J. Agric. Sci. Mansoura Univ., 31 (10): 6561 - 6575, 2006

TIMING OF CLUSTER THINNING AS A METHOD FOR CROP ADJUSTING AND IT'S IMPACT ON GROWTH, YIELD AND FRUIT QUALITY OF RUBY SEEDLESS GRAPEVINES

Aisha S.A. Gaser; Hanaa A. El-Helw and M.A. Abd El-Wahab
Viticulture Res. Dept., Hort. Res. Inst., Agric. Res. Center, Giza, Egypt

ABSTRACT

This study was carried out to disclose the effect of cluster thinning at different stages as a method for crop adjusting on growth, yield and fruit quality of Ruby seedless grapevines. One-quarter of the cluster number on each vine was removed at different stages of cluster development, thus, reducing the number of clusters per vine from 32 to 24. Vines were randomly assigned a date of cluster thinning based on the following stages of cluster development: pre-bloom (PB); full bloom (FB); berry set + one week after berry set (BS1); two weeks after berry set (BS2); three weeks after berry set (BS3) and four weeks after berry set (BS4) and unthinned vines (control), on which 32 clusters were retained through the experiment.

The results showed that the quality of Ruby seedless grapes could be easily improved by the cluster thinning. The early thinning of clusters pre-bloom (PB) ensured the best vegetative growth parameters and the highest bud fertility. However, Vines thinned at one week after berry set (BS1) can be recommended as the best effective treatment. The slight decrease in the yield obtained from this treatment could be compensated by improving physical properties of berries and decreasing percentage of shot berries per cluster , as well as achieving a highest percentage of TSS, better colouration and a lower percentage of acidity in the juice.

INTRODUCTION

Ruby seedless cultivar is a late maturing cultivar, ripens though the period from mid to late August, berry oval, color red to purple, seedless, high bud fertility which is reflected on the occurrence of the so-called overcropping phenomenon (Harry *et al.*, 1991).

The effects of overcropping have been reported to reduce vine vigour, increase shot berries and change fruit composition. The crop load is controlled by cluster thinning, which is a common practice carried out by table grape growers could be achieved, this led to the reduction of the yield as to be within the limits of the normal load so that high quality (Winkler, 1953; Weaver and Nelson, 1959; Winkler, 1962; Kaps and Cahoon 1989; Reynolds 1989; Collalto *et al.*, 1991; Donna 1993; Amati *et el.*, 1994; Bucelli and Giannetti I996; Rizk and Hassan (1996); Salvador *et al.*, 1996; Amati *et el.*, 1997; Morinaga *et al.*, 2000; Palliotti *et al.*, 2000; Ezzahouani and Williams 2001; Naor and Bravdo 2002; Abd El-Baki 2003; Cheema *et al.*, 2003; Ezzahouani and Williams 2003; Fawzi and El-Moniem 2003; Cus *et al.*, 2004; Nuzzo 2004 and Rubio *et al.*, 2004).

It is hypothesized that the reduction in the crop level though cluster thinning can improve quality of grapes. Other experiments have a rather wide range of crop; indicated that the intermediate crop level had a relatively positive effect on cluster quality. However, very low crops could not be compensated by the higher quality of clusters (Reynolds, 1989; Schalkwyk *et al.*, 1995 and Rizk-Alla 2006).

It is very important to determine the time at which the cluster thinning is done, the effect of time of cluster thinning through a wide range of cluster development stages from pre-bloom to veraison stages were reported by some researchers such as (Dokoozlian and Hirschfelt (1995) on Flame seedless grapevines; Sorokowsky (2000) on Chardonnay Musqué vines; Naor and Bravdo 2002; Ferree *et al.*, (2003); Keller *et al.*, (2005) on Cabernet Sauvignon, Riesling and Chenin blanc grapevines and Rizk-Alla (2006) on Crimson seedless grapevines).

The goal of this study was to determine the appropriate time of crop adjustment by cluster thinning on growth, yield and cluster quality of Ruby seedless grapevines.

MATERIALS AND METHODS

This investigation was conducted for two successive seasons (2003& 2004) in a private vineyard located at Mainiet Samanoud, Dakahlia governorate, on mature Ruby seedless grapevines. The chosen vines were ten-year-old, grown in a clay loamy soil and irrigated by drip irrigation system, spaced at 2.5 X 3 meters apart and trained to the bilateral cordon system. The vines were pruned during the first week of March with bud load of (24 buds/vine) resulting in an average of 30-32 clusters/vine. The vines were pruned to spurs and trellised according to the telephone system. Eighty four uniform vines were chosen. Each four vines acted as a replicate and each three replicates were treated by one of the following treatments.

