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(Original Article)

Impact of Pinching, Cluster Thinning and Girdling on Productivity and Quality Attributes of Ruby Seedless Grapevines Grown at Warm Region

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Abstract

The experiment was executed over the consecutive seasons of 2020 and 2021 on the grape cultivar Ruby Seedless growing at the experimental orchard of Assiut University, Faculty of Agriculture. Thirty vines planted in clay soil were selected for this study. The selected vines were at the same vigour and age and at the beginning of the experiment and obtained the same horticultural practices.

The selected vines were subjected to the following treatments: (Five vines/treatment), Pinching of the new shoots, Cluster thinning of the second cluster, girdling the arms, Pinching + Cluster thinning of the second cluster. Pinching + Thinning of the second cluster + Girdling the arms and Control.

Total yield weight, cluster measurements, berry attributes as well as the quality of grape berries were determined.

The obtained results suggested that all the treatments and their combinations were effective in enhancing productivity and berry quality of Ruby Seedless grape cultivar.

Keywords: *Grapes; Topping; Berry quality; Anthocyanins*

Introduction

The grape (*Vitis vinifera* L.) is considered one of the most important fruit crop all over the world. It became the second most popular crop in Egypt after citrus. During the past decade, the vineyards' area has grown significantly.

One of the most significant commercial fruit crops grown in temperate to tropical regions is the grape (Gowda *et al*., 2008).

The grape is becoming of prime importance due to its superior taste, high nutritional value, high contents of antioxidants, and higher returns. The consumption of table grapes has been increasing rapidly and consistently worldwide.

Around the world, grapes are grown on an estimated 7.8 million hectares of surface area in 100 different countries. Grape berries consumed fresh or after

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possessing including wine, jam, juice, grape seed extract, dried grapes, vinegar, and grape seed oil.

The consumption of table grapes has increased rapidly. With an annual production of 67.55 million tons. According to the Ministry of Agriculture statistics, the grape cultivation area in Egypt reached around 187358 feddans, produced about 1183968 tons (2020). In both domestic and international markets, the Ruby Seedless cultivar is considered one of the most significant table grapes.

Girdling, which involves removing a small strip of phloem from the area around the arm (about 2 mm in width), has been used for a long time to produce large grape berries meant for eating or to speed up fruit maturity by improving berry coloration or sugar accumulation and to increase berry size, and homogenize cluster maturity.

The treatment of "cluster thinning" is frequently used in vineyards because it is effective in enhancing berry quality. Additionally, according to Mohamed *et al.*, (2019), cluster thinning led to an improvement in juice quality (TSS, TSS/acidity, and Total anthocyanin) compared to the control.

Cluster thinning is a mean to regulate yield that involves removing a portion of the cluster; as a result, the yield per leaf area will be decreased and the quality of the grapes and wine will increase Fazekas *et al* (2012).

The removal of any vegetative tissues during the growing season, including shoot topping, removal of leaves, removal of cluster tendrils if present, and tipping, pinching, and topping of shoots, constitutes summer pruning. This procedure is crucial for the health, training, vigor, quality, and productivity of the vines. Abd El-Ghany (2005)

In order to its great fruitfulness, Ruby Seedless is one of the most famous table grape cultivars for both domestic and foreign markets. Due to its great nutritional content and several health benefits, it ripens in the late middle of the season and provides dark red crisp fruit that is delicious and juicy (Al- Obeed *et al*., 2010 and Asmaa and Aboryia, 2020). The problems facing this cultivar in the production areas are its small berry size, poor color, and high sensitivity to downy mildew and cluster compactness which can result in a significant loss in output and quality (Belal *et al*, 2016). The abundance of clusters/berries and the increased density of shoots (shading) have a detrimental effect on the quality small fruit size and poor coloring (El-Akad *et al*., 2021).

Therefore, determining the ideal number of clusters for this cultivar is important to obtain the desired berry quality either for domestic or exportation. With its very rapid growth and great fruitfulness, Ruby Seedless grape is regarded as one of the most widely grown seedless cultivars in Egypt. As a result of its exceptional nutritional qualities and marketability, it is widely accepted. According to the visual descriptor suggested by the International Organization of Vine and Wine, this cultivar has a significant production issue because its clusters are quite tall, compactness, and have an unattractive appearance (Mohamed *et al*

2019) For this cultivar to be produced sustainably, more horticultural practices are required.

The aim of this study is to examine the potential effects of notch of the new shoots, girdling, or pinching as well as cluster thinning on yield and berry quality improvement of Ruby Seedless grapes.

