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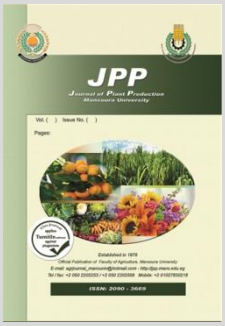
Effect of Different Levels of Pruning on Growth, Yield and Fruit Quality of Prime Seedless Grapevines under Gable Supporting System

Thoraua S. A. Abo-ELwafa*

Viticulture Department, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt.



ABSTRACT

This study was conducted through two consecutive seasons (2019 and 2020) seasons at a private vineyard at El-Khatatba region, Minufyia Governorate. The chosen vines were 7-years old, grown in a sandy soil, spaced at 2 X 3 meters, irrigated by the drip irrigation system, trellised by gable supporting system**.** Vines were trained to quadrilateral cordon and spur-pruned. Three different levels of pruning were used, namely (48 & 60 &72 nodes vine) under three different lengths of the nodes (2-3-4 nodes) with different number of fruiting spurs.Results show that the vines were pruning at levels 24 spurs×2 nodes (48 nodes /vine) gave the highest significant values of busted buds and bud fertility percentages, shoot length, number of leaves, leaf surface area, total chlorophyll in leave Nitrogen, the content of phosphorous, potassium and magnesium in leave, as well as improved physical characteristics of clusters and berries, TSS, % and TSS/acid ratio, while decreased total acidity in berries. On the other hand, the vines were pruning at levels 18 spurs/4 nodes (72 nodes / vine) gave the highest significant values of yield per vine.

Keywords: Grapevines, prime grapevines, spur- pruned, vegetative growth, yield and fruit quality.

INTRODUCTION

Grape (*Vitis vinifera*, L) is considered one of the most important fruit crop in the world. In Egypt, it is considered the second major fruit crop after citrus. Egypt takes an important position in viticulture of the world and ranks 13th place in grape production, where the total cultivated area of grape in Egypt reached about 200.000 feddans among them about 185.000 feddans fruitful with a total production about 1.7 Million tons according to the statistics of the (Ministry of Agriculture, 2020).

Prime grapevine is a large seedless berry with a creamy white color. The high sugar level gives this grape a sweet flavor with a hint of Muscat and an extremely high juice level. Prime is a very early ripening cultivar, has an amber colour, a Muscat flavour, crisp taste and excellent shelf life (Perl *et al*, 2003) .Prime is very fertile and can be spur pruned or with half long bearers, depending on the growing area (Van Der Merwe, 2014).

The vegetative growth, yield and its components of Prime grapevine are greatly influenced by the buds load per vine. Therefore pruning and buds load are an obvious management technique developed to regulate the balance among vegetative growth, yield and fruit quality of grapes (Senthilkumar *et al.*, 2015). Coban and Kara, (2002); Fawzi *et al.*, (2015) and Abdle Hamid *et al.*, (2015) found that pruning is considered the most important practice through which grape production and fruit quality can be improved. The bad use of pruning by leaving a lower or higher number of buds / vine were always accompanied by some negative effects on yield of all grapevines cultivars. Adjusting vine load seems to be very major for achieving a balance required between growths and fruiting of the vines. Yield and its components, and fruit quality of the Prime grapevine are attached to the number of buds which retained after winter pruning.

Pruning practices adopted in the vineyard are largely dependent on vine growing environment, variety and season. Further, pruning largely not only influences the productivity in terms of fruitfulness of a particular variety but also the quality of grape, berry size, TSS and sugar (Kumar *et al*., 2017). Abo Elwafa (2018) noticed that pruning Early Sweet grapevine at 24 spurs× 2 buds (48bud/ vine) enhanced bud behavior, vegetative growth, wood ripening, physical characteristics and weight of pruning. In addition, total carbohydrates in canes. On the other hand, the level load of 24spurs × 4 buds (96 bud / vine) gave the highest yield / vine in both years. Munkvold *et al.*, 1994; Van Niekerk *et al.*, 2005, 2006 and 2010) illustrated that pruning of grapevines and all agricultural practices done every winter led to maintain the balance among vegetative growth and reproductivity. Jard, (2004) reported that the purpose of pruning is to obtain maximum vegetative growth, yield and fruit quality grapes.

The grapes crop industry is constantly seeking for new technologies able to improvement the overall sustainability of the production systems together with an enhancement of yield and quality.

