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## **EFFECT OF ASCORBIC AND SALICYLIC ACIDS ON GROWTH AND FRUITING OF RUBY SEEDLESS GRAPEVINES**

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### **ABSTRACT**

The effect of spraying ascorbic and/ or salicylic acids each at 100 ppm either once, twice or thrice on growth, yield and berries quality of Ruby seedless grapevines was investigated during 2008 and 2009 seasons.

Application of ascorbic acid and/ or salicylic acids once, twice or thrice each at 100 ppm was very effective in enhancing main shoot length, leaf area and total surface area per vine, yield, cluster weight and length, cluster compactness and quality parameters. Using salicylic acid was favourable in enhancing yield and quality of the berries rather than application of ascorbic acid. Combined application of both compounds surpassed the application of each antioxidant alone. In most cases, increasing frequencies from twice to thrice failed to show clear differences on the investigated characters.

Treating Ruby seedless grapevines twice with ascorbic and salicylic acids each at 100 ppm was favourable for improving yield quantitatively and qualitatively.

## INTRODUCTION

Recently, many attempts were carried out for using different antioxidants for improving yield and quality of Ruby seedless grapes.

Application of antioxidants as previously mentioned by Mahran (2000); Ibrahiem- Asmaa (2006); Ahmed and Seleem- Basma (2008); Abada and Abd El- Hameed (2009); Ahmed *et al.*, (2010); Madian (2010); Uwakiem (2011) and Refaai (2011) was essential for stimulating growth traits, yield as well as physical and chemical characters of the berries in different grapevine cvs.

The target of this study was examining the beneficial effects of ascorbic and/ or salicylic acids on Ruby seedless grapevines.

## MATERIALS AND METHODS

The present study was carried out during 2008 and 2009 seasons on 120 uniform in vigour 10 years old Ruby seedless grapevines grown in a private vineyard located at Baramon Experimental Station, Dakahlia Governorate where the soil is clay loamy. The vines are planted at 2 × 3 m apart. The vines were trained according to double cordon training system with three wires the first wire, was on 80 cm height above the soil, the second one was on 120 cm height and the third one was on 160 cm height above the soil vine load was 92 eyes/vine (40 fruiting spurs × 2 eyes plus six replacement spurs × two eyes). Surface irrigation system was followed in the vineyard.

All the selected vines received regular and common horticultural practices that already applied in the vineyard except those dealing with the application of any antioxidants.

This experiment consisted from the following ten treatments from ascorbic and/ or salicylic acids.

- 1- Control (spraying the vines with water).
- 2- Spraying ascorbic acid once at 100 ppm.
- 3- Spraying ascorbic acid twice at 100 ppm.
- 4- Spraying ascorbic acid thrice at 100 ppm.
- 5- Spraying salicylic acid once at 100 ppm.
- 6- Spraying salicylic acid twice at 100 ppm.
- 7- Spraying salicylic acid thrice at 100 ppm.

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- ٨- Spraying ascorbic and salicylic acids once at ١٠٠ ppm.
- ٩- Spraying ascorbic and salicylic acids twice at ١٠٠ ppm.
- ١٠- Spraying ascorbic and salicylic acids thrice at ١٠٠ ppm.

Each treatment was replicated three times, four vines per each (١٢٠ vines). The selected antioxidants were sprayed once (just after berry setting), twice (just after berry setting and at two weeks later) or thrice (at the same previous two dates and at veraison stage). Each antioxidant was sprayed at ١٠٠ ppm. Triton B as a wetting agent at ٠.٠٥ % was added to all antioxidant solutions. Complete randomized block design was adopted.