One-quarter of the cluster number on each vine was removed at different stages of cluster development, reducing the number of clusters per vine to 24. Vines were randomly assigned a date of cluster thinning based on the stages of cluster and berry development: pre-bloom (PB); full bloom (FB); berry set + one week after berry set (BS1); two weeks after berry set (BS2); three weeks after berry set (BS3) and four weeks after berry set (BS4) and unthinned vines (control), on which 32 clusters were retained through the experiment.

***The following parameters were adopted to evaluate the tested treatments:-**

1. Yield and physical characteristics of clusters

Yield/vine was determined by multiplying the average number of clusters/vine by the average cluster weight.

Representative random samples of six clusters/vine were taken at harvest.The following characteristics were determined:average cluster weight (g), cluster width and length (cm), number of berries per cluster, coefficient of cluster compactness which was calculated by dividing number of berries per cluster by the length of the cluster, while percentage of shot berries of cluster was calculated by dividing weight of shot berries by weight of total berries per cluster.

2. Physical and chemical characteristics of berries:

Berry weight (g), berry size (cm^3) and berry dimensions (length and diameter) (cm) were measured. Total soluble solids in berry juice (TSS) (%) were recorded by a hand refractometer and total titratable acidity as tartaric acid (%) was also determined (AOAC 1985). TSS/acid ratio and total anthocyanin content of the berry skin (g/100g fresh weight) were calculated according to methods described by Husia *et al.*, (1965).

3-Morphological characteristics of vegetative growth

At growth cessation, the following morphological and chemical determinations were carried out on 4 shoots / the considered vine:

1- Average shoot length (cm).
2- Average shoot diameter (cm).
3- Average number of leaves/shoot.
4-Average leaf area (cm^2) of the apical 5^{th} and 6^{th} leaves using a planimeter.
5-Coefficient of wood ripening was calculated by dividing length of the ripened part by the total length of the shoot according to Bouard (1966).

4- Coefficient of bud fertility

This was calculated according to the equation of (No. of clusters/total number of buds) left on the vine at pruning time as mentioned by Bessis (1960). It is to be observed that this parameter was determined in the following year each season.

5- Statistical analysis:

The complete randomized blocks design was adopted for the experiment. The statistical analysis of the present data was carried out according to the methods described by Snedecor and Cochran (1972). Averages were compared using the new LSD values at 5% level. Percentages were transformed by the equation prior to the statistical analysis.

RESULTS AND DISCUSSION

1. Yield and physical characteristics of clusters

Results in (Table 1) show that all vines thinned between PB and BS4 stages significantly reduced the vine yield compared with control in both seasons of the investigation. However, significant differences were found among the thinning stages. Yield of vines thinned between PB and BS2 stages was significantly greater as compared to vines thinned at BS3 and BS4 stages.

Table (1): Effect of time of cluster thinning on Yield/vine and physical characteristics of bunches in 2003 and 2004 seasons

Caracteristic / Treatment	Yield/vine (kg)		Cluster weight (g)		Cluster length (cm)		Cluster width (cm)		No. of berries		Coe. of cluster compactnes		Shot berries (%)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Control	26.02	26.76	875.7	996.6	34.2	34.0	21.4	21.9	322.0	320.6	9.41	9.43	16.3	13.6
Pre-bloom (PB)	22.35	23.16	931.4	965.1	34.5	34.2	21.8	22.4	331.2	329.2	9.60	9.62	8.3	6.1
Full bloom (FB)	21.99	22.77	916.3	948.6	34.5	34.2	21.6	22.3	330.3	327.5	9.57	9.58	6.9	6.7
One week after berry set (BS1)	23.03	23.56	959.7	986.6	34.7	34.4	22.1	22.5	322.6	322.0	9.30	9.36	7.4	5.2
Two weeks after berry set (BS2)	22.56	23.27	939.9	989.5	34.6	34.3	22.0	22.6	323.7	320.6	9.35	6.35	7.7	5.6
Three weeks after berry set (BS3)	21.28	21.96	866.5	916.1	34.4	34.1	21.7	22.2	321.2	318.0	9.34	9.33	11.2	9.8
Four weeks after berry set (BS4)	21.10	21.69	879.2	903.9	34.3	34.0	21.6	22.0	322.0	319.5	9.39	9.40	14.6	13.3
new L.S.D. at 0.05 =	1.22	1.31	62.7	69.9	N.S	N.S	N.S	N.S	6.4	6.3	0.16	0.15	6.9	7.4

Vines thinned at BS1 had the highest yield compared with the other thinning stages in both seasons of this study. With respect to cluster weight, it was similarly affected by the conducted treatments to the effect on yield. These results are in agreement with those obtained by Dokoozlian and Hirschfelt (1995); Sorokowsky (2000); Naor and Bravdo 2002; Ferree *et al.*, (2003); Keller *et al.*, (2005) and Rizk-Alla (2006), who found that cluster thinning through a wide range of cluster development at stages from pre-bloom to veraison reduced the vine yield as compared with control.

