

## Response of Superior Grapevines To Spraying Salicylic And Boric Acids

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**Abstract:** During 2013 & 2014 seasons, Superior grapevines treated via leaves with salicylic acid at 50 to 200 ppm and / or boric acid at 0.025 to 0.1% three times. Results showed that spraying salicylic acid at 50 to 200 ppm and/ or boric acid at 0.025 to 0.1% three times was very effective in enhancing percentages of N, P, K and Mg in the leaves, berry setting %; yield, cluster weight, berry weight, T.S.S. %, T.S.S./ acid and reducing sugars and decreasing shot berries and total acidity over the check treatment. The effect was materially associated with increasing concentrations of each compound. No measurable effect was detected among the two higher concentrations of each compound on the studied parameters. Carrying out three sprays of a mixture containing salicylic acid at 100 ppm and boric acid at 0.05% gave the best results with regard to yield and berries quality of Superior grapevines grown under Minia region.

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### 1. Introduction

Recently, more studies were carried out for finding out unconventional tools for improving yield and tools for fruit quality of Superior grapevines. Out of those studies was using salicylic acid. Previous studies showed that salicylic acid is essential in protecting plant cells from senescences as well as enhancing cell division and the tolerance of plant to abiotic stress (**Gunes *et al.*, 2007 and Joseph *et al.*, 2010**).

Application of boron has many important functions in fruit trees. It is important in enhancing cell division, the uptake of nutrients, pollen germination, biosynthesis of IAA as well as building and translocation of sugars (**Adriano, 1985; Marschiner, 1995 and Fraguas and Silva, 1998**).

Vine nutritional status, yield and quality of the berries in different grapevine cvs were positively affected by spraying salicylic acid (**Abd El- Kareem, 2009; Ahmed *et al.*, 2010; El-Hanafy, 2011 and Ahmed *et al.*, 2014**) and boric acid (**Farahat, 2008; El- Sawy, 2009; Abd El- Wahab, 2010; Ahmed *et al.*, 2011a and 2011b, El- Kady- Hanaa, 2011 and Abdelaal, 2012**).

The merit of this study was elucidating the effect of single and combined applications of salicylic acid and boron on fruiting of Superior grapevines grown under Minia region.

### 2. Material and Methods

This study was carried out during two consecutive seasons 2013 and 2014 on forty- eight uniform in vigour of 6 years- old Superior grapevines. The selected vines are grown in a private vineyard located

at Kom Waly village, Matay district, Minia Governorate where the texture of the soil is clay (Table 2) . Soil analysis was done according to the procedures that outlined by **Wilde *et al.*, (1985)**.

The selected vines are planted at 2 x 3 meters apart. The chosen vines were trained by cane system leaving 72 eyes/ vine (six fruiting canes x 10 eyes plus six renewal spurs x two eyes) using Gable supporting method. Winter pruning was conducted at the middle of Jan. during both seasons. Surface irrigation system was followed using Nile water.

**Table (1): Analysis of the tested soil**

Constituent	Values
Sand %	7.0
Silt %	14.5
Clay %	78.5
Texture	Clay
O.M. %	2.50
pH ( 1 : 2.5 extract)	7.96
EC ( 1 :2.5 extract) (mmhos/cm/25°C)	0.95
CaCO <sub>3</sub> %	1.25
Total N %	0.13
Available P ( ppm)	5.0
Available K (ppm)	450

This experiment included sixteen treatments from two factors (A & B). The first factor (A) consisted from four concentrations of salicylic acid namely 0.0, 50 , 100 and 200 ppm while the second factor (B) comprised from four concentrations of boric acid namely 0.0 , 0.025 , 0.05 and 0.1%.

Each treatment was replicated three times, one vine per each. Both salicylic and boric acids were sprayed three times at growth start (mid. of Feb.), just after berry setting (mid. of April) and at one month later (mid. of May). Salicylic acid was solubilized in few drops of Ethyl alcohol before application Triton B as a wetting agent was added to all salicylic and boric acid before application. Spraying was done till runoff (2 L./ vine).