The present study aimed to study the effect different levels of pruning (buds load) on vegetative growth, yield and fruit quality of Prime grapevine CV.

MATERIALS AND METHODS

This study was carried out during two consecutive (2019 and 2020) experimental season in a private vineyard at El-Khatatba, Menoufiya governorate, Egypt on Prime grapevines cultivar. The vines were Seven-years-old, grown in a sandy soil, spaced at 2 X 3 meters apart, irrigated by the drip irrigation system, trellised by the Gable supporting system. Vines were trained to quadrilateral cordon and spur-pruned. Three different levels of pruning were used, namely (48 & 60 &72 nodes / vine) under three different spur lengths of the buds (2-3-4 nodes) with different number of fruiting spurs. The experiment consisted of nine treatments arranged in a randomized complete block design, a hundred and eight uniform vines were chosen. Each four vines

* **Corresponding author.**
E-mail address:
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acted as a replicate and each three replicates acted as treatment. The vines were pruned during the last week of December during the two seasons of study .All vines received the same cultural managements recommended by ministry agriculture.

The study included the following treatments:

T_1- pruning at 24 fruiting spurs ×2 nodes= 48 nodes
T_2- pruning at 16 fruiting spurs ×3 nodes= 48 nodes
T_3- pruning at 12 fruiting spurs ×4 nodes= 48 nodes
T_4- pruning at 30 fruiting spurs ×2 nodes =60 nodes
T_5- pruning at 20 fruiting spurs ×3 nodes =60 nodes
T_6- pruning at 15 fruiting spurs ×4 nodes =60 nodes
T_7- pruning at 36 fruiting spurs ×2 nodes =72 nodes
T_8- pruning at 24 fruiting spurs ×3 nodes =72 nodes
T_9- pruning at 18 fruiting spurs ×4 nodes =72 nodes

The following parameters were conducted:

Bud behavior: the following measurements were recorded during the two seasons 2019 and 2020**.**

- Bud burst percentage: numbers of buds were counted one month after bud burst and the percentage of bud burst were calculated according to Bessis (1960).

$$Bud\ burst\% = \frac{\text{No of bursted buds per vine}}{\text{Total buds per vine}} x100$$

- Bud fertility percentage: number of clusters per vine were counted and divided by the total number of buds according to Bessis(1960).

$$\text{Bud fertility\%} = \frac{\text{No of clusters per vine}}{\text{no of Total buds left at winter pruning}} \times 100$$

Vegetative growth parameters: vegetative growth parameters were determined after fruit set.

- Average shoots length (cm): twenty vegetative shoot were measured as average (cm),
- Number of leaves were calculated according to (El-Ashram 1993).
- Average leaf area (cm^2): twenty leaves / vine were picked at veraison of the apical 6th and 7th leaves using a CI-203-Laser Area-meter made by CID, Inc., Vancouver, USA.
- Chlorophyll content in the leaves: sixth and seventh leaves from the tip of the growing shoots were used for the determination of total chlorophyll content in the leaves after two weeks from last treatment according to (Mackinny, 1941).

N, P, K and Mg content in the leaves: at full bloom, samples of 20 leaf petioles per each replicate were taken from leaves opposite to cluster were used for the determination of N, P and K according to (Cottenie *et al*., 1982).

Yield and physical characteristics of clusters: harvesting indices (TSS% and acidity %) were weekly monitored from version till maturity when TSS reached about 16-17% according to Tourk *et al.,* (1995). Average cluster length (cm), Average cluster width (cm), average cluster weight (g) and yield/ vine were calculated.

physical characteristics of berries: average 50 berry weight (g), average berry diameter (mm) and average berry length (mm) were measured.

Chemical characteristics of berries: Total soluble solids (TSS % in berry juice using a hand refract meter, total treatable acidity (as tartaric acid %) according to the Official Analysis Methods (A.O.A.C., 2000) and TSS / acid ratio were calculated.

Statistical analysis :

The complete randomized block design was adopted for the experiment. The statistical analysis of the present data was carried out according to Snedecor and Cochran (1980). Average was compared using the new L.S.D. values at 5 % level.

