



Minia J. of Agric. Res. & Develop.
Vol. (32) No. 1 pp 165-175,
2012

FACULTY OF AGRICULTURE

ALLEVIATING THE ADVERSE EFFECTS OF SUNBURN ON THE PRODUCTION OF RED ROOMY GRAPEVINES GROWING UNDER MINIA REGION CONDITIONS

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Received 13 Feb. 2012

Accepted 3 April 2012

ABSTRACT

The effect of spraying CaCO_3 at 0.4, 0.8 and 1.6 % and salicylic acid at 100, 200 and 400 ppm on counteracting the adverse effects of sunburn on yield and quality of Red Roomy grapevines was investigated during 2010 and 2011 seasons. The vines received two sprays 30 days after berry setting and again 30 days later.

Results revealed that spraying CaCO_3 or salicylic acid at the prementioned concentrations effectively declined sunburned berries % and enhanced berry colouration as well as yield and grape quality comparing with unspraying. The effect either in reduction or promotion was associated with increasing concentrations. Using calcium carbonate was superior than the application of salicylic acid in reducing sunburn damage and improving yield quantitatively and qualitatively. Increasing concentrations of CaCO_3 from 0.8 to 1.6 % and salicylic acid from 200 to 400 failed to show measurable effect on the studied parameters.

Carrying out two sprays of CaCO_3 at 30 and 60 days after berry setting is suggested to reduce the inferior effects of sunburn on productivity of Red Roomy grapevines growing under Minia region conditions.

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INTRODUCTION

The drawback of Red Roomy grape cv. grown under Minia region is uneven colouration of berries in clusters due to the higher temperature during berry development as well as its susceptibility to sun heat.

Growth, yield and fruit development of various fruit crops improved gradually with increasing temperatures from 80 to 90 °F. The vice versa was obtained when the temperature was above 90 °F, since fruit trees suffered from sunburn. Sunburn is accompanied with inhibiting photosynthesis and plant pigments (Boyer, 1990) Calcium carbonate is responsible for forming protective film that acts as a superior reflective particle barrier to the harmful effects of solar radiation and water stress (Chadha and Shikhamany, 1999).

Salicylic acid is an endogenous growth regulator which participates in the regulation of physiological processes in plants. It plays an important role in the plant response to adverse environmental conditions such as high temperatures and salinity in the soil and water (Radha and Mathew, 1977).

Previous studies showed that using calcium carbonate via leaves was beneficial in inhibiting the adverse effects of heat on yield quantitatively and qualitatively of fruit crops (Melgarejo *et al.*, 2004; Peter, 2008; Morsy *et al.*, 2008 and Ahmed *et al.*, 2011).

Spraying salicylic acid was essential in improving productivity of different grapevine cvs (Ahmed and Abd El- Hameed, 2004; Farahat, 2008; Ahmed and Seleem- Basma, 2008; Abd El- Kariem, 2009; Abada and Abd El- Hameed, 2010; Ahmed *et al.*, 2010; El- Kady- Hanaa, 2011; El- Hanafy, 2011 and Bondok- Sawsan *et al.*, 2011 and Mohamed- Ebtessam, 2012).

The target of this study was elucidating the beneficial effects of spraying Red Roomy grapevines with calcium carbonate and salicylic acid on yield and quality of the berries.

MATERIALS AND METHODS

This study was carried out during 2010 and 2011 seasons on 45 uniform in vigour 10- years old Red Roomy grapevines in a private

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vineyard located at West Samalout, Minia Governorate where the soil texture is sandy. Pruning was done at the second week of Jan in both seasons using head pruning system leaving ٧٢ eyes/ vine (twenty fruiting spurs × ٣ eyes + six replacement spurs × two eyes). Vines are planted at ٣ × ٣ m. apart. Drip irrigation system was followed. All the selected vines received the same horticultural practices that already applied in the vineyard except those dealing with calcium carbonate and salicylic acid.

Seven treatments were involved in the present treatment arranged as follows:-

- ١- Control (water sprayed vines).
- ٢- Spraying calcium carbonate (CaCO_٣) at ٠.٤ %.
- ٣- Spraying calcium carbonate at ٠.٨ %.
- ٤- Spraying calcium carbonate at ١.٤ %.
- ٥- Spraying salicylic acid at ١٠٠ ppm.
- ٦- Spraying salicylic acid at ٢٠٠ ppm.
- ٧- Spraying salicylic acid at ٤٠٠ ppm.

