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EFFECT OF CLUSTER THINNING ON YIELD, FRUIT QUALITY AND STORAGE LIFE OF RUBY SEEDLESS GRAPES.

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ABSTRACT

This work was carried out during two seasons of 1997 and 1998 to study the effect of cluster thinning on yield, fruit quality and storage life of Ruby seedless grapes. Cluster thinning were performed after fruit set, using removal about 0, 15, 30 and 45% of cluster number combined with removal a last quarter of the cluster to reached about 18-20 cm length per cluster and thinning of berries were performed when berries size reached about 8 mm.

This study revealed that cluster thinning treatments used decreased the yield, shot berries percentage in cluster and acidity in berry juice than the untreated thinning. Increasing cluster removal percentage resulted in increased individual berry weight and size, juice volume, dry matter percentage in berries, T.S.S. content and total anthocyanin in berries skin. Moreover, decreased percentage of shatter, decay, loss in weight and total loss percentage had obtained during storage life than the control.

INTRODUCTION

Grape (*Vitis vinifera*, L.) is one of the most important fruits allover the world. This is due to its high production, which give a high net income to grower.

Recently, different important grape varieties were introduced from the U.S.A. One of these varieties is the heavy yield cultivars Ruby seedless. This cultivar was cultivated in Egypt about 11 years ago, and the area began to increase rapidly to occupy about 10% of the total area of grapes. Previously, it was found that hand thinning plays an important role with some grape varieties (Weaver and Ibrahim, 1968; Mahmoud and El-Wakeel, 1971; Lonney and Wood, 1978; Sarooshi, 1978; Looney, 1981; Prasad and Pathak, 1983; Fregoni and Carazzina, 1985; Ditillon, 1994 and Buchelli *et al*., 1996).

With Ruby seedless grape, the more suitable cluster number were removal not exactly known. Therefore, it is worthy to find out under Dakahlia environmental conditions the suitable number of cluster which could be improve the production, fruit quality and shelf life.

It is very important to give some light on its keeping quality during storage after applying these field practices. In this study, yield determination as well as cluster, berries quality and shelf life will be investigated.

MATERIALS AND METHODS

This investigation was carried out the during two seasons of 1997 and 1998 on 11-year-old King Ruby grapevines in a private orchard at Miniet Samanoud. Dakahlia Governorate. The vines were planted in clay loam soil under the drip irrigation system. The vines at spacing of 2.5 x 3 meters, and trained according to cardon system.

For this study, 60 vines of almost similar vigor, free from diseases were selected at random in 3 blocks. In each block, 4 vines were chosen at random.Crop load at all vines was adjusted to 35-40 bunches / vine prior to anthesis during the two seasons, respectively. The treatments evaluated in the trial are presented in Table 1.

Table 1. Various practices applied.

No.	Treatments
1	Control (untreated vines)
2	Berries thinning
3	15% cluster thinning + Berries thinning
4	30% cluster thinning + Berries thinning
5	45% cluster thinning + Berries thinning

Cluster thinning was performed after fruit set. Hand berries thinning was performed when berries size reached about 8 mm as follows:

1. The first four basal laterals were left.
2. From the fifth to the eighth basal laterals were altematively removed.
3. The last quarter of the cluster was removed so as to have a length of 18-20 cm per cluster.

At harvest, the following determinations were then made for each practice. Average yield per vine and cluster weight were determined. Cluster compactness coefficient was calculated by determining berries / cm lateral (second and third basal laterals) according to Tourky (1977), and shot berries percentage was also determined.

From each treatment, three samples each containing 100 berries were used for physical and chemical determination such as berry weight and size, juice volume, dry matter content, percentage of total soluble solids (by using hand refractometer), total acidity was also determined in berries juice according to A.O.A.C. (1980), T.S.S. / acid ratio and total anthocyanin in skin berries were determined according to Hsia *et al*. (1965).

Studies concerning the storage life of fruits:

Three samples of each practices (each sample was about 5 kgs) were taken to be held (stored) at room temperature (about 27-30°C) and relative humidity about 40-45%. Each sample put in a carton box.

