortion of flowers.

4- Preventing the accumulation of polyphenolic compounds.

5- Encouraging cell development and the elongation of cells through controlling of polysaccharide synthesis.

6- Controlling the formation of starch and preventing the excessive conversion of sugars into starch.

7- Encouraging root development.

8- Reducing at the lower extent the different disorders in the fruit crops.

These results are in accordance with those obtained by **Mohamed- Ebtessam (2012)**; **Gad El-Kareem and Abd El- Rahman (2013)**; **Akl *et al.*, (2014)**; **Mohamed (2014)** and **Abdelaal *et al.*, (2017)**.

5- Effect of plant extracts

Plant extracts are characterized by their higher content of organosulfur compounds, volatile components, fats, proteins, nutrients, tannins, vitamins and antioxidants (**Peter, 1999**). Therefore, these plant extracts is considered as a source of antioxidants and nutrients supplying the plants with their requirements from all antioxidants and nutrients. Their antioxidative properties appeared for preventing reactive oxygen species (**Kirtikar and Basu, 1984**; **Botelho *et al.*, 2007** and **Bhanu *et al.*, 2013**).

These results of **Irasema *et al.*, (2008)**; **El-Helw- Hanna *et al.*, (2011)**; **Larissa *et al.*, (2013)**; **Abdelaal and Aly (2013)**; **Gad El- Kareem and Abd El- Rahman (2013)**; **Melgarejo *et al.*, (2013)**; **Abada (2014)**; **Uwakiem (2014)** and **Ibrahiem (2017)** supported the present results.

6- Effect of Nitrogen

Nitrogen has important regulatory roles in building of proteins, amino acids, plant cells, enzymes, RNA. ATP, ADP, cytokinins, IAA, vitamins, antioxidants and plant pigments. It also encourages photosynthetic and cell division (**Mengel, 1984 and 1985** and **Dalbo, 1992**).

These results are in harmony with those obtained by **Abd El-Aziz (2011)**; **El-Khafagy (2013)**; **Abd El- Kareem (2014)** and **Ahmed *et al.*, (2017)**.

Conclusion:

From the obtained data, it is preferable to spray potassium silicate at 0.1% + selenium at 25 ppm three times at growth start, just after berry setting and at veraison stage for improving the yield of Crimson seedless grapevines. For improving quality

of the berries, it is suggested to spray ethrel at 125 ppm+ proton at 50 ppm once at veraison stage.

References:

1. Abada, M.A.M. (2014): A comparative study for the effect of green tea extract and some antioxidants on Thompson seedless grapevines. *International Journal of Plant & Soil Science* 3 (10): 1333-1342.
2. Abdelaal A. M.H.A. and Aly, M.M. (2013): The synergistic effects of using turmeric with some antioxidants on growth, vine nutritional status and productivity of Ruby seedless grapevines. *Hort. Science Journal of Suez Canal Univ. Vol. 1:* 305-308.
3. Abdelaal, A. H. M.; Abada, M. A. M. and Abd El-Rahman, M. A. Kh (2017): Response of Flame seedless grapevines to spraying boron and moringa extract. *Proc. Of 7th Inter. Conf. for Sustainable Agric. Develop.* 6-8 March 1-14.
4. Abd El- Aziz, Y. Z. (2011): Response of Thompson seedless grapevines to application of organic fertilizer humic acid and some biofertilizers. *Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.*
5. Abd El-Hameed, H.M. (2012): Using silicon, boron and folic acid to promote yield quantitatively and qualitatively of Early superior grapevines. *Minia J. of Agric. Res. & Develop. Vol. (32) No. 5:* 869-886.
6. Abd El- Kareem, A.M. (2014): The beneficial effects of biofertilization and weed control on fruiting of Superior seedless grapevines. *Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.*
7. Ahmed, F. F. and Morsy, M. H. (1999): A new method for measuring leaf area in different fruit crops. *Minia of Agric. Res. & Develop. Vol. (19) pp.* 97-105.
8. Ahmed, M.F. and Zargar, G.H. (2005): Effect of trunk girdling, flower thinning, GA3 and Ethephon application on quality characteristics in grape cv. Perlette under temperate Kashmir valley conditions. *Indian J. Hort.* 62:285-287.
9. Ahmed F. F.; Abdelaal, A. H. M.; El- Masry, S. M. A. and Ahmed, A. H. R. (2017): Effect of humic and fulvic acids, EM and amino acids on berries colouration, yield and quality of Flame seedless grapes. *Assuit J. Agric. Sci.* (48) No. (2): 88-103.
10. 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).
11. Akl A.M.M; Mohamed, M.A.; El- Sayed, M.A. and Moustafa, M.M.H. (2016): Behaviour of Superior grapevines to spraying silicon. *J. Biol. Chem. Environ. Sc.* 11 (3): 403- 412.
12. Al-Maisary, M.A.S. (2002): The effect of girdling and ethephon treatments on ripening and yield criteria for grapes Shadaa Soda and Yakooty. *M.Sc. Thesis Fac of Agric. Baghdad Univ. Iraqi.*
13. Al-Wasfy, M.M. (2014): The synergistic effects of using silicon with some vitamin on growth and fruiting of Flame seedless grapevines. *Stem Cell* 5 (1): 8-13.
14. Aly, Kh, A. M. (2017): Attempts for relaying problem for cluster colouration of Flame seedless grapevines grown under Upper Egypt climatic conditions. *M. Sc. Thesis Fac. Of Agric. Minia Univ. Egypt.*
15. Amiri, M.E., Fallahi, E. and Parseh, SH. (2010): Application of ethephon and ABA at 40% veraison advanced maturity and quality of 'Beidaneh ghermez' grape. *Acta Hort. (ISHS)* 884:371-377.
16. Amutha R. and Rajendran, N. C. (2001): Effect of growth regulating chemicals on yield and quality of Thompson seedlings grapes. *Res. on Crops.* 2(3): 332-337.
17. Association of Official Agricultural Chemists (2000): *Official Methods of Analysis of A.O.A.C. international 17th ed.* Published by O.A.C. international U.S.A.
18. Bahar, A., Kaplunov, T., Zutahy, Y., Daus, A., Lurie, S. and Lichter, A., (2012): Auto - fluorescence for analysis of ripening in Thompson Seedless and colour in Crimson Seedless table grapes. *Australian Journal of Grape and Wine Research*, 18(3), pp.353-359.
19. Bhanu, P.; Priyanka S.; Shilpec, Y.; Singh, S.C. and Dubey, N.K. (2013): Safety profile assessment and efficacy of chemically characterized Cinnamomum glaucens essential oil against storage fungi, insect, aflatoxin secretion and as antioxidant. *Food Chemical Toxicology*, 43: 446-475.
20. Blevius, D.G. and Lukaszewski, K.M. (1998): Boron in plant structure and function. *Anna. Plant physio. Plant Mol. Biol.* 49: 481.
21. Botelho, R.V.; Pavanello, A.P.; Pircs, E.J.P.; Terra, M.M. and Muller, M.M.L. (2007): Effects of chilling and garlic extract on bud dormancy release in Caberne Sauvignon grapevine cuttings. *Amer. J. of Enology and Vitic*, 58 (3): 402-404.
22. Bouard, J. (1966): *Recharches, physiologiques sur la vigen at en particulier sur laoudment des*