RESULTS AND DISCUSSION

Bud behavior (bud burst and bud fertility percentages):

Results in Table (1) revealed that bud burst and bud fertility percentages were significantly affected by different levels of pruning. The vines were pruned at 24 spurs ×2 nodes followed by the vines pruned at 16 spurs ×3 nodes (48 nodes / vine) gave the highest significant values of busted buds and bud fertility as compared with other treatments and non-significant difference between of them, while the vines pruned at24 spurs ×3nodes and the vines pruned at 18 spurs ×4 nodes (72 nodes /vine) recorded the lowest significant values of bud burst and bud fertility percentages in the two seasons of study. Also, the data show that the vines pruned under level (48 nodes /vine) gave non-significant difference between of them on bud fertility percentage in both seasons. These data go in line with Khamis *et al.,* 2017 and Abo-ELwafa (2018) who reported that early sweet vines which were pruned at 24 spurs×2 nodes (48 nodes / vine) gave the highest significant value of bud burst and bud fertility percentages as compared with 48 spurs×2 nodes (96 nodes / vine) during both seasons.

Table 1. Effect of different levels of pruning on bud behavior of Prime grapevines during 2019 and 2020 seasons

Characteristics		Bud burst (%)		Bud fertility (%)	
Treatments		2019	2020	2019	2020
48 nodes	24 spurs ×2 nodes	96.67	98.67	56.33	56.67
	16 spurs ×3 nodes	96.00	98.33	55.67	56.0
	12 spurs ×4 nodes	92.67	82.67	55.33	56.33
60 nodes	30 spurs ×2 nodes	92.67	94.67	54.67	55.33
	20 spurs ×3 nodes	91.33	80.67	52.67	53.67
	15 spurs ×4 nodes	90.00	78.0	51.33	53.33
72 nodes	36 spurs ×2 nodes	90.33	72.67	53.0	52.33
	24 spurs ×3 nodes	89.00	69.33	51.67	52.33
	spurs ×4 nodes 18	89.00	69.33	50.67	49.0
New LSD at 5%		1.29	2.28	1.58	2.14

Vegetative growth (shoot length, number of leaves and leaf area as well as chlorophyll content in the leaves):

It was evident from the obtained results in Table (2) that the vines were loaded with (48 buds/vine) recorded the greatest values of shoot length, number of leaves, leaf surface area and total chlorophyll in the leaves as compared with the vine were loaded with and (60 and 72 nodes /vine) during the two seasons. On the other side, the vines pruned at (72 nodes / vine) gave the lowest values of shoot length, number of leaves, leaf surface area and total chlorophyll in the leaves in both seasons. Also, data show that the vines were pruned at 24 spurs ×2 nodes followed by the vines were pruned at 16 spurs ×3 nodes gave the highest significant values in this respect as compared with other treatments and non-significant difference between of them of shoot length and number during the two seasons. The positive effect of light or moderate buds load/ vine on enhancing vegetative growth parameters may be due to reducing the competition among the shoots, promote bursting of laterals buds, growth and leaf elongation. Bassiony, (2020). These results are in agreement with Senthilkumar *et al*., (2015); Ali and Moumen (2016) and Alin, *et al.,* (2016). Also, Abo ELwafa (2018) reported that the highest shoot length, leaf area and chlorophyll A and B were recorded on the vines that pruned at (48 eyes/vine) as compared with (60 and 72 eyes /vine). Bassiony, (2020) found that the lightest buds load level (20 buds/ kg. of pruning wood weight) recorded the highest significantly values of laterals number/ shoot, laterals length and leaf area followed by (30 and 40 buds/ kg. of pruning wood weight), respectively, on "Flame seedless" grapevines.

Table 2. Effect of different levels of pruning on shoot length, number of leaves, leaf surface area and total chlorophyll in the leaves of Prime grapevines during 2019and 2020 seasons

Characteristics		Shoot length (cm)		Number of leaves		Leaf surface area(cm^2)		Total chlorophyll (mg\g F.W)	
Treatments		2019	2020	2019	2020	2019	2020	2019	2020
48 nodes	24 spurs ×2 nodes	153.0	174.0	26.33	26.67	99.55	103.8	39.55	40.43
	16 spurs ×3 nodes	151.67	173.67	25.67	26.33	96.96	100.81	36.96	39.80
	12 spurs ×4 nodes	146.0	171.0	25.33	26.00	94.17	99.7	36.16	39.40
60 nodes	30 spurs ×2 nodes	145.0	165.33	24.67	25.33	93.43	99.62	34.17	39.00
	20 spurs ×3 nodes	144.33	156.0	23.00	23.67	92.87	97.59	33.98	38.50
	15 spurs ×4 nodes	138.33	153.33	22.67	23.33	92.85	95.09	33.76	38.40
72 nodes	36 spurs ×2 nodes	136.33	152.0	21.67	22.33	92.62	96.14	33.32	37.57
	24 spurs ×3 nodes	129.0	149.33	21.33	22.33	92.22	94.9	32.85	37.57
	spurs ×4 nodes 18	123.33	149.33	20.67	19.00	91.32	94.32	30.10	37.27
New LSD at 5%		12.42	9.35	1.58	2.14	1.02	1.41	0.83	0.47