Determination carried out during storage:

Fruits were examined at 3 days interval. A sample of one box was taken in each sampling period to be subjected to the following determinations:

- Percent of loss in cluster weight: It included a reduction due to water loss or any other constituents.
- Percent of shatter (dropped berries).
- Percent of decayed berries.
- Percent total loss (percentage of weight loss, shatter and decayed fruits).

Average of berry weight and size, juice volume, T.S.S., total acidity and T.S.S./acid ratio in berries juice.

The date obtained were statistically analyzed as a randomized block design according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Yield and cluster weight:

Data presented in Table 2 show clearly that berries thinning treatments did not significantly affected the yield. But, cluster thinning treatments combined with berries thinning reduced the yield. The high level of cluster thinning gave a high reduction of yield. The reduction due to cluster thinning combined with berries thinning reached about (5.7, 15.5 and 25%, respectively in the two seasons under the study. Similar results were found by Sarooshi (1977), Looney and Wood (1978), Ditillon *et al*. (1994) and Bucellii (1996).

Table 2. Effect of thinning on yield, cluster weight, cluster compactness factor and shot berries percentage of Ruby seedless grapes during 1997 and 1998 seasons.

Treatments	Yield / vine (kg)		Cluster weight (gm)		Compactness factor*		Shot berries (%)	
	1997	1998	1997	1998	1997	1998	1997	1998
1. Control	24.00	23.87	600.0	596.7	7.50	7.60	8.80	12.80
2	23.60	23.73	590.0	593.3	6.30	6.20	7.26	10.17
3	22.50	22.57	703.0	705.0	6.20	6.20	6.57	8.10
4	20.17	20.30	720.0	725.0	6.10	6.10	6.57	7.33
5	17.77	18.00	740.0	750.0	6.10	6.20	5.97	6.70
L.S.D. at 5%	0.48	0.76	13.5	20.98	0.52	0.36	0.39	0.77

*** Compactness factor: No. of berries / cm lateral (a second and third basal laterals).**
2. Berries thinning. 3. cluster thinning 15% + Berries thinning.
4. cluster thinning 30% + Berries thinning.
4. cluster thinning 45% + Berries thinning.

Concerning the effect of thinning on cluster weight, data in Table 2 indicated that cluster weight did not effect significantly with berry thinning. Ditellon *et al*. (1994) recorded that berry thinning decreased bunch weight. Yet, cluster thinning treatments combined with berry thinning significantly increased cluster weight than the control. The increment reached about 17.7, 20.8 and 24.6%, respectively in the two seasons under the study.

2. Cluster compactness:

It is obvious from Table 2 that all the level of cluster thinning used significantly decreased compactness factor compared with the control. This reduction may be due to use of berry thinning. Interiei *et al*. (1995) and Rizk (1998) suggested that bunch density increased as a result of increasing berry size and to some extent due to increasing berry set. On the other hand, Sarooshi (1977) found in Sultana grape that thinning to 15 bunches / vine produced more compact bunches than 20 bunches / vine.

3. Shot berries percentage in the cluster:

Concerning the effect of hand thinning treatments on shot berries percentage, data presented in Table 2 show clearly that all thinning treatment gave a significant decrease in shot berries percentage than the control. Cluster thinning gave a high reduction of shot berries percentage than the control. Moreover, there were no significant effect between removal about 30 or 45% of cluster in the shot berries percentage.

The data also indicated that berries thinning decreased shot berry percentage than the control. These data go in line with those reported by Ditillon *et al*. (1994).

4. Berry weight size and juice volume:

Data presented in Table 3 indicated that cluster thinning and berries thinning significantly increased both berry weight and size than the control. The increment due to cluster thinning treatments reach about 13.6, 39.6, 43.2 and 47.6%, respectively in the two seasons. Moreover, cluster thinning treatments gave the most effective values in berry weight and size than berries thinning treatments and the control. The results of this study are in agreement with Ditillon *et al*. (1994).

Concerning the effect of cluster thinning treatments on juice percent, the data in Table 3 indicated that all thinning treatments used were significantly increased juice volume in the berries than the control.

5. Dry matter and moisture contents:

With regard to the effect of cluster and berries thinning treatments used on dry matter, data in Table 3 revealed that all treatments used significantly increased dry matter in the berries than the control. Moreover, the highest values in this respect were obtained from cluster thinning. The high level of cluster thinning treatments produced higher dry weight content.

