Assiut J. of Agric. Sci., 39 (5) (81-91)

IMPROVEMENTS IN BERRY QUALITY OF RUBY SEEDLESS AND BEAUTY SEEDLESS GRAPES

Aiman K.A. Mohamed and Mokhtar M. Shaaban

Horticulture Department, Faculty of Agriculture, Assiut University, Egypt

Abstract: Ruby Seedless and Beauty Seedless grapevines were used to investigate the effect of some compounds producing ethylene effects (ethrel, ethanol, and methanol), cluster thinning, shoulders thinning and girdling on berry quality during 2006 and 2007 seasons. The compounds exercising ethylene effects had a pronounced effect on berry chemical properties and advanced the ripening. Thinning by removing the undesirable clusters or shoulders increased berry; cluster weight and improved berry quality. The cluster or shoulders thinning had a significant effect on the 100 berries and cluster weight. Girdling had little effect on berry quality, but increased weight of cluster and 100 berries compared to the control.

Keywords: Ethrel; Methanol; Ethanol; Girdling; Thinning; Berry quality.

Introduction

Ruby Seedless is a late-season red seedless table grape produced by hybridization between Emperor and Pirovano 75 grape cultivars. Beauty Seedless is a mid-season table grape cultivar resulted from a cross of Queen of the Vineyard X Black Kishmish. The two cultivars are characterized by high fruitfulness of their basal buds and high fruit set, and hence, cluster compactness, uneven berries ripening, poor colouring, and decrease in quality were ensued. Therefore, horticultural treatments used to enhance berry quality and regulate yield should be the common practices for such cultivars.

The first means being used in a wide range is the application of some compounds producing ethylene effects e.g. ethephon, ethanol and methanol at the onset of berry colouring (veraison). These treatments have been shown to improve colour, advance maturity and increase soluble solids accumulation in many seedless grape cultivars (Szyjewicz *et al.*, 1984; Leao and Assis 1999; Chervin *et al.*, 2001; Nikolaou *et al.*, 2003; Sharma and Singh 2003; Chervin *et al.*, 2006).

The second practice performed on many table grape cultivars is cluster or berry thinning, thus more assimilate translocate to the remaining berries.

Received on: 10/11/2008 **Accepted for publication on:** 11/1/2009
Referees: Prof.Dr. Aasm Shaltot Prof.Dr. Abd-ElFatah El-Salhy

This practice is achieved by removing the poor clusters or shoulders from clusters. The effectiveness of this treatment was demonstrated by Fisher *et al.* (1977), Looney and Wood (1977), Wood and Looney (1977), Looney (1981), Sepulveda *et al.* (1984), El-Hammady *et al.* (2000), Ezzahouani and Williams (2001), Guidoni *et al.* (2002), Petrie and Clingeleffer (2006), Selim (2007), Samra *et al.* (2007) and Shaheen *et al.* (2007).

The third practice widely used is girdling which is executed after berry set to increase berry size and weight or at the onset of berry colour to increase berry quality without inducing berry size or colour. The ring may be removed from the trunk, the arms or the fruit canes or spurs. Girdling on arms is not advisable; however, girdling is done on either the trunk or the individual fruit canes or spurs (Winkler *et al.* 1974). Increasing berry quality due to this treatment was mentioned by Sepulveda *et al.* (1984), Ezzahouani *et al.* (1985), El-Hammady and Abdel-Hamid (1995), Nikolaou *et al.* (2003), Samra *et al.* (2007) and Shaheen *et al.* (2007).

Consequently, this study has been designed to trace the effects of exogenous application of ethrel, ethanol, methanol, thinning and girdling on berry quality of Ruby Seedless and Beauty Seedless grape cultivars.

Materials and Methods

An experiment was executed in the experimental orchard of fruit section, Faculty of Agriculture, Assiut University, Egypt during two successive seasons (2006 and 2007). The grapevines of the cultivars Ruby Seedless and Beauty Seedless were 13-year old at the beginning of the experiment. Ruby Seedless grapevines were trained as traditional head system while Beauty Seedless grapevines were trained as cordon training system. The orchard was subjected to the regular horticultural practices. Thirty-five uniform vines for each cultivar were chosen. The experiment consisted of seven treatments including the control. The experiment was set up as a complete randomized design with five replications, one vine per each.