The effect of time of cluster thinning on cluster dimensions, i.e. length and width were statistically insignificant.

No. of berries per cluster were increased significantly at vines thinned between PB and FB compared with the other thinning dates and control. As for the coefficient of cluster compactness, the thinned vines at PB and FB were found to have a higher coefficient of cluster compactness as a result to the increase in the number of berries/cluster. This result coincide with the findings of Reynolds (1989), who clarified that cluster thinning significantly increased number of berries/cluster.

Concerning percentage of shot berries/cluster, it was found that vines thinned at BS1 and BS2 generally exhibited a lower percentage of shot berries/cluster than vines thinned at BS4 and untreated control. The results in this respect are in line with those obtained by Abd El-Baki (2003), who found that cluster thinning to 20 clusters/vine decreased shot berries of Ruby seedless clusters.

2. Physical characteristics of berries:

Data in (Table 2) show that vines thinned between PB and BS2 had the highest values of berry weight, size and dimensions, i.e. length and diameter as compared to vines thinned at BS4 and control. Berry shape index was insignificantly affected in thinned vines as compared to control. Vines thinned at BS1 were superior to the other thinning stages in both seasons of this study. However, vines thinned at BS4 and control had no significant effect on these parameters in both seasons of the study.

These results are in agreement with those obtained by Dokoozlian and Hirschfelt (1995); Sorokowsky (2000); Naor and Bravdo (2002); Ferree *et al.*, (2003); Keller *et al.*, (2005) and Rizk-Alla (2006), who found that the maximum berry weight and dimensions were obtained when cluster thinning was carried out at one week after fruit set and two weeks after fruit set.

These results could be explained by the beneficial effect of cluster thinning that coincides with the still active cell division in the pericarp of the berries resulting in the rapid normal berry growth, and with the summer maximum content of carbohydrates in the shoots. The possible interpretation for the aforementioned increase in berry dimensions lies in the fact that under thinning, leaf/cluster ratio is increased with the result of which carbohydrates manufactured in the leaves are ready to immigrate rapidly towards berries.

3. Chemical characteristics of berries:

Results presented in (Table 3) revealed that all berry chemical characteristics; i.e. TSS, TSS/acid ratio and anthocyanin content of berry skin were significantly affected by timing of cluster thinning.

Table (2): Effect of time of cluster thinning on physical characteristics of berries in 2003 and 2004 seasons

Caracteristic / Treatment	Berry weight (g)		Berry size (cm3)		Berry length (cm)		Berry diameter (cm)		L/D	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Control	2.68	2.76	2.52	2.60	1.68	1.73	1.58	1.63	1.06	1.08
Pre-bloom (PB)	2.77	2.88	2.61	2.72	1.74	1.78	1.61	1.66	1.08	1.07
Full bloom (FB)	2.74	2.85	2.59	2.70	1.72	1.78	1.60	1.65	1.08	1.08
One week after berry set (BS1)	2.93	3.01	2.75	2.83	1.76	1.81	1.62	1.68	1.09	1.07
Two weeks after berry set (BS2)	2.86	2.97	2.69	2.80	1.78	1.80	1.62	1.67	1.09	1.08
Three weeks after berry set (BS3)	2.72	2.83	2.56	2.67	1.70	1.76	1.59	1.64	1.07	1.07
Four weeks after berry set (BS4)	2.69	2.78	2.53	2.62	1.68	1.74	1.58	1.64	1.08	1.06
new L.S.D. at 0.05 =	0.16	0.12	0.14	0.11	0.02	0.02	0.01	0.02	N.S	N.S

Table (3): Effect of time of cluster thinning on chemical characteristics of berries in 2003 and 2004 seasons

Caracteristic / Treatment	TSS (%)		Acidity (%)		TSS/acid ratio		Anthocyanin (g/100g F.W.)	
	2003	2004	2003	2004	2003	2004	2003	2004
Control	16.1	16.3	0.67	0.65	24.0	25.1	32.6	34.7
Pre-bloom (PB)	16.7	16.8	0.64	0.62	26.1	27.1	35.9	37.5
Full bloom (FB)	16.6	18.8	0.65	0.63	25.5	26.7	36.1	36.9
One week after berry set (BS1)	17.0	17.1	0.61	0.60	27.9	28.5	37.8	39.4
Two weeks after berry set (BS2)	16.9	16.9	0.63	0.61	26.8	27.7	38.7	38.3
Three weeks after berry set (BS3)	16.5	16.7	0.66	0.63	25.0	26.5	34.4	36.7
Four weeks after berry set (BS4)	16.3	16.6	0.66	0.64	24.7	25.9	34.0	35.9
new L.S.D. at 0.05 =	0.8	0.6	0.06	0.05	3.8	3.3	3.9	3.6