Data also revealed that all hand thinning of cluster and berries thinning significantly decreased berries moisture content than the control.

6. Total soluble solids, acidity and T.S.S. / acid ratio:

Data presented in Table 4 show clearly that all thinning treatments used significantly increased total soluble solids than the control. Moreover, the high level of cluster thinning treatment produced higher T.S.S. percentage in berries juice.

Wood and Looney (1978), Amati *et al*. (1995) and Bucelli (1996) indicated that cluster thinning gave higher sugar content and lower the percent of acidity. Also, Ditilon *et al*. (1994) found that berries thinning increase T.S.S. content and decreased total acidity in berry juice.

The data also show clearly that all thinning treatments used significantly decreased total acidity than the untreated vine in the two seasons under the study. Similar results were found by Lanin (1983) in Moscatel Rosada grapevine.

Table 4. Effect of thinning on T.S.S., acidity, T.S.S. / acid ratio and total anthocyanin of Ruby seedless grapes during 1997 and 1998 seasons.

Treatments	T.S.S (%)		Acidity (%)		T.S.S. / acid ratio		Total anthocyanin	
	1997	1998	1997	1998	1997	1998	1997	1998
1. Control	16.20	16.33	0.693	0.697	23.33	23.47	0.080	0.073
2	17.17	17.00	0.680	0.683	25.23	24.90	0.130	0.127
3	17.50	17.60	0.673	0.673	26.00	26.27	0.133	0.133
4	17.50	18.00	0.667	0.667	26.27	27.03	0.140	0.133
5	17.67	18.10	0.660	0.660	26.77	27.47	0.140	0.133
L.S.D. at 5%	0.89	0.58	0.019	0.021	1.53	1.04	0.021	0.019

2. Berries thinning. 3. cluster thinning 15% + Berries thinning.
4. cluster thinning 30% + Berries thinning.
4. cluster thinning 45% + Berries thinning.

7. Total anthocyanin:

Concerning the effect of thinning treatments on total anthocyanin, the results in Table 4 disclosed that all cluster thinning and berries thinning treatments used significantly increased the total anthocyanin in the skin berries than the control. Moreover, the high level of cluster thinning gave the best result in this respect. Yet, the data revealed that cluster thinning and berries thinning were necessary to improve the colour of Ruby seedless grapevines.

8. Effect of thinning on fruit during room storage:

8.1. Berry weight, size and juice volume:

Data presented in Table 5 indicated that berries weight and size with all treatments gradually decreased as the storage period (from 3 to 9 days) in the two seasons under this study. Cluster thinning gave the lowest reduction in this respect compared with the control.

Data in Table 5 show that the juice volume took nearly the same trend that found with berry weight and size. Also, cluster thinning treatments gave the lowest reduction in juice volume at the end of storage period than the control during the two seasons under study.

8.2. Total soluble solids, total acidity and T.S.S. / acid ratio:

Data in Table 6 indicated that T.S.S. increased gradually as the storage prolonged. Moreover, cluster thinning treatments gave the highest values of T.S.S. The high level of cluster thinning gave the best result in this respect than the control during the two seasons of study.

Table 6 show also that all treatments gradually decreased as storage period prolonged. It is clearly that cluster thinning treatments gave the high reduction on acidity on the berries juice.

From the same table, it is obvious that all treatments were almost similar to that found with T.S.S. The highest values of the T.S.S. / acid ratio were gained at the end of storage from all thinning treatments used.

Table 5. Effect of thinning on weight, size and juice volume of Ruby seedless grapes stored at room temperature during 1997 and 1998 seasons.

Treatments	1997 season								
	Weight of 100 berries			Size of 100 berries			Juice volume of 100 gm berries		
	Period in days								
	3	6	9	3	6	9	3	6	9
1. Control	216	210	206	215	208	202	74.5	73.2	72.5
2	248	240	239	230	220	210	75.5	74.3	74.2
3	306	300	295	290	285	276	76.4	75.5	75.2
4	309	302	297	298	285	275	76.3	75.7	75.3
5	309	303	297	308	305	285	76.7	75.7	75.7
L.S.D. at 5%	4.53	1.64	29.23	12.80	8.68	8.76	0.60	0.49	0.83
	1998 season								
1. Control	214	210	204	205	195	188	74	73	72
2	246	239	230	222	215	210	76	75	73
3	305	295	290	290	285	280	77	76	75
4	306	297	291	300	290	285	77	75	75
5	308	299	293	307	293	287	77	76	75
L.S.D. at 5%	9.63	7.62	14.39	15.90	12.50	12.90	0.90	1.60	1.90

2. Berries thinning. 3. cluster thinning 15% + Berries thinning.
4. cluster thinning 30% + Berries thinning.
4. cluster thinning 45% + Berries thinning.