The treatment categories were:

1- Application of Ethrel, Ethanol and Methanol spray:

Ethrel was used at a concentration of 500 ppm, however , ethanol and methanol were used at 30% as recommended by Nikolaou *et al.* (2003). All spraying treatments were applied at the onset of berry colouring. A small sprayer (2L) was used to scatter spray on all clusters of the vine.

2- Cluster thinning:

Clusters were hand thinned by removing all the second clusters mostly of a poor quality or by eliminating shoulders from each cluster and 10-12 shoulders/cluster were left. The second clusters were

removed after berry set however; shoulders were thinned after berry set by two weeks.

3- Girdling:

Girdling was carried on all vine spurs between the first and second eye from the base by using special knife to remove 2 mm of the bark at the same date of spraying (El-Hammady and Abdel-Hamid 1995).

Samples of berries were collected twice from each vine (replicate) to determine the total soluble solids (TSS) using the hand refractometer, total acidity using titration by NaOH at 0.1 N and phenolphthalene as an indicator then expressed as tartaric acid along with TSS/acid ratio.

The first and second samples were achieved at one and three weeks for Beauty Seedless and at two and four weeks for Ruby Seedless from the beginning of berry colouring.

At harvest, cluster weight (g) was calculated by dividing yield (kg) on total number of clusters as well as, 100 berries weight was determined. The differences were tested by analysis of variance (ANOVA) according to Snedecor and Cochran (1972). Means were compared using LSD value (least significant differences) at 5% level of the probability.

Results

I- Ruby Seedless cultivar:

During the first season (Table 1) the analysis of the first sample (FS) showed that ethanol and second cluster thinning had a significant effect on TSS % while the effect of other treatments were not signify-cant compared to the control. Additionally, all treatments had

Table(1): Effect of some compounds producing ethylene effects, cluster & shoulders thinning and girdling on chemical properties, 100 berries weight (g) and cluster weight (g) of Ruby Seedless grape cultivar during 2006 season.

Treatment	TSS		Acidity		TSS/acid ratio		100 berries Weight	Cluster weight
	FS	SS	FS	SS	FS	SS		
Ethrel (500 ppm)	15.9	19.5	0.360	0.360	44.2	54.5	158.4	401.3
Methyl Alcohol (30%)	15.2	18.7	0.375	0.330	40.6	57.3	155.3	404.3
Ethyl Alcohol (30%)	16.4	18.4	0.360	0.360	45.6	51.6	166.3	410.3
Second cluster thinning	16.4	18.4	0.360	0.360	45.7	51.4	180.2	464.5
Shoulders thinning	15.6	18.2	0.345	0.330	45.7	56.1	166.3	430.6
Girdling	14.4	17.3	0.390	0.360	37.2	48.3	166.7	430.4
Control	15.0	17.6	0.480	0.360	31.3	49.3	150.4	395.5
LSD 5%	1.0	1.0	NS	NS	8.6	7.2	13.2	27.3

FS: First sample SS: second sample

insignificant effect on total acidity percentage. Concerning the ratio of TSS/acidity, all treatments (except methanol and girdling) had significant differences. On the second sampling date (SS), ethrel and methanol spray resulted in a significant effect on TSS % while the other treatments had insignificant outcome. Moreover, all treatments except for methanol were non effective on acidity percentage or TSS/acid ratio.

On the first sampling date of the second season (Table 2) all the treatments significantly increased the percentage of TSS as compared to the control. Total acidity significantly decreased while TSS /acid ratio increased in response to all treatments(except for methanol). On the second sampling date, all the treatments induced a significant increase of TSS % as compared to the control. Total acidity percentage significantly surpassed that of the control in alliance with the application of ethrel and methanol spray. Concerning TSS/acid ratio, only ethanol and second cluster thinning gave significant differences comparing to the control.

Table(2): Effect of some compounds producing ethylene effects, cluster & shoulders thinning and girdling on chemical properties, 100 berries weigh (g) and cluster weight (g) of Ruby Seedless grape cultivar during 2007 season.