Vines thinned at BS1 and BS2 generally exhibited higher total soluble solids, TSS/acid ratio, anthocyanin content and lower acidity compared to control. No significant differences were detected between BS2 and control.

The obtained results are in accordance with those obtained by Dokoozlian and Hirschfelt (1995); Sorokowsky (2000); Naor and Bravdo 2002; Ferree *et al.*, (2003); Keller *et al.*, (2005) and Rizk-Alla (2006) who found that cluster thinning increased TSS in berry juice and provided a better subjection to light, which is essential for anthocyanin synthesis.

4-Morphological characteristics of vegetative growth

Data in (Table 4) show that the highest values of vegetative growth parameters (expressed as shoot diameter, shoot length, number of leaves/shoot, leaf area and coefficient of wood ripening) responded positively to cluster thinning at pre-bloom stage (PB) and at full bloom (FB) as compared to control and the other stages of thinning.

The results in this respect are in line with those of Abd El-Baki (2003) who found that shoot diameter, number of leaves/shoot and leaf area tended to increase with decreasing the number of clusters/vine of Ruby seedless grapevines.

The obtained results could be explained by Keller *et al.*, (2005), who found that the timing of thinning may be important. Removing crop early in the season (at bloom or soon after) may not lead to the desired result because the reduced sink size might in turn lead to lower leaf photosynthesis rates, so that the remaining berries may not have extra sugar available for import. If, however, photosynthesis remains unchanged, surplus photoassimilates could also be used to fuel more shoot (and root) growth. This growth would counteract the benefits of lower crop load because of its negative effect on vigor and canopy microclimate. Therefore, it might be beneficial to delay thinning until shoot growth has slowed and assimilates may be diverted to the fruit.

5-Coefficient of bud fertility:

Bud fertility was significantly increased by earlier thinning treatments (PB and FB) compared with the other thinning treatments and control in both seasons (Table, 4). These results could be explained by the time of cluster thinning which was carried out before flower induction resulting in the increase of bud fertility.

Data illustrated in (Figure 1 and 2) indicate that there was a highly positive correlation between leaf area and average berry weight and between leaf area and coefficient of wood ripening in both seasons.

Results illustrated in (Figure 3 and 4) reveal the presence of a highly positive correlation between leaf area and total soluble solids of berry juice and between leaf area and berry skin anthocyanin content in both seasons.

6. Economical justification of cluster thinning treatment at one week after berry set (The best treatment) as compared to control:

It can be shown from the data presented in (Table 5) that cluster thinning at one week after berry set (BS1) (as the best treatment) gave the maximum net profit compared with the control. The moderate rise in the cost of production/feddan in this treatment is economically justified in view of the higher price of the yield of this treatment.

Table (4): Effect of time of cluster thinning on morphological characteristics of vegetative growth in 2003 and 2004 seasons

Caracteristic / Treatment	Shoot diameter (cm)		Shoot length (cm)		No. of leaves/shoot		Leaf area (cm2)		Coe.of wood ripening		Coe.of bud fertility	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2004	2005
Control	0.93	0.96	143.3	154.1	23.2	25.2	182.7	190.4	0.73	0.79	0.83	0.88
Pre-bloom (PB)	0.97	1.03	161.4	170.6	26.3	30.3	191.6	202.9	0.81	0.87	0.92	0.94
Full bloom (FB)	0.97	1.02	158.2	166.7	26.0	29.1	190.8	199.7	0.80	0.85	0.91	0.93
One week after berry set (BS1)	0.96	1.01	154.5	164.0	25.0	28.2	188.9	197.1	0.78	0.84	0.86	0.90
Two weeks after berry set (BS2)	0.95	1.01	151.2	161.4	24.8	27.5	186.0	195.8	0.77	0.83	0.85	0.90
Three weeks after berry set (BS3)	0.94	1.00	147.7	159.1	24.1	27.0	184.7	194.0	0.74	0.81	0.85	0.89
Four weeks after berry set (BS4)	0.94	0.99	145.9	155.8	23.9	26.4	183.3	192.6	0.74	0.80	0.84	0.88
new L.S.D. at 0.05 =	0.03	0.03	10.3	11.2	1.8	2.9	5.7	7.2	0.05	0.05	0.05	0.03