Materials and Methods

This experiment was executed during two consecutive seasons of 2020 and 2021 on the grape cultivar Ruby Seedless growing at the Experimental Orchard of Assiut University Faculty of Agriculture Assiut University. Thirty vines, identical in growth and and age planted in clay soil, were selected for this study and obtained the same horticultural practices.

The selected vines were subjected to the following treatments (Five vines/ treatment).

T1 – Pinching of the new shoots.

T2 – Cluster thinning of the second cluster.

T3 – Girdling the arms.

T4 –Pinching + Cluster thinning of the second cluster.

T5 – Pinching + Thinning of the second cluster + Girdling arms)

T6 – Control (no treatment)

Measurements

Yield

At ripening, when TSS % in berry reached about 16-17 % in control, sound clusters /vine were weighted, and average cluster weight was determined and then the average cluster weight was multiplied by the total number of clusters/vine to determine the estimated yield weight/vine.

Physical properties

A sample of 5 clusters /vine was taken to determine the average cluster weight (g), average cluster length and width (cm), 100 berries weight (g), 100 berries juice volume (cm^3) berry length and width (cm).

Chemical properties

Total soluble solids content (TSS %) was determined by using a hand refractometer.

Total acidity percentage was determined according to A.O.A.C. (1980).

TSS/acid ratio was calculated by dividing the percentage of TSS by total acidity.

Total anthocyanins of the berry skin (mg/100g fresh weight) were determined according to Husia *et al.* (1965).

Reducing sugars (%) was determined according to A.O.A.C. (1980).

Statistical analysis

The complete randomized block design was adopted for the experiment. As well as the combined analysis over two years was done. The statistical analysis of the present data was carried out according to Snedecor and Chocran (1980). Treatment Means were compared using the new L.S.D. values at 5% level of the probability.

Results

1.) Yield components

Data presented in Table 1 shows the treatment effects on yield components of Ruby Seedless grape cultivar in 2020 and 2021 years of study.

1.1.) Yield weight (kg/vine)

The obtained results are found in Table 1. The presented data revealed that with an exception of pinching + cluster thinning + girdling in the 1st season, the other treatments significantly increased yield weight. The prevalent treatment in this respect was pinching which recorded 14.28 kg/vine during the 1st year of study. Girdling and then pinching + cluster thinning produced 12.59 and 12.19 kg/vine in the 1st season, respectively. While in the 2nd year pinching + cluster thinning, pinching + cluster thinning + girdling and then pinching gave the highest yield weight with no significant differences between them.

As an average of the two seasons of study, the obtained results suggested that the treatments significantly surpassed the untreated vines. The best treatment was pinching followed by pinching + cluster thinning, and thin girdling and pinching + cluster thinning + girdling treatments.

These treatments recorded an increment % of 33.55, 25.46, 17.10 and 15.72, over the control vines, respectively.

1.2.) Cluster weight (g)

The effect of various treatments on cluster weight (g) of Ruby Seedless grape cultivar is found in Table 1.

Table 1. Effect of pinching, cluster thinning and girdling on yield and cluster weight of Ruby Seedless grape cultivar

Characteristic Treatment	Yield Weight (Kg/vine)			Cluster weight (g)		
	2020	2021	Mean	2020	2021	Mean
Pinching	14.28 A	14.78 A	A 14.53	300.41 C	303.05 C	C 301.73
Cluster thinning	11.77 C	11.88 C	D 11.83	363.12 A	375.51 A	A 369.32
Girdling	12.59 B	12.88 B	C 12.74	259.37 D	328.20 B	C 293.79
Pinching + Cluster thinning	12.19 BC	15.12 A	B 13.65	318.12 B	390.00 A	B 354.06
Pinching + Cluster thinning + Girdling	10.13 D	15.04 A	C 12.59	311.25 BC	382.10 A	B 346.68
Control	10.52 D	11.25 D	E 10.88	263.60 D	281.20 D	D 272.40

The presented data revealed that, with an exception of girdling during the 1st season of study, the treatments significantly exceeded the control. The superior treatments in the 1st season were cluster thinning, pinching + cluster thinning and pinching + cluster thinning + girdling. The cluster weight of such treatments recorded 363.12, 318.12 and 311.25 (g), respectively. During the 2nd season of study, the same previous treatments represented the highest cluster weight with no significant differences between them. On the other side, the control produced the least cluster weight.