Randomized complete block design in split plot arrangement was followed. The four concentrations of salicylic acid and boric acid occupied the main and subplots, respectively

During both seasons, the following measurement were recorded, percentages of N, P, K and Mg (**Wilde et al., 1985**), berry setting %, yield expressed in weight (kg.) and number of clusters / vine, cluster weight (g.), shot berries %, berry weight (g.) , T.S.S. % , total acidity % as a g tartaric acid / 100 ml juice (**A.O.A.C., 2000**), T.S.S. / acid and reducing sugars (**A.O.A.C., 2000**).

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

### 3. Results and discussion

#### a) Results

##### 1-Percentages of N, P, K and Mg in the leaves.

Data in Tables (2 & 3) clearly show that spraying salicylic acid at 50 to 200 ppm and/ or boric acid at 0.025 to 0.1% three times significantly was accompanied with enhancing N, P, K and Mg in the leaves over the check treatment. The promotion was associated with increasing concentration of both salicylic acid from 0.0 to 200 ppm and boric acid from 0.0 to 0.1 %. Meaningless promotion on these nutrients was observed with increasing concentrations of salicylic acid from 100 to 200 ppm and boric acid from 0.05 to 0.1%. Combined application of salicylic acid at 200 ppm and boric acid at 0.1% gave the maximum values . These results were true during both seasons.

##### 2- Percentage of berry setting , yield and cluster weight

Data in Tables (4 & 5) clearly show that single and combined applications of salicylic acid at 50 to 200 ppm and boric acid at 0.025 to 0.1% was very effective in improving berry setting %, yield and cluster weight relatively to the check treatment. The promotion on these parameters was in proportional to the increase in concentrations of both salicylic acid and boric acid. Significant differences on these characters were observed between all concentrations of both materials except among the two higher concentrations of salicylic acid (100 & 200 ppm) and boric acid (0.05 & 0.1%). Therefore, from economical point of view the best treatment with regard to yield consisted from the application of salicylic acid at 100 ppm in combined

with boric acid at 0.05% three times. Yield under such promised treatment reached 9.0 and 12.0 kg compared with the yield of the control / vines that reached 6.7 & 7.0 kg during both seasons, respectively. The studied treatments had no – significant effect on the number of clusters / vine in the first season of study. Similar results were announced during 2013 & 2014 seasons.

##### 3- Percentage of shot berries

It is obvious from the data in Table (6) that shot berries % was significantly controlled with using salicylic acid at 50 to 200 ppm and boric acid at 0.025 to 0.1% either applied singly or in combinations comparing with the check treatment. There was a gradual reduction on the percentage of shot berries with increasing concentration of each material. Neglection reduction on shot berries was observed with increasing concentrations of salicylic acid from 100 to 200 ppm and boric acid from 0.05 to 0.01 %. The maximum values were recorded on the vines that received three sprays of a mixture containing salicylic acid at 200 ppm plus boric acid at 0.1 % . The minimum values were observed on untreated vines. These results were true during both seasons.

##### 4- Quality of the berries

As shown in Tables ( 6 to 8), quality of the berries in Superior grapevines was significantly improved in response to spraying salicylic acid at 50 to 200 ppm and/ or boric acid at 0.025 to 0.1% in terms of increasing berry weight, T.S.S. %, T.S.S./ acid and reducing sugars % and decreasing total acidity % rather than non- application . The promotion on quality of the berries was related to the increase in concentrations of both salicylic acid and boric acid. Negligible promotion was observed with increasing concentrations of salicylic acid from 100 to 200 ppm and boric acid from 0.05 to 0.1%. The best results from economical point of view were obtained with treating the vines three times with a mixture of salicylic acid at 100 ppm and boric acid at 0.05% . These results were true during both seasons.

### 4. Discussion

The previous positive action of salicylic acid on growth and fruiting of Superior grapevines might be attributed to its effect in enhancing H<sub>2</sub>O<sub>2</sub>, the biosynthesis of carbohydrates and ABA and cytokinins, cell division and the tolerance of trees to abiotic stress. Previous studies showed that salicylic acid is responsible for reducing catalase activity and free radicals (**Gunes et al., 2007 and Joseph et al., 2010**).

These results are in harmony with those obtained by **Abd El Kareem (2009); Ahmed et al., (2010); El-Hanafy (2011) and Ahmed et al., (2014)** on different grapevine cvs.