Each treatment was replicated three times, two vines per each. Calcium carbonate and salicylic acid were sprayed twice at ٣٠ days after berry setting (١st week of July) and at one month later (١st week of August). Completely randomized block design was followed. Temperatures for the three summer months namely June, July and August during ٢٠١٠ and ٢٠١١ seasons under Minia region were shown in Table (١).

Table ١: Temperature (°F) for summer months during ٢٠١٠ and ٢٠١١ seasons.

Months	٢٠١٠		٢٠١١	
	Min.	Max.	Min.	Max.
June	٩٤	٩٩	٩٥	٩٨
July	١٠٠	١٠٦	١٠٢	١٠٧
August	١٠٤	١٠٩	١١٠	١١٨

Source: Mallawy Meteorological authority Station.

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Harvesting was recorded when the T.S.S/ acid reached ۲۵/ ۱ for the control treatment. Yield per vine expressed in weight (kg.) was recorded. Five clusters were taken at random from the yield of each vine for measuring cluster weight (g.) and the following physical and chemical characters of the berries:-

- ۱- Percentage of colouration by dividing number of red berries by the total number of berries per cluster and multiplying the product by ۱۰۰.
- ۲- Percentage of sunburned berries by dividing number of sunburned berries by total number of berries per cluster and multiplying the product by ۱۰۰.
- ۳- Berry weight (g.).
- ۴- Total soluble solids %.
- ۵- Total sugars % (A. O. A. C, ۱۹۹۵).
- ۶- Total acidity % (as g. of tartaric acid/ ۱۰۰ g of juice, A. O. A. C, ۱۹۹۵).

All the obtained data were tabulated and statistically analyzed according to Mead *et al.*, (۱۹۹۳) using new L.S.D test at ۵ % for made all comparisons among different treatment means.

RESULTS AND DISCUSSION

۱- Effect of CaCO_۳ and salicylic acid on the percentage of sunburned berries:-

Data in Table (۲) clearly show that sunburned berries % was significantly reduced with spraying CaCO_۳ at ۰.۴ to ۱.۶ and salicylic acid at ۱۰۰ to ۴۰۰ ppm comparing with non- application. There was a gradual reduction on such undesirable phenomenon with increasing concentrations of each compound. Unsignificant reduction on such character was noticed among the higher two concentrations of each compound. Application of CaCO_۳ surpassed the application of salicylic acid in this respect. Treating the vines twice a year with CaCO_۳ at ۱.۶ % proved to be very effective in minimizing sunburned berries % (۵.۰ and ۴.۰ % respectively). But due to the slight effect among the higher two concentrations of CaCO_۳ on such character the

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suggested concentration was 0.8 %. Under such promised treatment sunburned berries % reached 0.1 and 0.2 % during both seasons, respectively. Untreating the vines gave the maximum values (18.9 and 19.0 %, respectively). This means that the previous promised treatment reduced sunburned berries % by 43.0 and 44.9 % in relative to the check treatment during both seasons, respectively. These results were true during 2010 and 2011 seasons.

The reducing effect of CaCO₃ on reducing sunburn damage might be attributed to its effect in reducing both fruit temperature and exposure to U.V. radiation. The beneficial effect of CaCO₃ on leaving a protective powdery film on the surfaces of fruits could explain the present results (Melgarejo, 2004).

The positive action of salicylic acid on increasing the tolerance of plants to heat could explain results.

These results are in harmony with those obtained by Morsy *et al.*, (2008) and Ahmed *et al.*, (2011) who worked on CaCO₃ as well as El- Kady- Hanaa (2011); El- Hanafy (2011) and Mohamed- Ebtessam (2012) who worked on salicylic acid.

2- Effect of CaCO₃ and salicylic acid on the yield and cluster weight:-

It is evident from the data in Table (2) that application of CaCO₃ or salicylic acid significantly was responsible for improving yield and cluster weight comparing to the control treatment. The promotion was associated with increasing concentrations. No significant promotion was detected among the higher two concentrations of each compound; therefore the recommended concentration was 0.8 for CaCO₃ and 200 ppm for salicylic acid. Using CaCO₃ was preferable than using salicylic acid in this connection. From economical point of view using CaCO₃ at 0.8 % twice gave the best results with regard to yield. In such promised treatment yield reached 11.0 and 11.6 kg comparing with yield that reached 7.0 and 7.1 kg for the control treatment. The percentage of increase due to application of the promised treatment over the check treatment reached 57.1 and 63.8 % during both seasons, respectively. These results were true during both seasons.

