



Effect of Pruning Levels on Yield and Fruit Quality of Melody (Blagratwo) Seedless Table Grape Cultivar



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Abstract: Three years old uniform vines for cv. "Melody syn. Blagratwo" seedless table grape were selected, and three levels of bud load were trimmed, namely 60, 72, and 78 buds/ vine. The findings revealed that vegetative growth traits, characteristics of yield and bunch quality were significantly affected by all different pruning levels of cane length in both seasons of this study. Highest bud load vines (78 buds/vine) produced the greatest yield and cluster number but had a negative effect on the percentage of bud behavior, shoot thickness, shoot length, weight of annual pruning (Kg/vine), cluster and berry quality parameters. In contrast, lowest vine bud load (78 buds/vine) had a better bud behavior, vegetative growth traits, cluster characteristics and berry characteristics but both bunch numbers and yield were reduced. In addition, vines pruned with bud load of 72 buds per vine significantly showed the best outcomes, since it successfully struck a balance between features of vegetative growth, yield, cluster and berry physical and quality attributes in both seasons.

1 Introduction

As a result of their excellent nutritional and medicinal value, grapes are a highly well-liked fruit. All around the world, grapes are farmed, and farmers profit more from them than from other types of crops. Grapes include various vital components that are important in prevention of some health problems. The grape is a very significant fruit in the globe and is occasionally referred to as the king of fruits (Khan et al 2020). Citrus is the most popular fruit crop in Egypt, and grapes are second one. Numerous experts have been working to identify effective and dependable techniques to boost grape output and quality due to a rise in demand for premium grapes on a global scale. (Abed EL-Hamied et al 2017). According to the

most recent statistics from the (M.A.L.R. 2020), the total cultivated area of grapevine in Egypt reached around (187358feddan), fruit area (133811feddan), yield (8.848ton/feddan) and producing about 1183968 tons. The grape is one of the world's tastiest, energizing, and healthiest fruits. The berries are an excellent source of nutrients and carbohydrates. In both seedless and seeded varieties, crop load has the greatest impact on yield, cluster quality, and vine vigour. Therefore, maintaining an optimal canopy size and bunch count per vine is necessary to provide superior fruit quality, which calls for careful balance of vigour and capacity. (Senthilkumar et al 2015). Pruning is regarded as the most crucial procedure for raising grape production and enhancing cluster quality. (Fawzi et al 2010, Cangi and Kilic 2011). For every grape cultivar to maximize potential output and quality, pruning must

be standardized according to the variety. Local grape producers' practice of pruning all mature canes to fruit bud level leads in increased exploitation of food reserves, which lowers the quality and hastens the onset of senility in vines. Poor fruit quality with low TSS and high fruit acidity is the outcome of vines bearing heavily. (SenthilKumar et al 2015). The ideal pruning severity needs to be assessed. (Morris et al 1984).

Melody (Blagratwo) seedless table grape cultivar is one of the new cultivars which were introduced to Egypt. It is a Mid-late season black seedless, strong vigor, medium-high fertility, good natural colour, elongated obvoid berry, and natural accepted berry size. Due to its mid-late maturity date and seedless berries, this cultivar shows tremendous promise for Egyptian commercial producers and exporters. This study's goals are to ascertain the ideal bud load per vine for the Melody (Blagratwo) seedless table grape cultivar and investigate the impact of bud load on bud behavior and cluster quality.

2 Materials and Methods

Vines were 3 years old planted at 2.0 x 3.0 meters in sandy soil under drip irrigation system, supported according to the Baron system under uncovered conditions and subjected to the normal horticulture managements. Vines were chosen as to be nearly similar in growth and vigour and pruned during the second week of January to 10 canes X 6 bud/cane, 12 canes X 6 bud /cane and 13 canes X 6 bud /cane Thus, the bud load was 60 ,72 and 78 eyes/vine. The experimental vines were arranged as complete randomized blocks design with five replicates and each replicate was represented by 3 vines. The vines of the experiment were subjected to the following estimation

2.1 Bud behavior

The percentage of bud burst (opening buds); bud fertility; bud fruitfulness and vegetative eyes were calculated as follows:

$$\text{Bud burst (\%)} = \frac{\text{Number of bursted buds}}{\text{Total number of buds}} * 100$$

$$\text{Bud fruitfulness (\%)} = \frac{\text{Number of fruitful buds}}{\text{Number of bursted buds}} * 100$$

$$\text{Bud fertility (\%)} = \frac{\text{Number of clusters/vine}}{\text{Total number of buds}} * 100$$

2.2 Vegetative growth characteristics and weight of annual pruning (Kg/vine)

- Average shoot length: to be measured at growth cessation in the 4th week of August, the maximum shoot length (gained growth).
- Shoot thickness (mm): shoot thickness was recorded by measuring the thickness of the basal internodes of ten canes per vine by using a venire caliper in the first week of September
- Weight of one year old pruning wood (Kg/vine): was recorded at the pruning time in the second week of January.