Treatment	TSS		Acidity		TSS/acid ratio		100 berries weight	Cluster weight
	FS	SS	FS	SS	FS	SS		
Ethrel (500 ppm)	13.5	16.8	0.450	0.390	30.0	43.4	148.7	361.5
Methyl Alcohol (30%)	13.5	16.8	0.465	0.405	30.0	42.3	148.0	378.4
Ethyl Alcohol (30%)	14.5	17.4	0.345	0.285	42.0	61.1	148.8	371.6
Second cluster thinning	14.9	17.8	0.420	0.315	35.9	56.5	194.1	464.5
Shoulders thinning	15.5	17.0	0.375	0.345	41.4	50.0	182.8	435.6
Girdling	13.5	16.3	0.435	0.375	31.0	43.4	167.3	399.3
Control	12.2	14.9	0.570	0.345	21.6	44.6	148.0	360.6
LSD 5%	1.2	1.0	0.110	0.070	8.9	12.3	11.6	27.3

FS: First sample SS: Second sample

II- Beauty Seedless cultivar:

On the first sampling date during 2006, the data presented in Table (3) showed that ethrel at 500 ppm and thinning of the second clusters significantly increased the percentage of TSS. However, ethanol and methanol led to a significant decrease of total acidity percentage compared to the control. All spraying treatments enhanced the ratio of TSS/acid. The effectiveness of ethrel spray was clearly exhibited. On the second sampling date, the same trend was also evident concerning the percentage of TSS where a significant response was obtained due to ethrel spray and second cluster thinning, while, there were insignificant differences in the percentage of total acidity. Ethrel and methanol spray induce significant effect in TSS/acid ratio compared to the control.

Table(3): Effect of some compounds producing ethylene effects, cluster & shoulders thinning and girdling on chemical properties, 100 berries weight (g) and cluster weight (g) of Beauty Seedless grape cultivar during 2006 season.

Treatment	TSS		Acidity		TSS/acid ratio		100 berries weight	Cluster weight
	FS	SS	FS	SS	FS	SS		
Ethrel (500 ppm)	12.9	14.6	0.810	0.720	16.3	20.4	130.3	332.4
Methyl Alcohol (30%)	11.1	13.3	0.795	0.660	14.1	20.5	129.6	332.4
Ethyl Alcohol (30%)	11.4	12.5	0.765	0.720	14.9	17.5	124.1	342.3
Second cluster thinning	13.1	14.2	0.960	0.735	14.2	19.4	162.2	422.5
Shoulders thinning	12.0	13.6	0.885	0.720	13.9	19.0	154.4	402.3
Girdling	10.9	12.7	0.960	0.750	11.7	17.0	140.3	366.4
Control	11.1	12.3	0.990	0.735	11.4	16.7	121.8	330.3
LSD 5%	1.2	1.3	0.180	NS	2.8	3.0	18.3	34.3

FS: First sample SS: second sample

During the second season (Table 4) ethrel spray increased TSS percentage in case of the two sampling dates. The differences in response to shoulders thinning or ethrel spray treatment; compared to the control; were also significant while, the other treatments showed insignificant effect. The effect of all treatments on acidity or TSS/acid ratio was not significant compared to the control.

Table(4): Effect of some compounds producing ethylene effects, cluster & shoulders thinning and girdling on chemical properties, 100 berries weight (g) and cluster weight (g) of Beauty Seedless grape cultivar during 2007 season.

Treatment	TSS		Acidity		TSS/acid ratio		100 berries weight	Cluster weight
	FS	SS	FS	SS	FS	SS		
Ethrel (500 ppm)	13.6	14.4	0.840	0.775	16.4	18.6	128.4	306.4
Methyl Alcohol (30%)	11.7	13.4	0.885	0.755	13.8	17.8	129.6	296.3
Ethyl Alcohol (30%)	12.0	13.7	0.810	0.690	15.1	20.0	131.6	303.6
Second cluster thinning	12.3	14.2	0.840	0.735	14.8	19.7	150.4	342.3
Shoulders thinning	12.8	15.3	0.855	0.795	15.4	19.4	142.1	325.4
Girdling	12.1	13.4	0.810	0.765	15.1	17.5	132.4	301.5
Control	11.9	13.0	0.930	0.735	13.1	17.7	125.8	290.4
LSD 5%	0.9	1.2	NS	NS	NS	NS	9.9	NS

FS: First sample SS: second sample

Generally thinning and sometimes girdling led to an increase of cluster and 100 berries weight compared to the control (Tables 1-4). However, the differences in response were mostly significant while the other treatments showed insignificant effect on these traits.