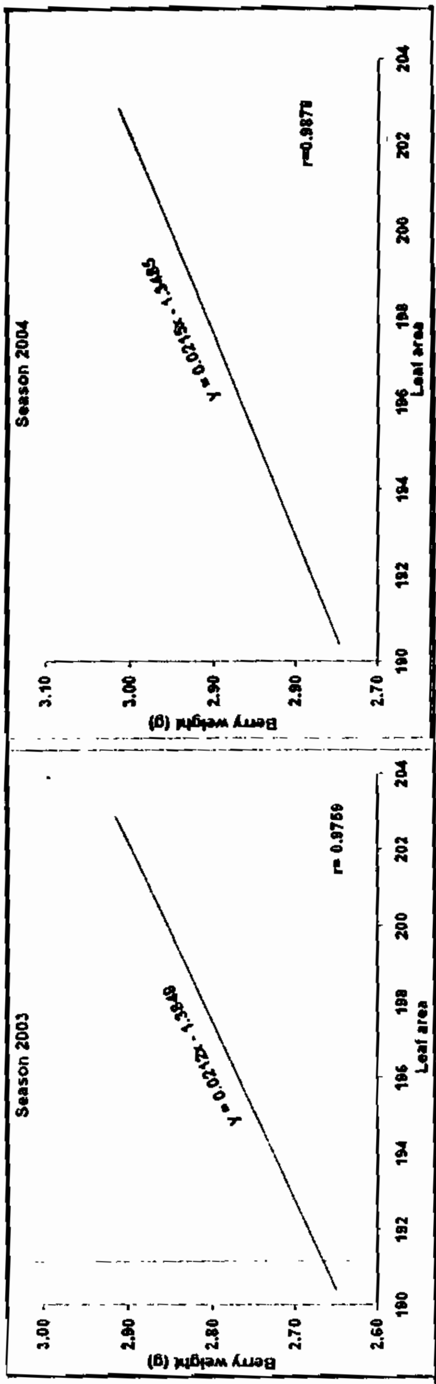

Fig (1): Relationship between leaf area and berry weight

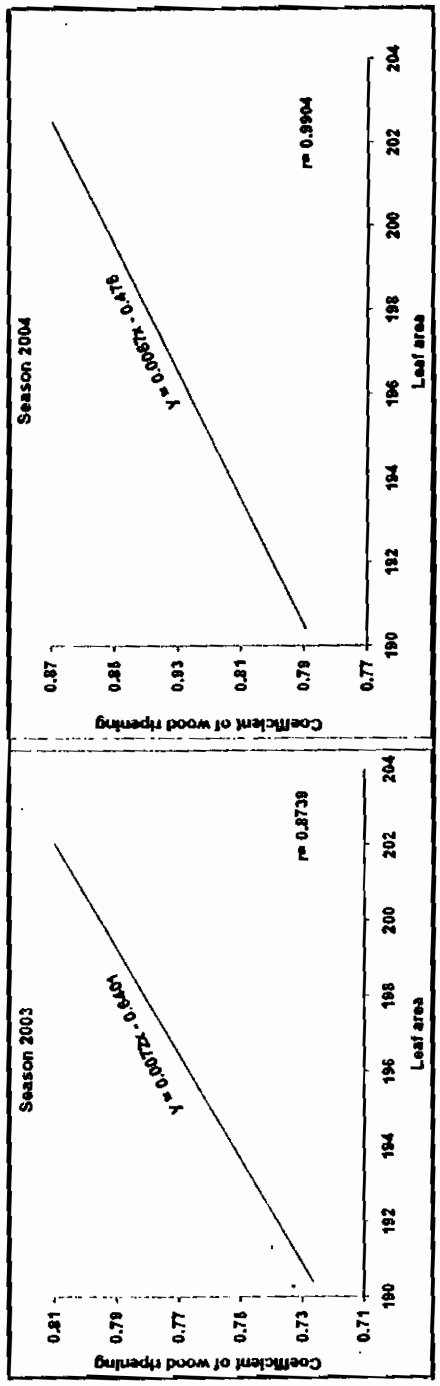

Fig (2): Relationahip between leaf area and coefficient of wood ripening

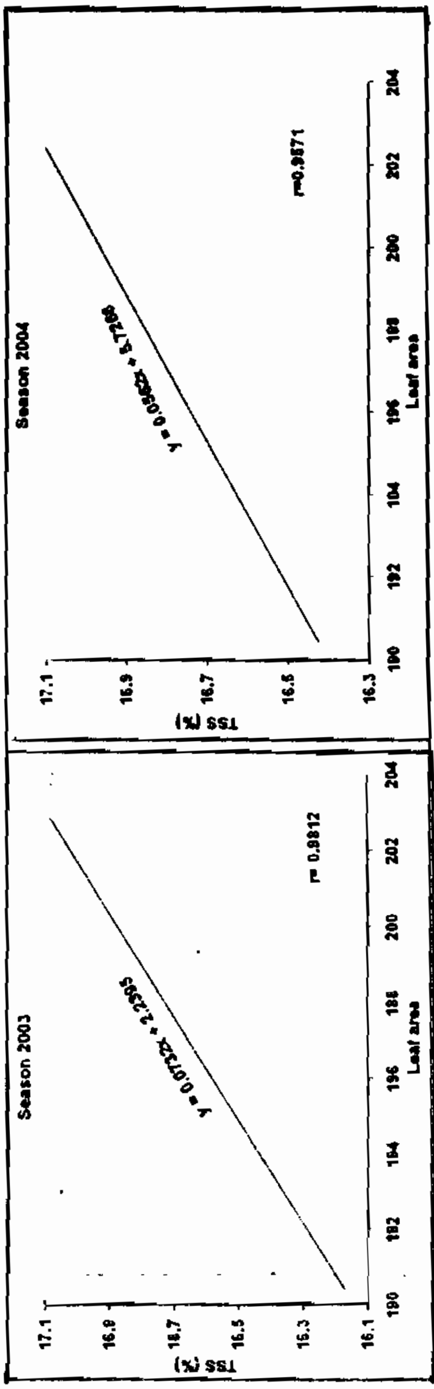

Fig (3): Relationship between leaf area and TSS

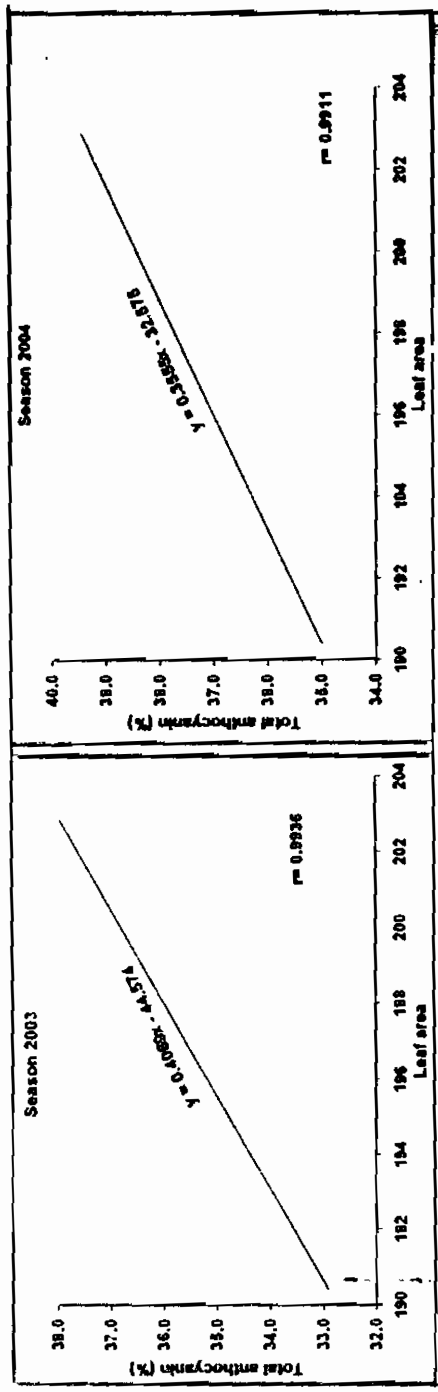

Fig (4): Relationship between leaf area and total anthocyanin content of berry skin

Table (5): Economical justification on the recommended treatment (cluster thinning at one week after berry set) compared with control

Per Feddan	2003		2004	
	BS1	control	BS1	control
Labour cost of cluster thinning (L.E.)	60.0	---	60.0	---
Cost of cultural practices (L.E.)	1600	1600	1800	1800
Total cost (L.E.)	1660.0	1600.0	1860.0	1800.0
Increase of total cost over control (L.E.)	60.0	---	60.0	---
Yield In (Kg)	12898.4	15692.5	13259.9	16102.9
Increase of the yield over control (Kg)	-2794.2	---	-2843.0	---
Yield (L.E.)	13543.3	12554.0	13922.9	12882.3
Price of the Increase in yield over control (L.E.)	989.3	---	1040.6	---
The net profit (L.E.)	11883.3	10954.0	12062.9	11082.3
The net profit (L.E.) over control (L.E.)	929.3	---	980.6	---

In conclusion, it can be said that the quality of Ruby seedless grapes could be easily improved by cluster thinning. The early thinning of clusters before blooming is an advantage to ensure the best vegetative growth parameters and bud fertility. However, vines thinned at one week after berry set (BS1) can be recommended as the best effective treatment. The slight decrease in the yield obtained from this treatment could be compensated by improving physical properties of berries and decreasing percentage of shot berries per cluster, as well as achieving a highest percentage of TSS, better colouration and a lower percentage of acidity in the juice.