Table 1 shows two seasons' average data of cluster weight. All the treatments statistically were significant compared with the control. The best treatment in this respect was cluster thinning. It significantly surpassed all the other treatments. The increment percentage of this treatment was 35.58% over the control. Pinching + cluster thinning and pinching + cluster thinning + girdling recorded a higher cluster weight with no significant differences between them. The increment percentages of cluster weight for these two treatments were 29.98 and 27.27% over the control vines, respectively.

2.) Cluster measurements

Table 2 shows the impact of pinching, cluster thinning and girdling on cluster length, width and L/D ratio of Ruby Seedless grapevines during 2020 and 2021 years of study.

2.1.) Cluster length (L) (cm)

Data found in Table 2 demonstrated that during the 1st season, pinching + cluster thinning + girdling surpassed the other treatments in respect of the cluster length. This treatment produced cluster length of 25.7 (cm), while the other treatment had no significant differences compared with the control. During the 2nd season of study, with an exception of pinching + cluster thinning and girdling, the treatments significantly exceeded the control. The best treatments were pinching and cluster thinning followed by pinching + cluster thinning + girdling.

On the other side, two seasons' average data demonstrated that only pinching + cluster thinning + girdling and pinching had a significant effect on cluster length. They recorded 24.15 and 23.15 (cm), respectively while the control gave 21.70 (cm).

2.2.) Cluster width (W) (cm)

The results found in Table 2 showed the effect of various treatments on cluster width (cm) of Ruby Seedless grapevines. The presented data revealed that in the 1st year, the control and pinching + cluster thinning + girdling produced the highest values with no significant differences between them. While the rest of treatments had no significant effect compared with the control. During the 2nd season of study, only pinching + cluster thinning + girdling significantly surpassed all the other treatments.

Table 2. Effect of pinching, cluster thinning and girdling on cluster measurement of Ruby Seedless grape cultivar

Characteristic Treatment	Cluster length (cm)			Cluster width (cm)			Cluster L/W ratio		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
Pinching	22.0 B	24.3 A	B 23.15	17.1 C	12.7 D	C 14.90	1.30 A	1.93 A	A 1.61
Cluster thinning	19.1 C	23.1 AB	CD 21.10	17.8 BC	15.2 C	B 16.50	1.07 B	1.53 B	CD 1.30
Girdling	22.8 B	17.8 E	D 20.30	17.9 BC	12.2 D	C 15.05	1.27 A	1.48 B	BC 1.38
Pinching + Cluster thinning	16.9 D	21.7 CD	E 19.30	13.0 D	14.1 C	D 13.55	1.33 A	1.54 B	B 1.43
Pinching + Cluster thinning + Girdling	25.7 A	22.6 BC	A 24.15	20.2 AB	21.1 A	A 20.65	1.28 A	1.07 C	DE 1.18
Control	22.5 B	20.9 D	C 21.70	22.3 A	18.9 B	A 20.60	1.03 B	1.10 C	E 1.07

2.3.) Cluster L/W ratio

Data presented in Table 2 revealed that the treatments, with an exception of cluster thinning during the 1st season and pinching + cluster thinning + girdling in the 2nd on significantly surpassed the control respecting the cluster L/W ratio. During the 1st season of study, the superior treatments had not significant differences between them. During the 2nd season of study, pinching significantly exceeded all the other treatments. Data from the two years showed that the treatments with an exception of pinching + cluster thinning + girdling significantly got over the check treatment. The superior treatment in this respect was pinching which recorded ratio of 1.61 while the control gave the least ratio.

3.) Berry attributes

The results concerning various berry attributes as affected by pinching, cluster thinning and girdling are found in Tables 3 and 4.

3.1.) 100 berries weight (g)

Table 3 demonstrated that, during the 1st season of study, the treatments showed no significant differences, while during the 2nd season of study the differences were significant compared with the control. The highest values were pinching + cluster thinning, girdling and pinching + cluster thinning + girdling. The differences between these treatments were not significant.

On the other side, two seasons' average data showed that all the treatments significantly surpassed the control. Pinching + cluster thinning, girdling and cluster thinning produced the highest weight of 100 berries. The increment percentages of such treatments recorded 16.59, 15.27 and 12.10% over the control, respectively.

3.2.) 100 berries juice weight

Table 3 shows the effect of various treatments on 100 berries juice weight of Ruby Seedless grape cultivar during 2020 and 2021 seasons.