The beneficial effects of boron on growth and fruiting of Superior grapevines might be attributed to

its essential roles in enhancing translocation and adsorption of sugars, cell division, uptake of water, root development, fertilization of flowers, pollen germination and reducing various disorders (Adriano, 1985; Marschiner, 1995 and Fraguas and Silva, 1998).

These results are in agreement with those obtained by Farhat (2008); El-Sawy (2009); Abd El-Wahab (2010); El-Kady-Hanaa (2011); Ahmed *et al.*, (2011a) and Abdelaal (2012) in different grapevine cvs.

**Table (2): Effect of single and combined applications of salicylic acid and boric acid on the percentages of N and P in the leaves of Superior grapevines during 2013 & 2014 seasons.**

Salicylic acid conc. (A)	Leaf N %										Leaf P %									
	2013					2014					2013					2014				
	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)
a <sub>1</sub> 0.0 ppm	1.61	1.71	1.82	1.83	1.74	1.59	1.69	1.79	1.80	1.72	0.19	0.23	0.27	0.28	0.24	0.18	0.22	0.26	0.27	0.23
a <sub>2</sub> 50 ppm	1.71	1.82	1.91	1.92	1.59	1.69	1.79	1.89	1.90	1.82	0.22	0.26	0.31	0.32	0.28	0.21	0.25	0.30	0.31	0.27
a <sub>3</sub> 100 ppm	1.81	1.94	2.06	2.07	1.97	1.81	1.91	2.00	2.01	1.93	0.26	0.30	0.33	0.34	0.31	0.24	0.28	0.31	0.32	0.29
a <sub>4</sub> 200 ppm	1.82	1.95	2.07	2.08	1.98	1.82	1.92	2.00	2.02	1.94	0.27	0.31	0.34	0.35	0.32	0.25	0.29	0.32	0.33	0.30
Mean (B)	1.74	1.86	1.97	1.98		1.73	1.83	1.92	1.93		0.24	0.28	0.31	0.32		0.22	0.26	0.30	0.31	
New L.S.D. at 5%	A B AB					A B AB					A B AB					A B AB				
	0.05 0.06 0.12					0.06 0.06 0.12					0.03 0.03 0.06					0.03 0.02 0.04				

**Table (3): Effect of single and combined applications of salicylic acid and boric acid on the percentages of K and Mg in the leaves of Superior grapevines during 2013 & 2014 seasons.**

Salicylic acid conc. (A)	Leaf K %										Leaf Mg %									
	2013					2014					2013					2014				
	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)
a <sub>1</sub> 0.0 ppm	1.41	1.51	1.61	1.62	1.54	1.49	1.60	1.71	1.72	1.63	0.33	0.40	0.48	0.49	0.43	0.29	0.39	0.45	0.46	0.40
a <sub>2</sub> 50 ppm	1.51	1.61	1.71	1.72	1.64	1.59	1.70	1.81	1.82	1.73	0.40	0.47	0.54	0.55	0.49	0.41	0.51	0.61	0.62	0.54
a <sub>3</sub> 100 ppm	1.59	1.69	1.79	1.80	1.72	1.70	1.80	1.90	1.92	1.83	0.48	0.59	0.69	0.70	0.62	0.50	0.61	0.71	0.72	0.64
a <sub>4</sub> 200 ppm	1.60	1.70	1.80	1.81	1.73	1.71	1.81	1.91	1.93	1.84	0.50	0.60	0.70	0.71	0.63	0.51	0.61	0.72	0.74	0.65
Mean (B)	1.53	1.63	1.73	1.74		1.62	1.73	1.83	1.85		0.43	0.52	0.60	0.60		0.43	0.53	0.62	0.64	
New L.S.D. at 5%	A B AB					A B AB					A B AB					A B AB				
	0.06 0.06 0.12					0.06 0.06 0.12					0.03 0.03 0.06					0.04 0.03 0.06				

**Table (4): Effect of single and combined applications of salicylic acid and boric acid on the percentage of berry setting and number of clusters / vine of Superior grapevines during 2013 & 2014 seasons.**