REFERENCES

Abd El-Baki, M. S. (2003): Effect of summer pruning and cluster thinning on growth and fruiting of King Ruby grapevines. M.Sc. in Pomolgy Science, Cairo Univ.

Amati, A, Marangoni, B; Zironi, R; Casteffari, M. and Arfelli, (1994): Orientated grape harvesting: The effects of cluster thinning on vine growth and yield parameters. Rivista di viticolture e di Enelogia 47 (2): 13-24.

Amati, A.; Zironi, R.; Marangoni, B.; Amati, A. and Castellari , M. (1997) : The effects of cluster thinning on some ripening parameters and wine quality. Acta Horticulturae, 427:379-386.

Association of Official Agricultural Chemists (1985). Official Methods of Analysis Published by AOAC, Benjamin Franklin Station, Washington DC, USA.

Bessis, R. (1960). Sur Différents Model expression Quantitative Delà fertilité chez la vigne Aca p.p. 828-882.

Bouard, J. (1966). Recherches physiologiques sur la vigne et en particulier pour l'aoutment des sarments. Thesis Sc. Nat Bordeaux-France. Pp.34.

Bucelli, P; and Giannetti, f (1996) : Effect of cluster thinning on grape and wine quality. Rivista di viticolture e di Enologia 49 (2): 59-67.

Cheema, S.S.; Singh, P. and W.S. Dhillon (2003): Effect of crop regulation and canopy management on fruit quality and disease incidence in grape. Indian J. Hort., 60 (3): 208- 213.

Collalto, G. Di; Ferrini, F. and Biricoltis (1991): Results of research on grape cluster thinning in the Tucson-hills. Vignevini 18 (7-8): 39-49.

Cus, F.; Z.K. Kouruza,; B. Koruza, and P. Lavrencic (2004): Influence of crop load and cultivar's dependent canopy management on grape must quality of Sipon, Zametovka and Rebula. Acta Horticulturae, (652): 141-146.

Dokoozlian, NK. and D.J. Hirschfelt (1995): The influence of cluster thinning at various stages of fruit development on Flame Seedless table grapes. Am. J. Enol. Vitic., 46 (4): 429-436.

Donna, H.S. (1993): Effect of cluster thinning at various stages of fruit development on Flame seedless table grape. Dinuba Table Grape Seminar Proceedings, UC cooperative Extension, Fresno country.

Ezzahouani, A. and L.E. Williams (2001): The effects of thinning and girdling on leaf water potential, growth and fruit composition of Ruby seedless grapevines. J. Inter. Sci. de la vigne et du vi 35 (2): 79-85.

Ezzahouani, A. and L.E. WilLiams (2003): Trellising, fruit thinning and defoliation have only small effects on the performance of Ruby seedless grape in Morocco. J. Hort. Sci. Biotech., 78(1): 79-83.

Fawzi, M. F. and E.A. El-Moniem (2003): Effect of girdling alone or combined with flower cluster thinning and ethephon application on fruit set, yield and fruit quality of Black Monukka grape. Arab Univ. J. Agric.Sci. 11(2): 733- 750.

Ferree ‹D.C.; G.A. Cahoon ; D. M. Scurlockand and M.V. Brown (2003): Effect of time of cluster thinning grapevines. Small Fruits Review, 2(1): 3-14.

Harry, A.; Fred J. and P. Elam (1991): Growing quality table grapes in the home garden. University of Califomia pp. (1-30).

Husia, C. L.; B. S. Luh and C. D. Chichester (1965): Anthocyanin in free stone peach. J. Food Science, 30: 5-12.

Kaps, M. L. and Cahoon, G.A. (1989): Berry thinning and cluster thinning influence vegetative growth, yield fruit composition, and net photosynthesis of "Seyval Blanc" grapes; J. Amer. Soc. Hort. Sci., 114 (1): 20-24.