- serments. Thesis Sci. Nat. Bardeux France, p.34.
23. Cottenie, A.; Verloo, M.; Velghe, M. and Camerlynck, R. (1982): Chemical Analysis of Plant and Soil. Ghent, Belgium, Laboratory of Analytical and Agro- chemistry. State Univ. pp. 200-210.
 24. Dal Ri, A., Pilati, S., Velasco, R., Moser, C., Costa, G. and Boschetti, A. (2010): Ethylene production during grape berry development and expression of genes involved in ethylene biosynthesis and response. *Acta Hort.* 884, 73-80.
 25. Dalbo, M. A. (1992): Nutrition and fertilization of grapevines. *Agrapecuaria Catarinenses* 5 (4): 32 - 35, Brazil.
 26. El - Halaby, E. H. S. (2006): Trials for producing early with high quality "Superior grapes". M.Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
 27. El- Helw- Hanna; Gehan H. Sabry and Ansam S. Abd El-Rahman (2011): A study on using jasmine oil as a breaking bud dormancy for Flame Seedless grapevines. *Report and Opinion*, 3(2): 48-56.
 28. El- Kady- Hanaa, F.M. (2011): Productive performance of Thompson seedless grapevine in relation to application of some antioxidants, magnesium and boron. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
 29. El-Khafagy, H. A. E. (2013): Physiological study on productivity and quality of some grape varieties under bio- organic fertilization. Ph. D. Thesis, Environmental Studies & Res. Institut., Minufiya Univ.
 30. El-Khawaga, A.S. (2014): Impact of vitamins B and C, glutamic acid and silicon on fruiting of Superior grapevines. *World Rural Observations*. 6 (4): 57-62.
 31. El-Sayed- A.A.M.S. (2007): Response of Flame seedless grapes to some improving treatments under Assuit Environments. M. Sc. Thesis Fac. of Agric. Assiut Univ. Egypt.
 32. Epstein, E. (1999): Silicon. *Annl. Rev. Plant. Physiol. Plant Mol-Bio.* 50:641-664.
 33. Farahat, I.A.M. (2017): Studies on pruning and fertilization of early and sweet grapevines growing under Minia Region condition. Ph.D. Thesis Fac. of Agric. Minia Univ., Egypt.
 34. Fawzi, M.I.F. and Abd El-Moniem, E.I. (2003): Effect of girdling alone or combined with flower cluster and Ethepon application on fruit set, yield and quality of Black Monukka grapes. *J. Agril. Sci.*, 11:733-750.
 35. Fraguas, J.C. and Silvo, U.J. (1998): Nutrition of grapevines in tropical regions. In *tropical regions. Inform Agropccuiario*, 19 (194): 70-75.
 36. Fulcki, T. and Francis, F.J. (1968): Quantitative methods for anthocyanins. I Extraction and determination for total anthocyanins in cranberries. *J. Food Sci.* 33:72-77.
 37. Gad El-Kareem, R.M. and Abd El- Rahman, A.M.M. (2013): Response of Ruby seedless grapevines to foliar application of seaweed extract, salicylic acid and roselle extract. *Hort. science Journal of Suez Canal Univ.* Vol. 1: 294-303.
 38. Gang, H.J.K.; Chen, K.M.; Chen, G.C.; Wan, S.M. and Zhang, C.L. (2003): Effect of silicon on growth of wheat under drought. *H. Plant. Nutr.* 26(5):1055-1063.
 39. Geny, L., Saucier, C., Deytieux, C. and Esteve, K., (2006): Influence of abscisic acid in triggering "veraison" in grape berry skins of *Vitis vinifera* L. cv. Cabernet-Sauvignon. *Journal international des sciences de la vigne et du vin= International journal of vine and wine sciences*, 40 (1), pp.7- 14.
 40. Gomez, K.A. and Gomez, A.A. (1984): *Statistical Procedures for Agriculture Research*, (the 2nd ed.) published by John Wiley and Sons, New York USA, p.10-20.
 41. Hattori, T; Inanaga, S.; araki, H.; An, P.; Martia, S.; Luxova, M. and Lux, A. (2005): Application of silicon enhanced drought tolerance in Sorgham bicolor. *Physiologia Plantarum*, 123:459-466.
 42. Hiscox, A. and Isralstam B. (1979): Method for the extraction of chlorophyll from leaf tissue without maceration. *Can. J. Bot.* 57:1332-1334.
 43. Ibrahiem, H.I.M. and Al- Wasfy, M.M. (2014): The promotive impact of using silicon and selenium with potassium and boron on fruiting of Valencia orange trees grown under Minia region conditions. *World Rural Observations*, 6 (2):28-36.
 44. Ibrahiem, R. H. (2017): Behaviour of Superior grapevines to applications of some plant extracts via leaves. M.Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
 45. Irasema Vargas-Arispmo, Consuelo Corrales-Maldonado and Miguel Angel Martincz -Tellez (2008): Compounds Derived From Garlic As Bud Induction Agents In Organic Farming Of Table Grape. *Chilean J. Agric. Res.* 68(1): 94-101.
 46. Jakovljevic, M.; Licina, V.; Antic- Mladenov, S. and Velickovic, M. (2011): The effects of selenium application on replant soil and its