8.3. Total loss:

Concerning the effect of cluster thinning and berries thinning treatments on the total loss percentage in clusters held under room temperature, Table 7 revealed that total loss which includes loss in fruit weight, loss attributed to decaying organisms and loss imputed to fruit shatter were increased gradually through storaged under room temperature. The control vines gave the highest weight loss. On the other hand, all cluster thinning treatments used gave a significant decrease on total loss percentage than the control in the two seasons under this study.

Moreover, cluster thinning treatments used significantly decreased the percentage of shatter and decay than the control. The high level of cluster thinning treatments gave the best results in this respect.

Table 6. Effect of thinning on T.S.S., acidity and T.S.S. / acid ratio of Ruby seedless grapes during 1997 and 1998 seasons.

Treatments	1997 season								
	T.S.S. (%)			Total acidity (%)			T.S.S. / acid ratio		
	Period in days								
	3	6	9	3	6	9	3	6	9
1. Control	16.7	16.9	17.0	0.68	0.66	0.65	24.6	25.6	26.6
2	17.8	17.8	18.0	0.67	0.65	0.63	26.6	27.5	28.6
3	17.9	18.1	18.2	0.66	0.64	0.62	27.1	28.3	29.4
4	18.0	18.2	18.3	0.66	0.63	0.61	27.3	28.8	30.0
5	18.2	18.3	18.4	0.65	0.63	0.61	28.0	29.1	30.2
L.S.D. at 5%	0.23	0.16	0.17	0.02	0.01	0.01	0.08	0.13	0.97
	1998 season								
1. Control	16.6	16.8	16.9	0.69	0.67	0.64	24.1	25.1	26.4
2	17.5	17.8	18.0	0.67	0.65	0.63	26.1	27.4	28.6
3	17.9	18.2	18.4	0.66	0.64	0.61	27.1	28.4	30.2
4	18.4	18.7	18.9	0.65	0.64	0.61	28.3	29.2	30.9
5	18.5	18.8	19.0	0.65	0.63	0.60	28.5	29.8	31.7
L.S.D. at 5%	0.72	0.27	0.06	0.03	0.03	0.03	2.05	0.16	0.12

2. Berries thinning. 3. cluster thinning 15% + Berries thinning.
4. Cluster thinning 30% + Berries thinning.
4. Cluster thinning 45% + Berries thinning.

Finally, we can conclude see that cluster thinning combined with berries thinning are necessary to improve the quality of cluster such as cluster weight, berry weight and size, T.S.S., berries colour, decreased shot berries percentage in cluster and decreased compactness factor in the cluster. Moreover, decreased the total loss through stored under room temperature compared with the control.

The high level of cluster thinning ranged from 30 and 45% reduced the yield about 15.5 and 25.5%. The best treatments of cluster thinning was remove about 15% of the number of cluster.

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تأثير الخف على المحصول وجودة الثمار والتخزين للعنب الروبى سيدلس0

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أجرى هذا البحث خلال موسم 1997 و 1998 لدراسة تأثير خف العناقيد والحبات على المحصول وجودة الثمار وأثر ذلك على التخزين لصنف العنب الروبى سيدلس0 وقد أجرى خف للعناقيد بعد العقد0 وقد أجريت المعاملات الآتية:-

1- خف للحبات فقط0
2- خف 15% من عدد العناقيد الكلى + خف الحبات0
3- خف 30% من عدد العناقيد الكلى + خف الحبات0
4- خف 45% من عدد العناقيد الكلى + خف الحبات0

وقد تم خف الحبات وإزالة الطرف الأخير للعنقود حتى نصل لطول العنقود 18-20 سم عند وصول حجم الحبات حوالى 8 مم0