During the 1st season of study, the presented data (Table 3) revealed that girdling and cluster thinning significantly produced the highest juice weight (g) (159.20 and 130.67 g, respectively). While the other treatments had not a significant effect compared with the control. The best treatments in this respect were pinching + cluster thinning + girdling, pinching + cluster thinning and girdling. They produced 128.00, 125.84 and 124.80 (g) of juice, respectively. Two seasons' average data showed that all the treatments had a significant effect on this trait. Girdling, pinching + cluster thinning + girdling and pinching + cluster thinning recorded the highest juice weight of 100 berries. The increment percentage of these treatments was 25.40, 23.19 and 21.84%, over the untreated vines, respectively.

Table 3. Effect of pinching, cluster thinning and girdling on 100 berry weight and juice weight of Ruby Seedless grape cultivar

Characteristic Treatment	100 berries weight (g)			100 berries juice weight (g)		
	2020	2021	Mean	2020	2021	Mean
Pinching	212.80 A	179.20 C	A 196.00	130.05 BC	107.20 B	C 118.62
Cluster thinning	214.00 A	187.04 BC	A 200.52	130.67 B	108.80 B	C 119.74
Girdling	210.00 A	202.40 A	A 206.20	159.20 A	124.80 A	A 142.00
Pinching + Cluster thinning	211.50 A	205.60 A	A 208.55	129.74 BC	125.84 A	BC 127.79
Pinching + Cluster thinning + Girdling	192.00 A	200.00 AB	A 196.00	130.40 BC	128.00 A	B 129.20
Control	198.40 A	159.36 D	B 178.88	114.40 C	95.36 C	D 104.88

3.3.) Berry dimensions

The effect of treatments on berry length (L) (cm), berry diameter (D) (cm) and L/D ratio is presented in Table 4.

3.3.1.) Berry length (L)

During the 1st season of study, Table 4 showed that pinching + cluster thinning + girdling followed by pinching + cluster thinning and pinching recorded the highest berry length.

During the 2nd season, there were no significant differences between the treatments.

Two years average data showed that the treatments with an exception of cluster thinning significantly exceeded the control.

3.3.2.) Berry diameter (D)

Data in such Table demonstrated that during the 1st season only cluster thinning had a significant effect while in the 2nd season pinching and pinching + cluster thinning + girdling recorded the highest values. Two seasons average.

Data from two season's average suggested that pinching + cluster thinning + girdling and pinching followed by cluster thinning significantly surpassed the rest of treatments.

3.3.3.) L/D ratio

During the 1st season, the treatments with an exception of cluster thinning and girdling had a significant effect. During the 2nd season of study there were no significant effects of the treatments compared with the control.

Two seasons average data showed that only pinching + cluster thinning + girdling gave a significant effect while the other treatments did not significantly differ compared with the control.

Table 4. Effect of pinching, cluster thinning and girdling on berry size and dimension of Ruby Seedless grape cultivar.

Characteristic / Treatment	Berry length (cm)			Berry diameter (cm)			Berry L/D ratio		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
Pinching	1.55 AB	1.42 A	A 1.49	1.34 BC	1.39 A	AB 1.37	1.16 B	1.02 BC	BC 1.09
Cluster thinning	1.51 B	1.31 B	B 1.41	1.40 A	1.31 BC	ABC 1.36	1.07 C	1.00 C	D 1.04
Girdling	1.51 B	1.45 A	A 1.48	1.38 AB	1.26 C	CD 1.32	1.09 C	1.15 A	AB 1.12
Pinching + Cluster thinning	1.55 AB	1.46 A	A 1.50	1.33 C	1.34 AB	BCD 1.34	1.16 AB	1.08 AB	AB 1.12
Pinching + Cluster thinning + Girdling	1.63 A	1.45 A	A 1.54	1.36 ABC	1.38 A	A 1.37	1.20 A	1.05 BC	A 1.13
Control	1.48 B	1.43 A	B 1.46	1.34 BC	1.31 BC	D 1.32	1.10 C	1.10 AB	B 1.10

4.) Chemical constituents

The effect of various treatments on chemical characteristics of Ruby Seedless berries was found in Tables 5 & 6.

4.1.) Total soluble solids (TSS %)

Data presented in Table 5 showed that, during the 1st season of study the treatments of pinching + cluster thinning + girdling and then cluster thinning represented the highest percentage of TSS. These treatments recorded 22.6 and 21.1%, respectively, while the other treatments showed non-significant differences compared with the control. During the second season of study, the treatments, with an exception of pinching, significantly exceeded the control. Cluster thinning and pinching + cluster thinning + girdling gave the highest percentage (17.9%) followed by girdling and pinching + cluster thinning (16.6%). Control produced the lowest percentage of TSS during the two seasons of study. With an exception of pinching, the treatments significantly exceeded the control as an average of 2 seasons.