During both seasons, the following parameters were measured:-

- ١- Mean shoot length (cm.) in the last week of July.
- ٢- Leaf area (cm<sup>٢</sup>) in the twenty leaves apposite to the based clusters according to Ahmed and Morsy (١٩٩٩), then the total surface area per vine (m<sup>٢</sup>) was calculated by multiplying the mean leaf area by the total number of leaves per vine.
- ٣- Yield per vine expressed in weight (kg.) was recorded at harvesting date (١<sup>st</sup> week of Sept.) when T.S.S/ acid in the berries of the check treatment reached at least ٢٣: ١
- ٤- Weight (g.) and length (cm.) of clusters
- ٥- Berry index (number of berries in ١٠٠ g. berry weight)
- ٦- Cluster compactness
- ٧- ١٠٠ berry weight (g.)
- ٨- Percentage of total soluble solids
- ٩- Percentage of total acidity (a g. tartaric acid/ ١٠٠ ml juice, A.O.A.C, ١٩٩٥)
- ١٠- T.S.S/ acid

All the obtained data were tabulated and statistically analyzed using new L.S.D test at ٥ % according to Gomez and Gomez (١٩٨٤).

## RESULTS AND DISCUSSION

### 1- Growth characters:

It is clear from the data in Table (1) that single or combined application of ascorbic and salicylic acids each at 100 ppm once, twice or thrice significantly was accompanied with stimulating main shoot length, leaf area and total surface area of the vine comparing with non- application. The stimulation was associated with increasing antioxidant frequencies. Application of salicylic acid was superior the application of ascorbic acid in enhancing growth characters of the vines. Combined application of both antioxidant compounds was significantly very effective in enhancing growth characters rather than application of each compound alone. The maximum values were recorded on the vines that received three sprays of a mixture of ascorbic and salicylic acids each at 100 ppm. Untreated vines had the lowest values. These results were true during the two seasons.

**Table 1: Effect of different frequencies of ascorbic and salicylic acids on some growth characters and the yield per vine (kg.) of Ruby seedless grapevines during 2008 and 2009 seasons.**

Antioxidant treatments	Shoot length (cm.)		Leaf area (cm <sup>2</sup> )		Total surface area of vine (m <sup>2</sup> )		Yield/ vine (kg.)	
	2008	2009	2008	2009	2008	2009	2008	2009
<b>Control</b>	122.3	120.3	127.1	127.8	10.9	10.8	13.89	13.92
<b>Ascorbic acid at 100 ppm</b>								
<b>Once</b>	130.7	133.1	129.3	129.3	17.0	17.2	14.08	14.78
<b>Twice</b>	137.2	138.1	131.0	130.9	17.4	17.4	14.97	15.07
<b>Thrice</b>	142.1	140.3	132.3	132.4	17.0	17.7	15.43	15.00
<b>Salicylic acid at 100 ppm</b>								
<b>Once</b>	149.2	148.3	133.3	133.0	17.7	17.7	15.79	15.73
<b>Twice</b>	151.0	153.0	134.0	134.4	17.9	17.0	15.93	16.02
<b>Thrice</b>	157.7	157.3	135.0	137.0	17.2	17.2	17.18	17.33
<b>Ascorbic and Salicylic</b>								
<b>Once</b>	172.3	174.3	137.0	137.7	17.7	17.0	17.40	17.03
<b>Twice</b>	179.2	178.3	138.0	138.0	17.9	17.8	17.78	17.80
<b>Thrice</b>	171.0	173.3	139.0	139.7	18.1	18.2	17.98	17.00
<b>New L.S.D at 5 %</b>	1.8	2.0	1.1	1.2	0.2	0.2	0.50	0.40

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The positive action of antioxidants on cell division and the biosynthesis of organic foods could result in stimulating growth characters.

These results are in agreement with those obtained by Mahran (٢٠٠٥) and Ibrahim- Asmaa (٢٠٠٦) on different grapevine cvs.

### ٢- Yield as well as weight and length of cluster:

Yield expressed in weight as well as weight and length of cluster were significantly increased in response to application of ascorbic and/or salicylic acids each at ١٠٠ ppm once, twice or thrice as compared with non- application. There was a gradual promotion on such parameters with increasing frequencies of antioxidants. Using salicylic acid was preferable than using ascorbic acid in improving yield as well as weight and length of cluster. Using salicylic and ascorbic acids together surpassed the application of each compound alone in this respect. Treating Ruby seedless grapevines three times with salicylic and ascorbic acids each at ١٠٠ ppm gave the maximum yield and produced heaviest clusters. Untreating the vines gave the minimum values. These results were true during the two experimental seasons (Tables ١ and ٢).