N, P, K and Mg content in the leaves:

Results in Table (3) revealed that the vines pruned at 24 spurs×2 nodes followed by the vines pruned 16 spurs × 3 nodes (48 nodes /vine) registered that the highest percentage of nitrogen, phosphorous, potassium and magnesium compared with other treatments in both seasons. On the other hand, the lowest mean percentage of nitrogen, potassium and magnesium was obtained when the vine pruning at 18 spurs × 4 nodes (72 nodes /vine) in both seasons of this study. These results as a general are in agreement with (Weaver, 1976 and Ali *et al*, 2016). Also, Abo ELwafa, (2018) found that the vines pruned at (48 nodes /vine) gave the highest percentage of nitrogen, phosphorous, potassium and magnesium compared with (72 nodes /vine) and (96 nodes /vine) in both seasons of study.

Table 3. Effect of different levels of pruning on N, P, K and Mg of Prime grapevines in 2019 and 2020 seasons

Characteristics		N		P		K		Mg	
Treatments		2019	2020	2019	2020	2019	2020	2019	2020
48 nodes	24 spurs ×2 nodes	1.57	1.66	0.37	0.41	1.48	1.48	0.48	0.50
	16 spurs ×3 nodes	1.49	1.49	0.32	0.36	1.40	1.43	0.38	0.40
	12 spurs ×4 nodes	1.42	1.49	0.15	0.22	1.27	1.32	0.32	0.32
60 nodes	30 spurs ×2 nodes	1.32	1.33	0.13	0.14	1.14	1.2	0.38	0.38
	20 spurs ×3 nodes	1.33	1.37	0.13	0.13	1.12	1.13	0.35	0.33
	15 spurs ×4 nodes	1.35	1.34	0.30	0.32	1.06	1.1	0.35	0.34
72 nodes	36 spurs ×2 nodes	1.41	1.40	0.25	0.30	1.0	1.0	0.32	0.38
	24 spurs ×3 nodes	1.33	1.37	0.20	0.21	1.1	1.11	0.32	0.35
	spurs ×4 nodes 18	1.31	1.33	0.23	0.25	0.98	1.02	0.32	0.32
New LSD at 5%		0.12	0.08	0.02	0.02	0.03	0.03	0.03	0.04

Yield and physical characteristics of clusters and berries:

Effect of different of pruning levels on cluster weight, yield /vine, cluster length and width as well as, 50 berries weight, berry diameter and length, of Prime grapevines are presented in (Table 4 and 5). The obtained results show that the vines loaded with (48 buds/vine) produced the highest significant values of cluster weight, cluster length and width, 50 berries weight, berry diameter and length, while produced the lowest significant values yield /vine as compared to the vines loaded with (60 and72 nodes /vine) in both seasons. On the other hand, the vines loaded with (72 nodes /vine) recorded highest significant values of yield /vine, while produced the lowest significant values of cluster weight, cluster length and width 50 berries weight, berry diameter and length in both seasons. However the treatments of 24 spurs×2 nodes and 16 spurs/3 nodes recorded the highest significant values of cluster weight, cluster length and width, 50 berries weight, berry diameter and length, while recorded the lowest significant values yield /vine as compared with treatments in both 2019 and 2020 seasons and non-significant differences between of them. On the other hand, the treatments of 24 spurs×3 nodes and 18 spurs/4 nodes recorded the highest significant values of yield /vine, while produced the lowest significant values of cluster weight, cluster length and width, 50 berries weight, berry diameter and length and non-significant differences between of them in both seasons. In general, the gradual increasing in load of pruning from (48 nodes /vine) to (60 nodes /vine) (72 nodes /vine) was accompanyed by increasing in number of buds which were left on vines during winter pruning, which led to an increased in number of busted buds, consequently increased clusters number and yield/vine, but clusters weight were decreased.