Discussion

The advancing of fruit ripening and berry quality by some treatments has proved of great commercial value in fruit production. The present study deals with the role of some compounds, used commercially to exercise ethylene effects, on berry quality of Ruby Seedless and Beauty Seedless grapevines. Moreover, special emphasis was laid on the effect of thinning and girdling on the advancement of berry ripening and improvement the berry quality.

The berries of Ruby Seedless grape considered to be ripe when their TSS/acid ratio reached 30:1 (Gouda, 2005). According to TSS/acid ratio, all treatments except girdling especially those exercising ethylene effects advanced berry ripening by about two weeks. In addition to the effect of thinning and girdling on improvement of berry quality, they have a pronounced effect on cluster and 100 berries weight. Second cluster thinning recorded the highest increment percentage of cluster and 100 berries weight followed by shoulders thinning then girdling. The results indicated that the girdling effect on 100 berries and cluster weight was lower than the

effect of thinning on such traits may be the girdling was done late at the onset of berry colouring while thinning was done after berry set. The results showed that the increment percentage of 100 berries weight in Ruby Seedless grape cultivar recorded 25.7, 17.1 and 11.9 (two season's average) for cluster thinning, shoulders thinning and girdling, respectively. This increment percentage reflected on the cluster weight where the increment percentage reached 23.3, 15.9 and 10.9 for such treatments compared to the control, respectively. The increment percentage of 100 berries weight of Beauty Seedless grape cultivar reached 26.4, 14.9 and 10.2 (two season's average) while cluster weight recorded an increment of 22.9, 16.9 and 7.4% for cluster thinning, shoulders thinning and girdling compared to the control, respectively. On the other hand, the effect of spraying with compounds producing ethylene effects had insignificant effect either on cluster or 100 berries weight.

The role of natural ethylene which can easily diffuse through biomembranes and affects several developmental processes such as the ripening of fruits has been known for many years ago. The study made by Chervin *et al.* (2006) on Cabernet Sauvignon grape cultivar showed that berries treated with 1-methylcyclopropene; a specific inhibitor of ethylene receptors; accumulated less sucrose than did control. The same cultivar when treated with aqueous ethanol showed an increase of internal ethylene concentration in berries (Chervin *et al.*, 2001). Additionally, Abdel-Hamid (2000) studied the effect of ethylene inhibitors on Crimson seedless grape and found that they delayed ripening by 8-25 days. Ethrel applied to Cardinal grape in the form of ethephon, ethanol and methanol increased total soluble solids, brix/titratable acidity (Nikolaou *et al.*, 2003). On the other hand, Sepulveda *et al.* (1984) found that ethephon applied to Moscatel Rosado grapes in the concentrations of 250 or 500 ppm at veraison had no effect on brix or colour intensity. Numerous factors including cultivars, concentration, timing, method of application, pH, adjuvant, temperature, and vine water status influence grapevine responses to ethephon (Szyjewicz *et al.*, 1984). Generally, it is possible that many effects previously considered to be induced directly by ethylene are mediated by an intervening reaction in which ethrel, ethanol or methanol induce the formation of ethylene, following which ethylene induces particular responses leading to fruit ripening and other developmental processes.

Cluster and berry thinning are a common practice performed on many table grape cultivars to spare more carbohydrates for the remaining berries which surely reflected on advancing the berry ripening and improving its quality. The current work involved two

means of thinning; the first one is carried out by removing the second clusters that in most cases are poorly developed. The second procedure was achieved by removing shoulders. Tarter and Keuter (2005), suggested that the brix of cluster may be represented poorly by berries near the bottom of the cluster. The obtained data indicated that shoulder thinning had a pronounced effect on the weight and chemical properties of the berry. Also second cluster thinning increased the berry weight and advanced berry quality. The differences between the two thinning treatments were insignificant. The results of thinning effect were in accordance with those reported by Fisher *et al.* (1977), Looney (1981), Ezzahouani and Williams (2001), Guidoni *et al.* (2002), Petrie and Clingeleffer (2006), Samra *et al.* (2007) and Shaheen *et al.* (2007) on some grape cultivars. They found that cluster thinning increased berry weight and/or its quality. On the other hand, Keller *et al.* (2005) found that cluster thinning and its timing had little or no effect on berry weight and fruit composition (TSS, acidity, pH, colour).