The promoting effect of antioxidants on growth and vine nutritional statuses surely reflected on enhancing cluster weight and yield.

These results are in agreement with those obtained by Ahmed *et al.*, (٢٠١٠) and Uwakiem (٢٠١١).

### ٣- Berry index:

It is evident from the data in Table (٣) that single or combined application of ascorbic and salicylic acids each at ١٠٠ ppm significantly caused a reduction on berry index (number of berries in ١٠٠ g berry weight) comparing with non- application. The reduction was in proportional to the increase in antioxidant frequencies

The great reduction on berry index was observed due to using salicylic acid in combined with ascorbic acid comparing with using each alone. Using salicylic acid was very effective in reducing berry index comparing with using ascorbic acid. The lowest values were

recorded when both two antioxidants were applied together three times at 100 ppm. The maximum values were recorded when the vines were untreated with antioxidants. Similar trend was observed during two seasons.

**Table 2: Effect of different frequencies of ascorbic and salicylic acids on weight (g.) and length (cm.) of cluster, berry index and cluster compactness of Ruby seedless grapevines during 2008 and 2009 seasons.**

Antioxidant treatments	Cluster weight (g.)		Cluster length (cm.)		Berry index		Cluster compactness	
	2008	2009	2008	2009	2008	2009	2008	2009
<b>Control</b>	512.0	547.1	27.7	28.0	49.0	48.0	9.01	9.37
<b>Ascorbic acid at 100 ppm</b>								
<b>Once</b>	575.3	587.2	28.3	28.3	47.0	47.0	9.72	9.79
<b>Twice</b>	607.3	627.3	28.5	28.7	47.0	47.0	9.87	9.87
<b>Thrice</b>	645.3	651.7	29.0	29.1	45.0	45.0	9.93	9.94
<b>Salicylic acid at 100 ppm</b>								
<b>Once</b>	664.7	668.7	29.5	29.5	44.0	44.0	9.97	9.97
<b>Twice</b>	682.3	683.3	29.9	29.8	44.0	43.0	9.99	9.98
<b>Thrice</b>	693.3	693.3	30.1	30.2	42.0	42.0	10.00	10.01
<b>Ascorbic and Salicylic</b>								
<b>Once</b>	708.7	713.7	30.7	30.7	42.0	41.0	10.03	10.05
<b>Twice</b>	725.3	730.7	31.2	31.4	40.0	40.0	10.07	10.07
<b>Thrice</b>	749.0	752.7	31.7	31.7	39.0	39.0	10.08	10.08
<b>New L.S.D at 5 %</b>	21.0	26.0	0.3	0.3	2.0	2.0	0.09	0.08

**4- Cluster compactness:**

It was significantly improved in response to application of salicylic and/ or ascorbic acids once, twice or thrice at 100 ppm comparing with non- application. The promotion was correlated with increasing number of sprays. Salicylic acid surpassed ascorbic acid in improving cluster compactness. Combined application gave the highest values comparing with using each compound alone. Spraying the vines three times with ascorbic and salicylic acids each at 100 ppm gave the maximum values. Untreating the vines with these antioxidants gave loose clusters. These results were true during both seasons (Table 1).

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### •- Berries quality:

It is quite clear from the data in Table (۳) that single or combined application of ascorbic and salicylic acids each at ۱۰۰ ppm was significantly very effective in improving quality of the berries in terms of increasing berry weight, total soluble solids and T.S.S/ acid and reducing total acidity comparing with non- application. The promotion on quality of the berries was associated with increasing frequencies of antioxidants. Application of salicylic acid was favourable in improving quality of the berries comparing with using ascorbic acid. Combined application was preferable in enhancing quality of the berries rather than application of each compound alone.