- content in apple leaves and fruits. Acta Hort. 477: IV Inter. Sym. On Replant Proplems P.1.
47. Kirtikar, K.P. and Basu, B.D. (1984): Indian medicinal Plants. Vol. IV Bishen Singh and Mohendropal Sing. Dehre Dun pp. 2417- 2426,
 48. Koyama, K., Sadamatsu, K., and Gotoyamamoto, N. (2010): Abscisic acid stimulated ripening and gene expression in berry skins of the Cabernet Sauvignon grape. *Functional & Integrative Genomics*, 10 (3), 367-381.
 49. Lane, J. H. and Eynon, L. (1965): Determination of reducing sugars by means of Fehling's solution with methylene blue as indicator. A.O.A.C. Washington D.C. U.S.A. pp. 490 – 510.
 50. Larissa Lima de Sousa; Sonalle Carolina Albuquerque de Andrade; Ana Julia Alves Aguiar Athayde; Carlos Eduardo Vasconcelos de Oliveira; Camila Verissimo de Sales; Marta Suely Madruga; and Evandro Leite de Souza (2013): Efficacy of *Origanum vulgare* L. and *Rosmannns officinalis* L. Essential oils in combination to control postharvest pathogenic Aspergilli and autochthonous mycoflora in *Vitis lahrusca* L. (table grapes). *International Journal of Food Microbiology*, 165: 312-318.
 51. Lombard, P.J.; Viljoen, J.A.; Wolf, E.E.H. and Colitz, F.J. (2004): The effect of Ethephon on the berry colour of Flame seedless and Bonheur table grapes. *South African J. of Enology and Vitic* 25(1): 1-12.
 52. Lux, A.; Luxova, M.; Abe, J. Tanmoto, E. and Inanaga, S. (2003): The dynamic of silicon deposition in the sorghum root endodermis. *New Physiol.* 158:437-441.
 53. Marschner, H. (1995): Mineral Nutrition of higher plants. 2nd Ed. Academic Press, London, p. 10- 20.
 54. Masoud, S. E. Y. (2017): Response of Superior grapevines grown under sandy soil to foliar application of silicon and selenium. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
 55. Mead, R.; Currow, R. N. and Harted, A. M. (1993): Statistical Methods in Agricultural and Experimental Biology. Second Ed. Chapman & Hall London. pp 10 – 20.
 56. Melgarejo, B.G.; Ortega-Ramirez, L.A.; Siva Espinoza, B.A.; Gonalez-Aguilar, G.A.; Miranda, M.R.A. and Ayala-Zavala, J.F. (2013): Antifungal protection and antioxidant enhancement of table grapes treated with emulsions, vapors and coatings of cinnamon leaf oil. *Post Harvest Biology Technology*, 86: 321- 328.
 57. Mengel, K. (1984): Nutrition and Metabolism of Plants. Fisher Verlage Stuttgart and New York. pp 100-140.
 58. Mengel, K.E.; Kirkbt, A.; Koesgarten, H. and Appel. T. (2001): principles of plant nutrition 5th El- Kluwer Academic publishers, Dordrecht p. 1-311.
 59. Mohamed- Ebtasam, S.E. (2012): Response of Banaty grapevine to some ethrel, nutrient and antioxidant treatments, Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
 60. Mohamed, T.M.M. (2014): Relation of fruiting in Superior grapevines with spraying salicylic acids and boron. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
 61. Mnayer, D., Fabiano-Tixier, A. S., Petitcolas, E., Hamieh, T., Nehme, N., Ferrant, C., Fernandez, X and Chemat, F. (2014): Chemical composition, antibacterial and antioxidant activities of six essentials oils from the Alliaceae Family. *Molecules*, 19 (12), 20034-20053.
 62. Nagy-Dina, A.M. (2016): Response of Flame seedless grapevines to spraying silicon. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
 63. Nijjar, G. S. (1985): Nutrition of Fruit Trees. Mrs Usah Raj. Kumar, for Kalyani Publishers, New Delhi India, pp. 283 – 302.
 64. Omar, A.H. and Girgis, V.H. (2005): Some treatments affecting fruit quality of Crimson seedless grapevines. *J. of Agric. Sc. Mansoura Univ.* 30 (8): 4665-4673.
 65. Peach, K. and Tracey, I.M.V. (1968): Modern Methods of Plant Analysis, Vol. 11 p. 36-38. Inter Sci. New York.
 66. Peter, K.V. (1999): Information on turmeric and ginger. *Indian species* 6 (2 & 3): 12-1 4.
 67. Piper, C.S. (1950): Soil and Plant Analysis. Inter Science- New York pp. 48-110.
 68. Rangaswamy R (1995): Randomized Complete Block Design. In: A Text Book of Agricultural Statistics. New Age International Publishers, pp 281-309.
 69. Rao, G. N. (2007): Statistics for Agricultural Sciences. BS Publications.
 70. Shiyu, L., Yuan, W., Deng, G., Wang, Ping., Yang, P., Aggarwal, B. (2011): Chemical composition and product quality control of turmeric (*Curcuma longa* L.). Stephen F Austin State Univ. SFA Sholarworks.
 71. Snedecor, G.A.V. and Cochran, G. W. (1980): Statistical methods. 7th ED. Iowa State Univ. Press. Ames, Iowa, U. S. A 507.
 72. Strydom, J. (2014): The effect of foliar Ethephon and ABA in combination with a leonardite fertigation product on flame seedless