Salicylic acid conc. (A)	Berry setting %										Number of clusters / vine									
	2013					2014					2013					2014				
	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)
a <sub>1</sub> 0.0 ppm	8.0	8.6	9.4	9.5	8.9	8.1	8.7	9.5	9.6	9.0	19.0	19.0	20.0	20.0	19.5	20.0	22.0	24.0	24.0	22.5
a <sub>2</sub> 50 ppm	8.6	9.9	11.0	11.1	10.2	8.7	10.1	11.0	11.1	10.2	19.0	20.0	20.0	20.0	19.8	22.0	24.0	26.0	26.0	24.5
a <sub>3</sub> 100 ppm	9.1	11.1	12.1	12.1	11.1	9.2	11.2	12.1	12.2	11.2	19.0	20.0	20.0	20.0	19.8	24.0	26.0	28.0	28.0	26.5
a <sub>4</sub> 200 ppm	9.2	11.2	12.1	12.1	11.2	9.2	11.2	12.1	12.2	11.2	19.0	20.0	20.0	20.0	19.8	24.0	26.0	28	28.0	26.5
Mean (B)	8.7	10.2	11.2	11.2		8.8	10.3	11.2	11.3		19.0	19.0	19.8	20.0		22.0	24.5	26.5	26.5	
New L.S.D. at 5%	A B AB					A B AB					A B AB					A B AB				
	0.3 0.3 0.6					0.4 0.4 0.8					NS NS NS					1.7 1.8 3.6				

**Table (5): Effect of single and combined applications of salicylic acid and boric acid on the yield per vine (kg.) and average cluster weight (g.) of Superior grapevines during 2013 & 2014 seasons.**

Salicylic acid conc. (A)	Yield / vine (kg.)										Av. cluster weight (g.)									
	2013					2014					2013					2014				
	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)
a <sub>1</sub> 0.0 ppm	6.7	7.1	7.9	7.9	7.4	7.0	8.2	9.4	9.4	8.5	355.0	375.0	395.0	397.0	381	350.0	371.0	391.0	392.0	376
a <sub>2</sub> 50 ppm	7.1	7.9	8.3	8.3	7.9	8.2	9.5	10.8	10.8	9.8	375.0	396.0	415.0	416.0	401	371.0	395	415.0	416.0	399
a <sub>3</sub> 100 ppm	7.5	8.5	9.0	9.0	8.5	9.4	11.1	12.6	12.6	11.4	395.0	425.0	450.0	451.0	430	391.0	425	450.0	451.0	429
a <sub>4</sub> 200 ppm	7.5	8.5	9.0	9.0	8.5	9.4	11.1	12.6	12.7	11.5	397.0	426.0	451.0	452.0	432	392.0	426	451	452.0	430
Mean (B)	7.2	8.0	8.6	8.6		8.5	10.0	11.4	11.4		380.5	405.5	428	429.0		376	404	427	428	
New L.S.D. at 5%	A B AB					A B AB					A B AB					A B AB				
	0.4 0.4 0.8					0.4 0.5 1.0					15.0 16.0 32.0					16.0 16.5 33.0				

**Table (6): Effect of single and combined applications of salicylic acid and boric acid on the percentage of shot berries and average berry weight (g.) of Superior grapevines during 2013 & 2014 seasons.**

Salicylic acid conc. (A)	Shot berries %										Av. berry weight (g.)									
	2013					2014					2013					2014				
	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)
a <sub>1</sub> 0.0 ppm	8.0	6.0	4.8	4.6	5.9	7.8	6.0	4.5	4.4	5.7	3.50	3.71	3.99	4.00	3.80	3.61	3.81	4.00	4.01	3.86
a <sub>2</sub> 50 ppm	6.4	5.0	4.4	4.3	5.0	6.3	4.9	4.3	4.2	5.0	3.72	4.11	4.50	4.51	4.28	3.71	4.11	4.50	4.51	4.21
a <sub>3</sub> 100 ppm	5.5	4.0	3.5	3.4	4.1	5.4	3.9	3.3	3.2	4.0	3.92	4.31	4.61	4.62	4.37	3.95	4.41	4.71	4.72	4.45
a <sub>4</sub> 200 ppm	5.4	3.9	3.4	3.3	4	5.3	3.8	3.3	3.1	3.9	3.94	4.32	4.62	4.63	4.38	3.96	4.42	4.72	4.73	4.46
Mean (B)	6.3	4.7	4.0	3.9		6.2	4.7	3.9	3.7		3.77	4.11	4.43	4.44		3.81	4.15	4.48	4.49	
New L.S.D. at 5%	A B AB					A B AB					A B AB					A B AB				
	0.4 0.4 0.8					0.4 0.5 1.0					0.05 0.06 0.12					0.05 0.05 0.10				