2.3 Yield and cluster characteristics

Random samples of five clusters /vine were harvested at maturity when TSS reached about 16-17% and complete dark color of berries, nearly in the first week of July for both seasons.

Number of clusters per vine were counted to determine the total yield per vine.

Total yield: weight of harvested mature clusters is expressed as (kg)/tree. Cluster physical characteristics (cluster weight (g), average clusters dimensions (length and width (cm)) were determined.

At harvest time representative samples per each replicate were harvested and taken to laboratory in the Horticultural Department, Faculty of Agriculture, Ain Shams University to determine the following characters:

Cluster weight (g): was determined by using a digital balance.

Cluster length (cm) –Cluster width (cm) is measured at the cluster shoulders, widest part of the cluster by using a regular ruler.

2.4 Physical and chemical characteristics of berries

Weight of 100 berries (g). The berry length (cm) and berry width (cm) were measured by using venire caliper. Berry firmness (g/cm²) and berry adherence strength as gram force (gf) were measured by using (fruit texture analyzer model “GS-15, serial No. FTA2).

2.5 Chemical characteristics of berries

From the captured clusters of each replicate, two clusters were randomly selected as a sample. for quality determination., as follows:

Total soluble solids (TSS %) by utilizing a hand refractometer (HR-110.) was established.

Titrate acidity (TA%) was determined as gm tartaric acid / 100 ml juice by titrating 10 ml of the juice against sodium hydroxide (0.1 N) and phenolphthalein 1% as indicator according to (A.O.A.C. 1985).

T.S.S: acid ratios berry juice: This ratio was calculated by dividing TSS percent by acidity.

Total anthocyanin of the berry skin (mg/100g fresh weight) was determined according to (Hsia et al 1965).

2.6 Statistical analysis

The data were submitted to the proper statistical analysis of variance. Tukey test was used to compare treatment means carried out by Tukey (1977). Data were statistically analyzed using the analysis of variance adopting a SAS package.

3 Results and Discussion

3.1 Bud behaviors

Data in **Table 1** show that there was a significant difference between the number of eyes per vine as a load effect. In this respect, 60 and 72 bud/vine showed the greatest percentages of bud burst readings without significant differences between them. followed by 78 bud/vine which gives a low percentage of bud burst. The same table shows that, bud load per vine influenced bud fruitfulness percentages. The highest values were recorded in vines that loaded with 60 bud/vine in the two seasons. So, vines pruned to 78 buds/vine gave a lower bud fruitfulness percentage in both seasons. Concerning the data of bud fertility %, vines pruned to 60 buds/vine were the highest, while vines pruned to 72 and 78 buds/ vine were the lowest in the 1st and 2nd season.

Pruning weights and pruning severity are both decreased during winter pruning, and the similar results were achieved by (Main et al 2008). Also, according to (Geller et al 2013) when vines are just minimally pruned, their pruning weights tend to be lower. (Fawzi et al 2010) showed that increasing bud load for Crimson seedless grapevines affected bud fertility and fruitfulness. (Singh et al 2014) recorded that maximum percent fruitful buds were recorded at 2-bud level followed by 3, 4 and 5bud pruning level. Node levels beyond 80 nodes reduced bud fruitfulness of Niagara (*Vitis labruscana* Bailey) (Sabbatini et al 2015). (Abdle Hamid et al 2015) the findings demonstrated that there was a considerable reduction in the percent-

age of bursted buds by increasing bud load /vine of Autumn Royal seedless grapevines. (Bassiony 2020) cleared that, as bud load level decreased as bud burst and fertility improved on" Flame seedless" grapevines. (Abo-ELwafa 2021). show that Prime Seedless Grapevines were pruned at lowest nodes number/vine) gave the highest significant values of bursted buds and bud fertility percentages.

Table 1. Effect of vine bud load on bud burst, bud fruitfulness and bud fertility percentages of Melody (Blagratwo) seedless table grape cultivar during 2018 and 2019 seasons

Bud load	Bud burst %	Bud fruitfulness %	Bud fertility %
2018/2019			
Bud load 60 Buds	95.73a	93.01a	87.22a
Bud load 72Buds	94.44a	91.34b	84.26b
Bud load 78 Buds	92.59b	87.96c	84.19b
2019/2020			
Bud load 60 Buds	89.00a	89.90a	77.22a
Bud load 72Buds	88.67a	86.85b	74.36b
Bud load 78 Buds	84.43b	84.11c	74.07b

* Values in each column under each season that are preceded by the same letter do not differ substantially according to Tukey test at the 5% level.