4.2.) Total acidity %

During the 1st season of study the control and girdling recorded the lowest acidity percentage while during the 2nd season, most of the treatments had no significant effect compared with the control. Two seasons' average data showed that there were no significant differences between the treatments and the control.

4.3.) TSS/acid ratio

The results found in Table 5 showed the effect of various treatments on TSS/acid ratio of Ruby Seedless grapes during 2020 and 2021 seasons.

Table 5. Effect of pinching, cluster thinning and girdling on TSS, acidity and TSS/acid ratio of Ruby Seedless grape cultivar

Characteristic Treatment	Total soluble solids %			Total acidity %			Total soluble solids/Acid ratio		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
Pinching	19.4 C	16.0 BC	CD 17.70	0.41 BC	0.44 A	A 0.42	47.19 AB	36.69 BC	C 41.94
Cluster thinning	21.1 AB	17.9 A	AB 19.48	0.42 ABC	0.39 AB	AB 0.41	50.19 AB	45.99 A	A 48.09
Girdling	19.9 BC	16.6 B	C 18.24	0.38 CD	0.40 AB	B 0.39	52.66 A	41.97 AB	AB 47.31
Pinching + Cluster thinning	20.4 BC	16.6 B	BC 18.50	0.46 A	0.39 AB	A 0.43	44.70 B	42.85 A	BC 43.77
Pinching + Cluster thinning + Girdling	22.6 A	17.9 A	A 20.26	0.46 AB	0.38 B	AB 0.42	49.69AB	47.11 A	A 48.36
Control	18.7 C	15.2 C	D 16.95	0.36 D	0.43 A	AB 0.39	53.13 A	35.63 C	ABC 44.38

The presented data showed that during the 1st season, the control recorded the highest ratio followed the girdling. During the second season of study, the treatments mostly exceeded the control. The highest value in this respect was taken from pinching + cluster thinning + girdling followed by cluster thinning and then pinching + cluster thinning. Two season's average data showed that pinching + cluster thinning + girdling and cluster thinning produced the highest ratio of TSS/acid followed by girdling.

4.4.) Reducing sugars %

Table 6 showed that, during the 1st year of study pinching and cluster thinning and then cluster thinning recorded the highest percentage of reducing sugars. Their percentages were 19.61 and 18.10%, respectively. In the 2nd year of experiment, most of treatments significantly got over the check treatment. The cluster thinning recorded the highest percentage (15.74%) followed by pinching (15.58%) and thinning pinching + cluster thinning (15.31%) and girdling (15.17%), while the control gave the least value.

Two season's average data suggested that pinching + cluster thinning recorded the highest percentage of reducing sugars followed by cluster thinning. The percentage of reducing sugars associated with such treatments were 17.46 and 16.92%, respectively.

4.5.) Total anthocyanins (mg/100 g)

Data found in Table 6 show the effect of various treatments on total anthocyanin content of Ruby Seedless grapes during 2020 and 2021 seasons of study. The results demonstrated that, during the 1st season of study pinching + cluster thinning and then girdling represented the highest content of anthocyanins while the other treatments had not a significant impact compared with the control. During the 2nd season, most of the treatments were significant and surpassed the untreated vines. The previous two superior treatments in the 1st year also produced the highest anthocyanin content during the 2nd one.

The two studied years average (Table 6) suggested that girdling and pinching + cluster thinning recorded the highest values followed by pinching and pinching + cluster thinning + girdling.

Table 6. Effect of pinching, cluster thinning and girdling on reducing sugars and total anthocyanins of Ruby Seedless grape cultivar.

Characteristic Treatment	Reducing sugars %			Total Anthocyanin (mg / 100 g fruit)		
	2020	2021	Mean	2020	2021	Mean
Pinching	16.35 BC	15.58 A	BC 15.97	29.10 B	27.22 B	B 28.16
Cluster thinning	18.10 AB	15.74 A	AB 16.92	24.13 B	21.44 D	C 22.79
Girdling	15.58 C	15.17 AB	C 15.38	34.50 A	31.50 A	A 33.00
Pinching + Cluster thinning	19.61 A	15.31 AB	A 17.46	35.77 A	30.20 A	A 32.99
Pinching + Cluster thinning + Girdling	17.29 BC	14.78 BC	BC 16.04	28.48 B	26.44 B	B 27.46
Control	17.06 BC	14.11 C	C 15.59	25.08 B	23.99 C	C 24.54