Girdling has been shown to increase the carbohydrates above the removed ring and inhibiting the translocation of carbohydrates from the leaves to the other vine parts thus improving berry quality. Girdling on Cardinal grape increased the total soluble solids and caused faster ripening (Nikolaou *et al.*, 2003). Additionally, it increased cluster weight and improved berry quality of Red Roumi (Samra *et al.*, 2007) and of Ruby Seedless grapes (Shaheen *et al.*, 2007)

In conclusion, it is recommend removing the second cluster and/or shoulders from clusters if the farmer aimed to induce berry or cluster weight and enhance berry quality concerning TSS/acid ratio. In addition for hastening the berry ripening and obtaining the highest berry quality, it is recommended spraying the clusters with compounds producing ethylene effects.

References

Abdel-Hamid, N. 2000. Pre-harvest application of some ethylene inhibitors delays "Crimson" seedless grape ripening and improves storability. Annals Agric. Sci. Ain Shams Univ., Cairo 45 (1), 295-314.

Chervin, C., A. Elkereamy, J.P. Roustan, J. Faragher, A. Latche, J.C. Pech, and M. Bouzayen. 2001. An ethanol spray at veraison enhances colour in red wines. AGJWR 7 (3), 144-145.

Chervin, C., N. Terrier, A. Ageorges, F. Ribes, and T. Kuapunyakoon. 2006. Influence of ethylene on sucrose accumulation in grape berry. Am. J. Enol. Vitic. 57 (4), 511-513.

El-Hammady, A.M. and N. Abdel-Hamid. 1995. Effects of GA_3, NAA and cane girdling on yield and quality of "Kings Ruby" grapevines. Annals Agric. Sci., Ain Shams Univ., Cairo, 40 (1): 293-305.

El-Hammady, A.M., A.D. Shaltout, N. Abdel-Hamid and M. El-Sayed. 2000. Effect of sitofex (CPPU) and shoulder thinning on yield and quality of King's Ruby grapes. Arab Universities J. of Agric. Sciences, 8 (3): 735-754.

Ezzahouani, A. and L.E. Williams. 2001. The effects of thinning and girdling on leaf water potential, growth and fruit composition of Buby Seedless grapevines. J. International des Sciences de la vigne et du vin. 35 (2): 79-85. (C.F. Selim 2007).

Ezzahouani, A., A.M. Lasheen, and L. Walali. 1985. Effects of gibberellic acid and girdling on 'Thompson Seedless' and 'Ruby Seedless' table grapes in Morocco. HortScience 20, 393-394.

Fisher, K.H., O.A. Bradt, J. Wiebe, and V.A. Dirks. 1977. Cluster-thinning Ae'de Chaunac' French hybrid grapes improves vine vigour and fruit quality in Ontario. J. Amer. Soc. Hort. Sci. 102, 162-165.

Gouda, F.M.A. 2005. Effect of training system and application of hydrogen cyanamide (Dormex) and mineral oil on bud break, vegetative growth and fruiting of King Ruby grapevines under Assiut conditions. PhD. Fac. Agric., Assiut Univ., Egypt pp-120.

Guidoni, S., P. Allara, and A. Schubert. 2002. Effect of cluster thinning on berry skin anthocyanin composition of *Vitis vinifera* cv. Nebbiolo. Am. J. Enol. Vitic. 53 (3) 224-226.

Keller, M., L.J. Mills, R.L. Wample, S.E. Spayd. 2005. Cluster thinning effects on three deficit-irrigated *Vitis vinifera* cultivars. Am. J. Enol. Vitic. 56 (2), 91-103.

Leao, P.C.De.S and J.S.De Assis. 1999. Effects of ethephon on colour and quality of Red Globe grape in the Sao Francisco Valley. Revista Brasileira de Fruiticultra, 21 (1): 84-87. (C.F. Selim 2007).

Looney, N.E. 1981. Some growth regulator and cluster thinning effects on berry set and size, berry quality, and annual productivity of de Chaunac grapes. Vitis 20, 22-35.