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The reducing effect of foliage temperature due to using CaCO₃ and salicylic acid may improve net photosynthesis through reducing daytime stomatal closure and day time respiration especially in hot dry climates, leading to better fruit retention and yield.

Table 2: Effect of spraying calcium carbonate and salicylic acid on sunburned berries %, yield (kg.), cluster weight (g.) and colouration % of Red Roomy grapevines during 2010 and 2011 seasons.

Treatments	Sunburned berries %		Yield/ vine (kg.)	
	2010	2011	2010	2011
Control.	18.9	19.0	7.0	7.1
CaCO ₃ at 0.4 %.	13.0	10.0	10.0	10.7
CaCO ₃ at 0.8 %.	5.1	4.2	10.9	11.5
CaCO ₃ at 1.6 %.	5.0	4.0	11.0	11.6
Salicylic acid at 100.	17.6	16.0	8.0	8.3
Salicylic acid at 200.	16.2	14.1	8.8	9.2
Salicylic acid at 400.	16.1	14.0	9.0	9.3
New L.S.D at 5 %	1.1	1.2	0.7	0.8
Character	Cluster weight (g.)		Colouration %	
Control.	310.0	311.0	66.0	64.5
CaCO ₃ at 0.4 %.	371.0	372.0	77.0	79.2
CaCO ₃ at 0.8 %.	388.0	390.0	84.0	87.0
CaCO ₃ at 1.6 %.	389.0	391.0	85.0	88.0
Salicylic acid at 100.	330.0	331.0	68.3	71.0
Salicylic acid at 200.	349.0	351.0	71.9	75.0
Salicylic acid at 400.	350.0	353.0	72.2	75.5
New L.S.D at 5 %	16.0	15.9	1.8	2.0

These results are in harmony with those obtained by Morsy *et al.*, (2008) and Ahmed *et al.*, (2011) who worked on CaCO₃ as well as El- Kady- Hanaa (2011); El- Hanafy (2011) and Mohamed-Ebtesam (2012) who worked on salicylic acid.

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٣- Effect of CaCO_٣ and salicylic acid on berries colouration:-

It is obvious from the data in Table (٣) that treating Red Roomy grapevines twice with CaCO_٣ or salicylic acid significantly was followed by enhancing berries colouration comparing with the check treatment. Berries colouration % was increased from ٦٦ % in the untreated vines to ٨٥.٠ in the vines treated with CaCO_٣ at ١.٦ % in the first season and from ٦٤.٥ % to ٨٨ % in the second season, respectively. Berries colouration % was gradually increased with increasing concentrations. Using CaCO_٣ was preferable in hastening colouration % comparing with using salicylic acid. Spraying CaCO_٣ at ١.٦ % gave the best results with regard to colour intensity. Colouration was minimized in untreated vines. These results were true during ٢٠١٠ and ٢٠١١ seasons.

The beneficial effect of such two compounds in lowering leaf temperature and stimulating both photosynthesis and biosynthesis of plant pigments explained the present results (Melgarejo, ٢٠٠٤).

٤- Effect of CaCO_٣ and salicylic acid on some physical and chemical characteristics of the berries:-

It is noticed from the data in Table (٣) that treating Red Roomy grapevines twice a year with CaCO_٣ or salicylic acid significantly was accompanied with improving quality of the berries in term of increasing berry weight, total soluble solids % and total sugars % and decreasing total acidity % rather than non- application. The stimulation was associated with increasing concentrations. No significant differences were observed on quality parameters among the higher two concentrations of each compound. Spraying CaCO_٣ was superior than application of salicylic acid in this connection. From economical point of view application of CaCO_٣ at ٠.٨ % gave the best results. Untreating the vine gave unsatisfactory effect.

The profit of CaCO_٣ and salicylic acid in stimulating photosynthesis and the formation of plants pigments could explain the present results.

These results are in harmony with those obtained by Morsy *et al.*, (٢٠٠٨) and Ahmed *et al.*, (٢٠١١) who worked on CaCO_٣ as well as

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El- Kady- Hanaa (٢٠١١); El- Hanafy (٢٠١١) and Mohamed- Ebtesam (٢٠١٢) who worked on salicylic acid.