**Table (7): Effect of single and combined applications of salicylic acid and boric acid on the percentages of total soluble solids and total acidity in the berries of Superior grapevines during 2013 & 2014 seasons.**

Salicylic acid conc. (A)	T.S.S. %										Total acidity %									
	2013					2014					2013					2014				
	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)
a <sub>1</sub> 0.0 ppm	18.0	18.5	18.8	18.9	18.6	18.2	18.6	18.9	19.0	18.7	0.710	0.600	0.550	0.549	0.602	0.727	0.600	0.551	0.550	0.607
a <sub>2</sub> 50 ppm	18.4	19.0	19.4	19.5	19.1	18.9	19.2	19.5	19.6	18.3	0.671	0.550	0.500	0.499	0.555	0.660	0.551	0.500	0.408	0.552
a <sub>3</sub> 100 ppm	19.0	19.5	20.0	20.1	19.7	19.5	20.0	20.9	21.0	20.4	0.600	0.500	0.450	0.448	0.500	0.550	0.500	0.450	0.446	0.487
a <sub>4</sub> 200 ppm	19.1	19.5	20.0	20.2	19.7	19.6	20.0	21.0	21.0	20.4	0.599	0.500	0.449	0.447	0.499	0.540	0.500	0.450	0.445	0.486
Mean (B)	18.6	19.2	19.6	19.7		19.1	19.5	20.1	20.2		0.645	0.538	0.487	0.486		0.622	0.538	0.488	0.485	
New L.S.D. at 5%	A B AB					A B AB					A B AB					A B AB				
	0.3 0.3 0.6					0.3 0.3 0.6					0.019 0.020 0.040					0.020 0.020 0.040				

**Table (8): Effect of single and combined applications of salicylic acid and boric acid on T.S.S./ acid and percentage of reducing sugars in the berries of Superior grapevines during 2013 & 2014 seasons.**

Salicylic acid conc. (A)	T.S.S./ acid										Reducing sugars %									
	2013					2014					2013					2014				
	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	Main (A)
a <sub>1</sub> 0.0 ppm	25.4	30.8	34.2	34.4	31.2	25.0	31.0	34.3	34.5	31.2	16.1	16.6	17.1	17.2	16.8	16.0	16.7	17.1	17.1	16.8
a <sub>2</sub> 50 ppm	27.4	34.5	38.5	39.1	35.0	28.6	34.8	39.0	39.4	35.5	16.5	17.1	17.5	17.6	17.2	16.6	17.1	17.7	17.7	17.3
a <sub>3</sub> 100 ppm	31.7	39.0	44.4	44.9	40.0	35.5	40.0	46.4	47.1	42.3	16.9	17.5	18.0	18.1	17.6	17.1	18.0	18.4	18.5	18.0
a <sub>4</sub> 200 ppm	31.9	39.0	44.5	45.2	40.2	35.7	40.0	46.7	47.2	42.4	17.1	17.6	18.1	18.2	17.8	17.2	18.0	18.5	18.6	18.1
Mean (B)	29.1	35.8	40.5	40.9		31.2	36.5	41.6	42.1		16.7	17.2	17.7	17.8		16.7	17.5	17.9	18.0	
New L.S.D. at 5%	A B AB					A B AB					A B AB					A B AB				
	1.0 1.0 2.0					1.1 1.0 2.0					0.3 0.3 0.6					0.3 0.3 0.6				

## Conclusion

Carrying out three sprays (at growth start, just after berry setting and at one month later) of a mixture of salicylic acid at 100 ppm plus boric acid at 0.05% gave the best results with regard to yield and fruit quality of Superior grapevines.

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