3.2 Vegetative growth characteristics and weight of annual pruning (Kg/vine)

It is obvious from **Table 2** that bud load 60 eyes/vine showed the highest significant average shoot thickness, shoot length, and weight of annual pruning in both seasons. On the other hand, canes with 78 buds per vine showed the lowest average shoot thickness, shoot length, and weight of annual pruning while bud load of 72 buds per vine resulted in intermediate values for the same vegetative growth characteristics in the same seasons study.

Similar results were observed by (Diab 2015) on Early sweet grapes vines, vines pruned to a lower eyes /vine gave a higher internode thickness and weight of annual pruning (kg /vine) than the other pruning severities in the two seasons. While vines pruned to 72 eyes /vine produced the lowest significant. Shorter eye loads and canes showed better vegetative development features, according to (Ghobrial 2018). As a result of effectively striking the proper balance between

vegetative growth factors and the yield and bunch of Autumn Royal in both seasons, vines that have been pruned to have the ideal cane length generate the best results. (Bassiony 2020) cleared that, as bud load level decreased, vegetative growth parameters improved on "Flame seedless" grapevines. (Abo-ELwafa 2021) show that the Prime Seedless Grapevines vines gave the highest significant values of shoot length when pruned at lowest nodes number/vine.

Table 2. Effect of vine bud load on shoot thickness (mm), shoot length (cm) and weight of annual pruning (Kg/vine) of Melody (Blagratwo) seedless table grape cultivar during 2018 and 2019 seasons

Bud load	Shoot thickness (mm)	Shoot length (cm)	Weight of annual pruning (Kg/vine)
2018/2019			
Bud load 60 Buds	17.47a	345.00a	4.10a
Bud load 72Buds	17.01b	297.33b	3.49b
Bud load 78 Buds	16.99b	249.00c	3.83c
2019/2020			
Bud load 60 Buds	17.37a	345.00a	3.93a
Bud load 72Buds	17.27b	256.33b	3.60ab
Bud load 78 Buds	16.55c	296.00c	3.00c

* Values in each column under each season that are preceded by the same letter do not differ substantially according to Tukey test at the 5% level.

3.3 Yield and cluster characteristics

From **Table 3** vines pruned to 72 and 78 buds/vine gave the highest significant values concerning the number of clusters per vine. These treatments recorded 50.67 and 54.67 clusters / vine during 2018 season and 46.67and 49.00 clusters / vine in 2019 season respectively. In the same table, it appeared an increase of cluster weight by decreasing the bud load on the vine. Highest significant cluster weight was obtained with 60 bud/vine in both seasons (580and 585) respectively. While vines that pruned to78 buds/vine maintained the lowest cluster weight value 539.67g in the 1st season and 535g in the 2nd season but vines pruned to 72 bud/vine exhibited the intermediate cluster weight (565.00 g and 551g) in both successive seasons of study. Vines pruned to

60 buds/vine recorded the lowest yield (28.24 and 23.21 kg/vine) in both seasons, respectively. The highest significant yield/vine was recorded by78 bud/vine in (29.5 and 26.2) both seasons respectively.

Table 3. Effect of vine bud load on number of clusters per vine, cluster weight (g) and eeight of annual pruning (Kg/vine) of Melody (Blagratwo) seedless table grape cultivar during 2018 and 2019 seasons

Bud load	Number of clusters per vine	Cluster weight (g)	Total yield (kg/vine)
Season 2018			
bud load 60 Buds	48.67b	580.00a	28.24c
bud load 72Buds	50.67a	565.00b	28.62b
bud load 78 Buds	54.67a	539.67c	29.50a
Season 2019			
bud load 60 Buds	39.67b	585.00a	23.21c
bud load 72Buds	46.67a	551.00b	25.72b
bud load 78 Buds	49.00a	535.00c	26.22a

* Values in each column under each season that are preceded by the same letter do not differ substantially according to Tukey test at the 5% level.

These results agreed with those of (Fawzi et al 2010) on Crimson seedless "grapevines" with higher bud loads that had more clusters per vine and produced more fruit, but the weight of the clusters was lower. In addition, (Abdle Hamid et al 2015) showed that For Autumn Royal seedless "grape-vines," increasing the bud load increased the number of clusters per vine and the yield, but it decreased cluster weight. (Sabbatini et al 2015) declared that Node levels above fixed nodes level decreased yield and cluster weight. Pruning vines at 20 and 40 nodes retained reduced vine yield. So long as vine health and long-term vineyard sustainability were not compromised, keeping 80 fixed nodes produced sustainable yield of Niagara' (*Vitis labruscana* Bailey). On terminate grapevines, the number of clusters harvested per vine and yield increased as the pruning severity decreased, according to (O'Danie et al 2012). The same was found with (Ghobrial 2018) reveal that highest bud/load per cane attained higher yield, in contrast, shorter eye load/cane reduced both bunch numbers and yield. On the other hand, as it was possible to create an adequate balance between vegetative growth features and yield on Autumn Royal grapevines, vines pruned with the

ideal cane length considerably produce the best results. According to (Abo-ELwafa 2021) the vines were pruned at level 72 nodes/vine produced the highest significant yield per vine of Premium seedless grapevines.