As a conclusion, for protecting Red Roomy grapevines from sunburn as well as improving yield, it is suggested to use CaCO_3 at ٠.٨ % twice.

Table ٣: Effect of spraying calcium carbonate and salicylic acid on some physical and chemical characteristics of Red Roomy grapevines during ٢٠١٠ and ٢٠١١ seasons.

Treatments	Berry weight (g.)		T.S.S %	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control.	٤.٣١	٤.٢٨	١٨.٠	١٨.٢
CaCO_3 at ٠.٤ %.	٥.٠٨	٥.١١	٢٠.١	٢٠.٥
CaCO_3 at ٠.٨ %.	٥.٣٣	٥.٣٥	٢٠.٨	٢١.٣
CaCO_3 at ١.٦ %.	٥.٣٦	٥.٣٧	٢٠.٩	٢١.٥
Salicylic acid at ١٠٠.	٤.٥٥	٤.٥٧	١٨.٦	١٩.٠
Salicylic acid at ٢٠٠.	٤.٨٠	٤.٨٥	١٩.٢	١٩.٨
Salicylic acid at ٤٠٠.	٤.٨٥	٤.٨٧	١٩.٣	١٩.٩
New L.S.D at ٥ %	٠.٢١	٠.٢٢	٠.٥	٠.٦
Character	Total sugars %		Total acidity %	
Control.	١٥.٢	١٥.٥	٠.٧٢٠	٠.٧٢٢
CaCO_3 at ٠.٤ %.	١٧.١	١٧.٢	٠.٦٠٦	٠.٦٠٥
CaCO_3 at ٠.٨ %.	١٨.٠	١٨.١	٠.٥٧٥	٠.٥٧٤
CaCO_3 at ١.٦ %.	١٨.١	١٨.٢	٠.٥٧٢	٠.٥٧١
Salicylic acid at ١٠٠.	١٥.٧	١٥.٩	٠.٦٨٠	٠.٦٧٨
Salicylic acid at ٢٠٠.	١٦.٥	١٦.٩	٠.٦٤٢	٠.٦٤٠
Salicylic acid at ٤٠٠.	١٦.٦	١٧.٠	٠.٦٤٠	٠.٦٣٨
New L.S.D at ٥ %	٠.٤	٠.٤	٠.٠٣١	٠.٠٢٩

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تقليل حدة التأثيرات الغير مرغوبة لضربة الشمس على إنتاجية كرمات العنب الرومي الأحمر النامية تحت ظروف منطقة المنيا.

أسماء انور إبراهيم

قسم بحوث العنب - معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة - مصر.

تم دراسة تأثير رش كربونات الكالسيوم بتركيز ٠.٤ ، ٠.٨ ، ١.٦ % وحامض السلسليك بتركيز ١٠٠ ، ٢٠٠ ، ٤٠٠ جزء في المليون في تخفيف حدة التأثيرات الضارة لضربة الشمس علي كمية المحصول وخصائص الجودة في كرمات العنب الرومي الأحمر خلال موسمي ٢٠١٠ ، ٢٠١١ ولقد تم رش الكرمات مرتان بعد العقد بشهر وشهرين. ولقد أشارت نتائج الدراسة أن رش كلا من كربونات الكالسيوم وحامض السلسليك بالتركيزات السابقة قد أدت إلي تقليل النسبة المئوية للحبات المصابة بضربة الشمس وتحسين تلوين الحبات والإنتاجية وذلك بالمقارنة بعدم الرش وكان التأثير سواء بالنقص أو الزيادة مرتبطا بزيادة التركيز المستخدم وكان استخدام كربونات الكالسيوم متفوقا عن استخدام حامض السلسليك في تقليل الأثر الضار لضربة الشمس وتحسين كمية المحصول كما ونوعا ولم يكن لزيادة التركيز المستخدم من كربونات الكالسيوم من ٠.٨ إلي ١.٦ % وحامض السلسليك من ٢٠٠ إلي ٤٠٠ جزء في المليون أية تأثير محسوس علي الصفات تحت الدراسة.

يقترح رش كربونات الكالسيوم مرتان بعد عقد الحبات بشهر وشهرين وذلك لتقليل التأثيرات الضارة لضربة الشمس علي إنتاجية كرمات العنب الرومي الأحمر النامي تحت ظروف منطقة المنيا.