Discussion

Pinching or shoot topping is a horticultural practice commonly executed in vineyards. This involves removing the tip of the shoot to avoid it becoming too long, so it will be better balanced and give bigger bunches. This practice will also ensure more consistent shoots for next year in terms of thickness and buds. Pinching also helps to clear and open the vine rows. Results of the present study revealed that pinching the shoots significantly surpassed all the other treatments. The effectiveness of this treatment in increasing the yield weight might be attributed to the carbohydrate content and C/N ratio of the pinched shoots were larger and reflected in increasing the berry weight and decreasing the shot berries (Klin *et al*., 1987). Kadhum (2009) found that shoot pinching had the highest significant impact on berry setting and yield quantity compared to the non-treated vines. Results of the present study came online with abovementioned studies as well as with those reported by El-Salhy *et al*. (2009) and Bassiony (2020).

Cluster thinning is removing shoulders or even whole clusters from the vine. This practice will help alter the crop load. By removing the clusters, we decrease

the number of berries that receive nutrients and photosynthesis from the vines which leads to improve the quality of the remaining clusters. Clusters can be removed from the vines at any time between fruit set and near veraison but it is better to do it earlier to get effective results under the conditions of the present study, cluster thinning by removing the 2nd cluster significantly increased cluster and berry weight and improved the berry quality. The effectiveness of cluster thinning increased when combined with pinching. The results of our study came on line with that reported by Myriathouses (1966), James *et al*. (1983), Dokoozlian and Hirschfelt (1995), Gamerol *et al*. (2014), Abd-El-Wahab (2006), Prajitna *et al*. (2007), Reynolds *et al*. (2007), Rathea *et al*. (2011), Fazekas *et al*. (2012), Matteo Gatti *et al*. (2012), Nurhan Keskin *et al*. (2013), El-Kenawy (2018) Bassiony (2020) and El-Kenawy (2022)

Girdling executed by cutting out a thin strip of bark from around the trunk or arms by using a special knife. This practice interrupts the flow of carbohydrates down making more food available for the fruit.

The time of girdling differs according to its purpose. If the purpose is to increase the fruit set, then it conducts early after flowering. If the purpose to improve the fruit characteristics, then it takes place at or just before fruit maturation. Girdling was effective in increasing the vine productivity and berry quality. The results are accordant with that reported by Myriathoasis (1966), Novello *et al*. (1999), Ezzahouani (2000), Yahuaca *et al* (2006) Lee *et al*. (2010), AbuZahra (2010), Koshita *et al*. (2011), Ferrara *et al* (2014) Belal (2016) Gawankar *et al* (2019) and El-Salhy *et al*. (2021). They demonstrated that girdling had great impact on vine productivity and improving berry quality of various grape cultivars.

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تأثير التطويش وخف العنقود والتحليق على الانتاجية وخصـــائص جودة الحبات في كروم العنب الروبي سيدليس النامية في منطقة حارة

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الملخص

أجري هذا البحث على مدى موســمين متتاليين (2020 و2021) على صــنف العنب الروبي عديم البذور في البستان التجريبي بكلية الزراعة جامعة أسيوط. تم اختيار ثلاثين كرمة زرعت في تربة طينية لهذه الدراسة وحصلت على نفس الممارسات البستانية. كانت الكروم المختارة في نفس القوة والعمر في بداية التجربة وحصــلت على نفس الممارســات البســتانية. تم إخضــاع الكروم المختارة للمعاملات التالية: (خمسة كروم / معاملة)، التطويش /خف العنقود الثاني / تحليق الأذرع / التطويش + خف العنقود الثاني / التطويش + خف العنقود الثاني + تحليق الأذرع.

عند نضـج المحصـول تم جمع العناقيد لكل كرمة واحصـاء العدد الكلي ثم وزن المحصـول ومنهما تم حساب وزن العنقود. ثم أخذت عناقيد عشوائيا لتقدير الصفات الطبيعية والكيماوية مثل صــفات العنقود وخصــائص الحبات ومكوناتها الكيماوية من الســكريات والحموضــة وصــبغة الأنثوسيانين.

أوضـحت النتائج المتحصـل عليها أن جميع المعاملات ومجموعاتها كانت فعالة في تحسـين المحصول وجودة الحبات لصنف عنب روبي الخالي من البذور.