**Table ۳: Effect of different frequencies of ascorbic and salicylic acids on some physical and chemical characters of the berries of Ruby seedless grapevines during ۲۰۰۸ and ۲۰۰۹ seasons.**

Antioxidant treatments	۱۰۰ berry weight (g.)		T.S.S %		Total acidity %		T.S.S/ acid	
	۲۰۰۸	۲۰۰۹	۲۰۰۸	۲۰۰۹	۲۰۰۸	۲۰۰۹	۲۰۰۸	۲۰۰۹
<b>Control</b>	۲۱۴.۰	۲۱۸.۳	۱۷.۲	۱۷.۳	۰.۷۲۲	۰.۷۲۵	۲۳.۸	۲۳.۸
<b>Ascorbic acid at ۱۰۰ ppm</b>								
<b>Once</b>	۲۲۴.۳	۲۲۶.۰	۱۷.۶	۱۷.۷	۰.۶۸۰	۰.۶۷۳	۲۵.۹	۲۶.۳
<b>Twice</b>	۲۳۱.۰	۲۳۱.۹	۱۷.۸	۱۷.۸	۰.۶۶۵	۰.۶۶۱	۲۶.۸	۲۶.۹
<b>Thrice</b>	۲۳۸.۰	۲۳۸.۰	۱۸.۰	۱۷.۹	۰.۶۴۶	۰.۶۴۹	۲۷.۹	۲۷.۶
<b>Salicylic acid at ۱۰۰ ppm</b>								
<b>Once</b>	۲۴۶.۰	۲۴۶.۰	۱۸.۴	۱۸.۴	۰.۶۳۱	۰.۶۲۹	۲۹.۲	۲۹.۳
<b>Twice</b>	۲۵۰.۰	۲۵۴.۶	۱۸.۶	۱۸.۶	۰.۶۰۵	۰.۶۱۰	۳۰.۷	۳۰.۵
<b>Thrice</b>	۲۵۷.۳	۲۵۸.۷	۱۸.۹	۱۸.۹	۰.۵۸۴	۰.۵۸۰	۳۲.۴	۳۲.۶
<b>Ascorbic and Salicylic</b>								
<b>Once</b>	۲۶۴.۷	۲۶۵.۷	۱۹.۱	۱۹.۲	۰.۵۳۱	۰.۵۳۶	۳۶.۰	۳۵.۸
<b>Twice</b>	۲۶۹.۳	۲۶۸.۷	۱۹.۵	۱۹.۶	۰.۴۹۶	۰.۴۹۹	۳۹.۳	۳۹.۳
<b>Thrice</b>	۲۷۱.۶	۲۷۵.۳	۲۰.۰	۲۰.۲	۰.۴۵۵	۰.۴۵۰	۴۴.۰	۴۴.۹
<b>New L.S.D at ۵ %</b>	۳.۶	۳.۳	۰.۲	۰.۲	۰.۱۵	۰.۱۲	۰.۶	۰.۶

The best results with regard to quality of the berries were recorded on the vines that received both compounds together three times at ۱۰۰ ppm. Similar results were announced during the two seasons.

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The beneficial of antioxidants on building organic foods especially carbohydrates surely reflected on advancing fruit maturity and improving quality of the berries.

These results are in concordance with those obtained by Ahmed and Seleem- Basma (2008); Abada and Abd El- Hameed (2009); Madian (2010) and Refaai (2011) on various grapevine cvs.

**٦- Economical study:**

Data of Table (٤) indicated that average yield of anti- oxidant foliar spray treatments reached ١٤.٦٨, ١٥.٠٠, ١٥.٥٠, ١٥.٨٠, ١٦.٠٠, ١٦.٣٠, ١٦.٥٠, ١٦.٨٠ and ١٧.٠٠ tons respectively represents approximately ١٠٦.٢٢ %, ١٠٨.٥٣ %, ١١٢.١٥ %, ١١٤.٣٢ %, ١١٥.٧٧ %, ١١٧.٩٥ %, ١١٩.٣٩ %, ١٢١.٥٦ % and ١٢٣.٠١ %, respectively of the average from yield per feddan compared with ١٣.٨٢ tons of the average from productivity which means that first, second, third, fourth, fifth, sixth, seventh, eighteenth and ninth anti- oxidant treatments had excelled as a productive about ٦.٢٢ %, ٨.٥٣ %, ١٢.١٥ %, ١٤.٣٢ %, ١٥.٧٧ %, ١٩.٣٩ %, ٢١.٥٦ %, ٢٣.٠١ %, respectively.