- grape quality. S. Afr. J. Enol. Vitic. 35 (2), pp.283-291.
73. Summer, M.E. (1985): Diagnosis and Recommendation Integrated System (DRIS) as a guide to orchard fertilization. Hort. Abst. 55 (88): 7502.
 74. Tahir, M.A.; Rahmatullah, A.; aziz, T.; Ashraf, M.; Kanwal, S. and Magsood, A. (2006): Beneficial effects of silicon in wheat (*Triticum aestivum* E.) under salinity stress. Pak. J. Bot. 38 (5):1715-1727.
 75. Taiz, A. and Zeiger, M. (2002): Plant Physiology, third Ed. 306 p. Academic press, London, pp. 100-120.
 76. Thomas, C.M. (1979): Biochemistry and Physiology of Plant Hormones Springer Verlage Inc. New York. pp 90-142.
 77. Uwakiem, M. Kh. (2014): The synergistic effect of spraying some plant extracts with some macro and micro nutrients of Thompson seedless grapevines. International Journal of Plant & Soil Science, 3 (10): 1290-1301.
 78. Uwakiem, M. Kh. (2015): Effect of spraying silicon, selenium and humic acid on fruiting of early sweet grapevines. The 2nd Inter. Conf. on Hort. Crops. 15-18 March. Egypt. J. Hort. 42 (1): pp:333-343.
 79. Von-Wettstein, D.V. (1957): Chlorophyll latele ubder submikro skopiche formwechsel der plastids. Experimental cell Res. 12: 427-433.
 80. Wassel, A.M.M.; Abdelaziz, F.H.; Aly-Mervat, A. and Mohamed-Attia, A.M. (2015): Trials for Alleviating the Adverse Effects of Salinity on Some Grapevine Cvs. World Rural Observations. 7 (4): 14-21.
 81. Yildirim, A.; Onoguv, E. and Irshad, M. (2002): Investigations on the efficiency of some natural chemicals against powdery mildew (*Ucinula nector*, (schw, Burr) of grape. J. Phytopathol. 150:697-702.
 82. Zhang, M., Yuan, B., and Leng, P. (2009): The role of ABA in triggering ethylene biosynthesis and ripening of tomato fruit. Journal of Experimental Botany, 60 (6), 1579-1588.

12/20/2017