Table 4. Effect of different levels of pruning on cluster weight, yield /vine, cluster length and width of Prime grapevines in 2019 and 2020 seasons

Characteristics		Cluster weight(g)		Yield/vine(kg)		Cluster width (cm)		Cluster length (cm)	
Treatments		2019	2020	2019	2020	2019	2020	2019	2020
48 nodes	24 spurs ×2 nodes	566.67	576.00	10.00	12.50	19.67	20.33	22.33	23.00
	16 spurs ×3 nodes	550.00	556.67	11.15	13.00	19.33	20.33	21.67	23.00
	12 spurs ×4 nodes	533.33	541.67	11.50	13.00	18.67	20.00	21.67	22.67
60 nodes	30 spurs ×2 nodes	450.00	503.33	13.00	13.00	18.00	19.00	20.33	21.00
	20 spurs ×3 nodes	450.00	483.33	13.50	13.90	18.00	18.67	19.67	20.67
	15 spurs ×4 nodes	433.33	463.33	13.50	14.50	17.33	18.67	19.33	20.33
72 nodes	36 spurs ×2 nodes	383.33	433.33	16.00	15.10	17.33	18.67	19.33	20.00
	24 spurs ×3 nodes	333.33	433.33	16.50	15.60	16.33	18.33	19.33	20.00
	18 spurs ×4 nodes	371.67	416.67	17.00	16.25	16.67	18.00	19.00	19.67
New LSD at 5%		50.33	42.95	1.51	0.88	0.48	0.73	0.74	0.76

The positive effect of sever pruning (low buds load level) on physical characters may be due to the reduction of clusters number per vine, which reduces the competition between clusters. Our results are agreement with (Omar and Abd El-kawi 2000; Aly, 2001, Ansam 2002; EL-Baz *et al.*, 2002; Abd El-Hamid *et al.*, 2015; Fawzi *et al.*, 2015; Ali and Moumen, 2016; Serhii and Antonina 2018 and Ghobrial, 2018) they found that increasing of buds load/vine led to increased cluster number and

total yield/vine, while decreased cluster weight, berry weight, and berry diameter and length. Also, Abo-ELwafa, (2018) reported that the highest values of cluster weight, berry weight and size were recorded when the vines were pruned at (48 nodes /vine) as compared to (72 and 96 nodes /vine) in both seasons, while the vines which were pruned at (96 nodes /vine) gave the maximum yield per vine and the minimum of berry weight and size.

Table 5. Effect of different levels of pruning on 50 berries weight, berry diameter and berry length of Prime grapevines in 2019 and 2020 seasons

Characteristics		50 berries weight (g)		Berry diameter(mm)		Berry length(mm)	
Treatments		2019	2020	2019	2020	2019	2020
48 nodes	24 spurs ×2 nodes	291.67	313.00	27.67	27.67	24.33	25.00
	16 spurs ×3 nodes	290.00	311.67	26.33	26.67	23.67	24.33
	12 spurs ×4 nodes	248.33	285.33	25.67	26.67	23.67	24.67
60 nodes	30 spurs ×2 nodes	235.00	264.00	26.33	27.00	24.33	25.00
	20 spurs ×3 nodes	230.00	260.00	25.33	26.00	23.33	24.00
	15 spurs ×4 nodes	225.00	241.33	25.67	26.33	23.33	23.00
72 nodes	36 spurs ×2 nodes	213.33	233.33	24.67	25.33	22.67	20.67
	24 spurs ×3 nodes	203.33	221.67	23.67	24.33	21.33	22.33
	spurs ×4 nodes 18	203.33	225.00	23.33	23.67	19.67	20.33
New LSD at 5%		18.42	17.18	0.45	0.45	0.54	0.96

Chemical characteristics of berries:

Effect of different buds load levels on TSS, Acidity % and TSS/acid ratio of Prime grapevines are listed in Table (6). The obtained results cleared non-significantly difference among all treatments which were pruned at (48 and 60 nodes / vine) on TSS and TSS/acid ratio in both seasons of Prime grapevines cultivar. Since, the vines were pruned by leaving 24 spur× 2 nodes gave the highest values of total soluble solids content and TSS/acid ratio and the lowest values of total acidity as compared with other treatments in both seasons. The obtained results go in line with those by, Ansam (2002) and Cangi and Klc (2011). Also, Abo ELwafa (2018) found that the vines pruned at (48 buds / vine) 12 spur ×4 nodes and 24spur × 2 nodes gave the highest total soluble solids content and decreased Acidity compared with treatments (72 nodes /vine) and (96 nodes /vine) respectively in both seasons of study. (Dhillon 2004; Almanza-Merchan *et al.,* 2014 and Sabbatini *et al.,* 2015). Beside, Rizk *et al.,* (1994) and Abd El-Wahab (1997) they noticed that total soluble solids of grape berries was not affected by treatments of bearing unit length. In this trend