**Table ٤: Some indicators of economic productivity of anti- oxidant extract foliar spray treatments on Ruby seedless grapevines as a mean of two seasons (2008 and 2009).**

Antioxidant treatments	Productivity per feddan		Total revenue in pound/ F (١)	Total anti- oxidant in pound/ F (٢)	The net revenue in pound/ F over control pound/ F	
	Yield	Total figure %			(١) - (٢)	Pound/ F
Control	١٣.٨٢	١٠٠	١٣٨٢	٣٤٠	١٠٤٢	----
<b>Ascorbic acid at ١٠٠ ppm</b>						
Once	١٤.٦٨	١٠٦.٢٢	١٥٥٩	٤٠٠	١١٥٩	١١٧
Twice	١٥.٠٠	١٠٨.٥٣	١٦٢٧	٤٤٠	١١٨٧	١٤٥
Thrice	١٥.٥٠	١١٢.١٥	١٧٣٨	٤٧٠	١٢٦٨	٢٢٦
<b>Salicylic acid at ١٠٠ ppm</b>						
Once	١٥.٨٠	١١٤.٣٢	١٨٠٦	٥٢٥	١٢٨١	٢٣٩
Twice	١٦.٠٠	١١٥.٧٧	١٨٥٢	٥٦٠	١٢٩٢	٢٥٠
Thrice	١٦.٣٠	١١٧.٩٥	١٩٢٢	٦٠٠	١٣٢٢	٢٨٠
<b>Ascorbic and Salicylic</b>						
Once	١٦.٥٠	١١٩.٣٩	١٩٦٩	٦٤٠	١٣٢٩	٢٨٧
Twice	١٦.٨٠	١٢١.٥٦	٢٠٤٢	٦٨٠	١٣٦٢	٣٢٠
Thrice	١٧.٠٠	١٢٣.٠١	٢٠٩١	٧٢٠	١٣٧١	٣٢٩



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As a conclusion, treating Ruby seedless grapevine three times with salicylic and ascorbic acids each at 100 ppm was responsible for improving yield quantitatively and qualitatively.

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## Effect of ascorbic and salicylic acids on ruby seedless grapevines

### تأثير حامض الأسكوربيك والسلسليك علي النمو والإثمار في كرمات العنب الروبي سيدلس

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تم دراسة استجابة تأثير رش حامض الأسكوربيك والسلسليك اما بمفردهما أو مع بعض بتركيز ١٠٠ جزء في المليون إما مرة واحدة، مرتان أو ثلاثة مرات علي النمو وكمية المحصول وخصائص الجودة لحبات العنب الروبي سيدلس وذلك خلال موسمي ٢٠٠٨، ٢٠٠٩

أدي استخدام حامض الأسكوربيك والسلسليك اما بمفردهما أو مع بعض مرة ، مرتان أو ثلاثة مرات بتركيز ١٠٠ جزء في المليون إلي تحسين طول النمو الرئيسي ومساحة الورقة والمسطح الورقي للكرمة وكمية المحصول ووزن وطول العنقود وتكسد العنقود وخصائص الجودة وكان استخدام حامض السلسليك مفضلا عن استخدام حامض الأسكوربيك في تحسين كمية المحصول وخصائص الجودة للحبات. وكان استخدام حامض الأسكوربيك مع حامض السلسليك مفضلا عن استخدام كل منهما بمفرده وفي معظم الحالات فإن زيادة عدد مرات الرش من مرتين الي ثلاثة مرات لم يكن له تأثير واضح علي الصفات تحت الدراسة.

كانت معاملة كرمات العنب الروبي سيدلس مرتين بحامض الأسكوربيك والسلسليك كل بتركيز ١٠٠ جزء في المليون مفيدا في تحسين كمية المحصول كما ونوعا.