Looney, N.E., and D.F. Woody. 1977. Some cluster thinning and gibberellic acid effects on fruit set, berry size, vine growth and yield of de Chaunac grapes. Can. J. Plant. Sci. (Ottawa) 57, 653-659.

Nikolaou, N., E. Ziozou, D. Stavrakas, and A. Patakas. 2003.

Effects of ethephon, methanol, ethanol and girdling treatments on berry maturity and colour development in Cardinal table grapes. AGJWR 9 (1), 12-14.

Petrie, P.R., and R. Clingeleffer. 2006. Crop thinning (hand versus mechanical), grape maturity and anthocyanin concentration: outcomes from irrigated Cabernet Sauvignon (*Vitis vinifera* L.) in a warm climate. AGJWR 12 (1), 21-29.

Samra, N.R., G.I. El-Banna, M.A. Iraqi, and T.E. Mahfouz. 2007. Some cultural practices to hasten yield and cluster characteristics of Red Roumi grape. J. Agric. Sci. Mansoura Univ., 32 (4), 2917-2927.

Selim, A.A. 2007. Response of Flame Seedless grapes to some improving treatments under Assiut environments. M.Sc. Thesis, Fac. Agric., Assiut Univ., Egypt pp-150

Sepulveda, R.G., G.O. Mondaca, and P.N. Rojas. 1984. Advancing maturation and coloration of Moscatel Rosado grapes (I-III). Investigaction y Progreso Agropecuario La Platina 25, 8-13.

Shaheen, M.A., S.M. Abdel Wahab, and A.S. Abd-El-Rahman. 2007. Effect of boron, berry thinning, girdling and GA_3 on yield and fruit quality of Ruby Seedless grapes. J. Agric. Sci. Mansoura Univ., 32 (5), 3621-3630.

Sharma, S. and D. Singh. 2003. Effects of different chemicals and trunk girdling on preharvest berry drop and quality in Beauty Seedless grapes (*Vitis vinifera* L.). Agric. Science Digest. 23 (1): 14-16.

Snedecor, G.W., and W.G. Cochran. 1972. Statistical methods 6th. Ed. The Iowa State University Press, Ames, Iowa, USA.

Szyjewicz, E., N. Rosner, and W.M. Kliewer. 1984. Ethephon ((2-chloroethyl) phosphonic acid, ethrel, CEPA) in viticulture – a review. Am. J. Enol. Vitic. 35 (3) 117-123.

Tarter, M.E., and S.E. Keuter. 2005. Effect of rachis position on size and maturity of Cabernet Sauvignon berries. Am. J. Enol. Vitic. 56 (1), 86-89.

Winkler, A.J., J.A. Cock, W.M. Kliewer and L.A. Lider. 1974. General viticulture. Univ. of California Press, 710p.

Woody, D.F., and N.E. Looney. 1977. Some cluster thinning and gibberellic acid effects on juice and wine quality of de Chaunac grapes. Can. J. Plant Sci. (Ottawa) 57, 643-646.

Assiut J. of Agric. Sci., 39 (5) (81-91)

تحسين جودة الحبات فى العنب روبى سيدلس و بيوتى سيدلس

أيمن كمال أحمد محمد ، مختار ممدوح شعبان

قسم البساتين – كلية الزراعة – جامعة أسيوط

أجري البحث فى مزرعة التجارب الخاصة بكلية الزراعة جامعة أسيوط خلال موسمى ٢٠٠٦ ، ٢٠٠٧ على صنفي العنب روبي سيدلس و بيوتي سيدلس وذلك لدراسة تأثير الرش ببعض المركبات التى تعطى تأثير الإثيلين (الاثيريل ، الإيثانول ، الميثانول) وكذلك تأثير خف العناقيد وخف فريعات العنقود والتحليق غلى خصائص الحبات.

إتضح من النتائج أن مركبات الرش كان لها تأثير فعال على تحسين خصائص الحبات وأدت إلى الإسراع من النضج. بينما سبب الخف بإزالة العنقود الثانى أو خف الفريعات الجانبية إلى حدوث زيادة فى وزن الحبات والعنقود وحسن من خصائص الجودة. بينما كان تأثير التحليق على جودة الحبات أقل من بقية المعاملات ولكنه تفوق على الكنترول.