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

Morinaga, K. ; 11. Yakushigi ; V. Kosita ; S. Imai ; J.V. Possingham and G.H. Neilsen (2000): Effect of fruit load levels on root activity, vegetative growth and sugar accumlation in berries of grapevine. Acta Horticulturae, 512: 121-128.

Naor, A.; V. Gal and B. Bravdo (2002): Shoot and cluster thinning influence vegetative growth, fruit yield, and wine quality of Sauvignon blanc grapevines. J. Amer. Soc. Hort. Sci., 127 (4): 628-634.

Nuzzo, V. (2004): Crop load effects on leaf area evolution and light interception In Montepulciano grapevines (*Vitis vinifera* L.) trained to Tendone system. Acta Horticulturae, (652): 133-139.

Palliotti, A.; A. Cartechini ; J.V. Possiugham and Gil. Nelilsen (2000): Cluster thinning effects on yield and grape composition in different grapevine cultivars. Acta Horticulturae, 512: 111-119.

Reynolds, A. G. (1989): Riesling grapes respond to cluster thinning and shoot density manipulation. J. Amer. Soc. Hort. Sci., (3): 364-368.

Rizk-Alla, M. S. (2006): Effect of levels and time of thinning at various stages of fruit development on yield and cluster quality of Crimson seedless grapevines. Egypt J. Appl. Sci., 21(3):262-281.

Rizk, I.A. and F.F. Hassan (1996): Influence of cluster thinning on yield and cluster quality of Thompson seedless grapevines. Fourth Arabic Conf. for Horticultural Crops, Minia.

Rubio, J.A. ; M.V. Alburque and J. Yuste (2004): Influence of water stress and crop load on the physiology and the productivity of tempranillo under semiarid conditions. Acta Horticulturac. (640): 99-106.

Salvador, F. R. D.; Zippo, G, and loreto, G. Di (1996): Techniques for improving the quality of seedless table grapes. Informatore Agrario 52 (3) 74-77.

Schalkwyk. D; Ran Huntex; Hunter J. I. and venture, J. (1995): Effect of cluster removal on grape composition and wine quality of Cv. Chardonnay. South African J. Enol. Viticul., 16 (2):15-25.

Snedecor, G. W. and Cochran. W.G. (1972): Statistical Methods . 6th ed, The Iowa State Univ. . Press . Ames. , Iowa , U.S.A. , pp. 50

Sorokowsky, D. (2000): The effects of cluster thinning and Cinn-free enzyme on the monoterpene content of Chardonnay Musqué. Brock University St. Catharines, Ontario Copyright,

Weaver, R. .1. and K.E. Nelson (1959). Improving grape quality by thinning girdling and plant regulators. California Agric. Exper. Station Extension service leaflet 120.

Winkler, A. J. (1953). Producing table grapes of better quality. Blue Anchor, 30(1): 28-31.

Winkler, A. J. (1962). General Viticulture. University of California Press, Berkeley and Los Angeles. pp. 285-289.

توقيت خف العناقيد كوسيلة لتنظيم الحمل وتأثيره على النمو والمحصول وجودة الثمار لكرمات عنب الروبى سيدلس

عائشة صالح عبد الرحمن جاسر ، هناء أحمد الحلو، محمد عبد العزيز عبد الوهاب
قسم بحوث العنب – معهد بحوث البساتين – مركز البحوث الزراعية بالجيزة – مصر

أجرى هذا البحث لدراسة تأثير خف العناقيد فى مواعيد مختلفة كوسيلة لتنظيم الحمل على النمو والمحصول وجودة ثمار عنب الروبى سيدلس. تم خف ربع عدد العناقيد لكل كرمة من ٣٢ إلى ٢٤ عنقود فى مواعيد مختلفة تمثل مراحل مختلفة من نمو العناقيد: قبل التزهير، قمة التزهير، أسبوع بعد العقد ، أسبوعين بعد العقد ، ثلاثة أسابيع بعد العقد، أربعة أسابيع بعد العقد بالاضافة إلى الكنترول وهى كرمات لم تخف عناقيدها (٣٢ عنقود للكرمة).

أشارت نتائج الدراسة إلى أن الخف المبكر للعناقيد قبل التزهير قد أعطى أفضل نمو خضرى مع زيادة خصوبة البراعم، بينما أدى خف العناقيد بعد العقد بأسبوع إلى حدوث انخفاض طفيف فى المحصول أمكن تعويضه من خلال تحسين الصفات الطبيعية للحبات وخفض النسبة المئوية للحبات الحصرم فى العنقود، بالاضافة إلى زيادة نسبة المواد الصلبة الذائبة الكلية فى عصير الحبات والحصول على أفضل درجة تلوين للحبات كما إنخفضت الحموضة فى عصير الحبات.