Table 6. Effect of different of pruning on TSS, acidity% and TSS/acid ratio of Prime grapevines in 2019 and 2020 seasons

Characteristics		TSS		Acidity(%)		TSS/acid ratio	
Treatments		2019	2020	2019	2020	2019	2020
48 nodes	24 spurs ×2 nodes	17.0	17.00	0.73	0.70	23.29	24.28
	16 spurs ×3 nodes	16.33	17.33	0.93	0.73	17.55	23.73
	12 spurs ×4 nodes	16.67	17.00	0.87	0.80	19.16	21.25
60 nodes	30 spurs ×2 nodes	16.67	17.33	0.80	0.73	22.83	23.73
	20 spurs ×3 nodes	16.67	17.33	0.83	0.73	20.08	23.73
	15 spurs ×4 nodes	16.67	17.67	0.87	0.67	19.16	26.37
72 nodes	36 spurs ×2 nodes	16.67	16.33	0.93	0.90	19.00	18.14
	24 spurs ×3 nodes	16.33	17.00	0.87	0.80	18.77	21.25
	18spurs ×4 nodes	16.33	17.00	0.97	0.90	16.83	18.88
New LSD at 5%		0.55	0.47	0.06	0.08	13.97	3.41

CONCLUSION

From aforementioned results, it was found that thereis a relation between different levels of pruning and yield and physiochemical characteristics of clusters and berries. The gradual increasing in pruning /vine from (48 nodes / vine) to (60 nodes / vine) or (72 nodes / vine) led to a gradual increasing in clusters number and yield/vine, while gave a gradual decreasing in physiochemical characteristics of clusters and berries. The vine which were loaded at 12 spurs ×6 nodes (72 nodes / vine) recorded the highest significant values of yield/vine ,while the vines which were loaded at 24 spurs ×2 nodes (48 nodes / vine) recorded the highest significant values on nutritional status in vines, vegetative growth parameters and physiochemical characteristics of clusters and berries.

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تأثير مستويات مختلفة من التقليم الشتوى على النمو والمحصول وصفات الجودة لعنب البرايم سيدلس تحت نظام تدعيم الجيبل

ثريا صابر على أبوالوفا*

قسم بحوث العنب - معهد بحوث البساتين – مركز البحوث الزراعيه – الجيزة

أجريت هذه الدراسة خلال موسمي (2019 & 2020) فى مزرعة خاصة بالخطاطبه - محافظة المنوفيه على كرمات عنب البرايم سيدلس عمرها 7سنوات ومنزرعة فى تربة رمليه تروى بنظام الرى بالتنقيط وعلى مسافة زراعة 3x2 م ومرباه بطريقة الكردون الرباعى تحت نظام تدعيم الجيبل . وقد استهدف هذا البحث دراسة تأثير مستويات مختلفة من حمولة البراعم على سلوك العيون والنمو الخضرى والمحصول وجودة الثمار لعنب البرايم سيدلس .حيث تم استخدام ثلاث مستويات مختلفة من حمولة البراعم وهى (48-60-72عين / كرمه) تحت ثلاثة أطوال مختلفة للدوابر (2-3-4عين / دابرة) مع عدد دوابر ثمرية مختلفة وقد أظهرت النتائج أن هناك علاقة بين مستويات التقليم المختلفة والمحصول والخصائص الفيزيائية والكيميائية للعناقيد والحبات. حيث أدت الزيادة التدريجية في حمولة البراعم / الكرمة من (48 عين / كرمة) إلى (60عين / كرمة) أو (72 عين / كرمة) إلى زيادة تدريجية فى المحصول / كرمة ، بينما أعطت تناقصًا تدريجيًا في الخصائص الفيزيائية والكيميائية للعناقيد والحبات وقد سجلت الكرمات التي تم تقليمها ب 18(دابره × 4 عين) (72عين/ كرمة) أعلى قيم معنوية للمحصول /كرمة ، بينما سجلت الكروم التي تم تحميلها عند (24 دابره × 2عين) (48 عين/كرمة) أعلى القيم المعنوية على الحالة الغذائية في الكروم ومعايير النمو الخضري والخصائص الفيزيائية والكيميائية للعناقيد والحبات.

الكلمات الدالة : العنب - البرايم سيدلس - حمولة البراعم – التقليم الدابرى- المحصول وجودة الحبات