وقد أوضحت الدراسة أن خف الحبات فقط لم يؤثر على المحصول ولكن خف العناقيد مع خف الحبات أدى إلى نقص معنوى فى المحصول وقد أدت أيضا معاملات الخف إلى نقص ملحوظ فى نسبة الحبات الصغيرة ونسبة الحموضة فى العصير0

وقد زاد حجم ووزن الحبات وحجم العصير والمادة الجافة وزيادة تلوين و .T.S.S فى الحبات مع نقص معامل التزاحم بالعنقود0 وقد أدت أيضا معاملات خف العناقيد إلى تقليل نسبة الفاقد الكلى فى العنقود وأثناء فترة تداول العنب لمدة 9 أيام0 وقد قلت نسبة الأعفان والفرط فى العنقود عن الكنترول0

وقد أوضحت الدراسة أيضاً أن أحسن معدل لخف العناقيد كان إزالة حوالى 15% من عدد العناقيد على الكرمة حيث أن زيادة الخف عن ذلك (30-45%) أدى إلى نقص كبير فى المحصول حوالى 15.5 - 25% من المحصول الكلى للكرمة0

Table 3. Effect of thinning on berry weigh, berry size, juice volume, dry matter and moisture content percentage during 1997 and 1998 seasons.

Treatments	Berry weight / 100 berries (gm)		Berry size / 100 berries (ml)		Juice volume / 100 berries (ml)		Dry matter (%)		Moisture content (%)	
	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
Control (untreated vines)	230.0	225.0	220.0	210.3	75.33	75.00	17.20	17.20	82.80	82.80
Berries thinning	260.0	256.7	240.0	230.0	76.67	77.00	17.67	17.90	82.33	82.10
15% cluster thinning + Berries thinning	320.0	315.0	300.0	295.0	77.33	78.00	18.33	18.50	81.67	81.50
30% cluster thinning + Berries thinning	330.0	321.7	310.0	305.0	77.33	78.00	18.53	18.67	81.97	81.33
45% cluster thinning + Berries thinning	340.0	331.7	320.0	315.0	77.67	78.67	18.57	18.70	81.34	81.30
L.S.D. at 5%	20.63	13.15	16.84	9.42	1.11	1.85	0.26	0.25	0.26	0.25

Table 7. Effect of thinning on weight loss, decay, shattering and total loss of Ruby seedless grapes during 1997 and 1998 seasons.

Treatments	1997 season											
	Weight loss (%)			Decay (%)			Shattering (%)			Total loss %		
	Period in days											
	3	6	9	3	6	9	3	6	9	3	6	9
1. Control	5.30	6.60	15.80	4.10	6.20	13.50	2.60	5.90	6.90	12.00	18.70	36.20
2	5.20	6.20	14.10	3.10	5.20	12.10	2.20	5.40	6.60	10.50	16.50	32.80
3	4.90	6.00	14.00	3.30	5.50	11.90	2.20	5.40	6.40	10.40	16.10	32.30
4	5.20	6.00	13.90	3.60	5.90	12.80	2.40	5.40	6.60	11.20	17.30	33.30
5	5.80	5.90	13.80	3.70	5.80	12.90	2.30	5.20	6.70	11.30	16.90	33.40
L.S.D. at 5%	0.21	0.20	0.22	0.22	0.2	0.20	0.22	0.17	0.2	0.54	0.43	0.22
	1998 season											
1. Control	6.30	7.60	16.80	5.10	7.20	14.50	3.60	6.90	7.90	15.00	21.70	39.20
2	5.30	6.60	14.00	4.30	6.60	13.80	3.10	5.50	7.50	12.70	18.70	35.30
3	6.00	7.10	14.60	4.50	6.70	13.60	3.20	5.50	7.30	13.70	19.10	35.40
4	5.10	6.20	14.10	4.20	6.10	13.80	3.30	5.90	7.30	12.60	18.40	35.20
5	4.90	6.20	13.90	4.30	6.30	13.90	3.20	5.60	7.20	12.50	19.10	35.00
L.S.D. at 5%	0.20	0.18	0.20	0.20	0.18	0.16	0.30	0.22	0.52	0.45	0.34	0.22

2. Berries thinning. 3. cluster thinning 15% + Berries thinning.
4. cluster thinning 30% + Berries thinning.
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