Regarding cluster characteristics, data in **Table 4** indicated that increasing the bud load/ vine reduced the average length and width of clusters while weight of 100 berries was increased with vines pruned to 60 buds/ vine in both seasons.

These results coincided with those of (Fawzi et al 2010) mentioned that Moderate pruning for Crimson seedless "grapevines gave the greatest cluster length. (Bassiony 2020) cleared that, as bud load level decreased cluster physical characteristics improved. (Abbas et al 2008) who revealed that vines with long pruning caused a significant reduction in bunch dimensions in comparison with short pruning.

Table 4. Effect of vine bud load on cluster length (cm), cluster width (cm) and weight of 100 berries (g) of Melody (Blagratwo) seedless table grape cultivar during 2018 and 2019 seasons

Bud load	Cluster length (cm)	Cluster width (cm)	Weight of 100 berries (g)
Season2018			
bud load 60 Buds	18.00a	17.50a	666.67a
bud load 72Buds	17.83b	17.17b	666.67a
bud load 78 Buds	16.17c	17.17b	566.67b
Season2019			
bud load 60 Buds	18.33a	18.00a	558.33a
bud load 72Buds	18.00a	17.00b	516.67b
bud load 78 Buds	17.33b	16.67c	508.33c

* Values in each column under each season that are preceded by the same letter do not differ substantially according to Tukey test at the 5% level.

3.4 Berry Physical and chemical characteristics of berries

Data of **Table 5** show the effect of different bud load/ vine on berry width (cm), berry length (cm) and berry firmness of "Melody seedless". Thus, it is appeared to increase by decreasing the bud load on the vine. In this respect, vines which were pruned to 60 buds/ vine maintained the high-

est value studied traits during both seasons of this study. On the other hand, there is a decrease with the same parameters by pruning vines to 78 eyes/vine. While 72 eyes / vine represented the intermediate values for all aspects in both seasons.

These results are similar to previous studies as found with (Fawzi et al 2010) Moderate pruning for Crimson seedless "grapevines gave the greatest berry weight, berry firmness. (Abbas et al 2008) who showed that vines with short bearers yielded heavier berries in comparison with those with longer ones. (Bassiony 2020) " cleared that, as bud load level decreased berry physical characteristics improved in Flame seedless" grapevines.

Table 5. Effect of vine bud load on berry width (cm), berry length (cm) and berry firmness (mm) of Melody (Blagratwo) seedless table grape cultivar during 2018 and 2019 seasons

Bud load	Berry width (cm)	Berry length (cm)	Berry firmness (g/cm ²)
Season2018			
bud load 60 Buds	1.92a	2.60a	0.255a
bud load 72Buds	1.75b	2.45b	0.241b
bud load 78 Buds	1.71b	2.29c	0.241b
Season2019			
bud load 60 Buds	1.57a	2.13a	0.265a
bud load 72Buds	1.53a	2.23a	0.251b
bud load 78 Buds	1.47b	2.10a	0.251b

* Values in each column under each season that are preceded by the same letter do not differ substantially according to Tukey test at the 5% level.

Regarding berry adherence strength (gf), T.S.S % and acid ratio (%) as shown in **Table 6**, data revealed that berry adherence strength and berry TSS%, were significantly affected by different bud load in both seasons. Highest significant values of berry adherence strength and acid ratio%, were attained from vines pruned with 78 buds/ vine followed by vines pruned with 72 bud / vine with significant differences observed between them. While vines of 60 bud/vine had significantly the least values of these ones except TSS%, which take opposite trends in both seasons.

These results are in harmony with (Fawzi et al 2010) found that Moderate pruning for Crimson seedless grapevines gave the greatest berry adherence and T.S.S.%. (Rahmani et al 2015) revealed that soluble

solid content was significantly affected by bud pruning, moderate bud pruning can be considered for increasing table grape nutritional quality red and white seedless table grapes. According to (Sabbatini et al 2015) the pH and percentage of soluble solids of Niagara grape fell as the number of nodes kept rose. In same trend (Porika et al 2015) recorded that all the plants that were pruned at low bud level had the greatest total soluble solids and the lowest titratable acidity of grapes from the red globe variety. (Abdle Hamid et al 2015) declared that the highest pruned buds/vine showed a higher percent of TA than the other levels of bud load of Autumn Royal seedless. (Abo-ELwafa 2021) showed that the lowest levels of nodes /vine improved TSS, % while decreasing total acidity in berries of Prime Seedless grapevines. These results coincided with those of (Abbas et al 2008) who reveal that vines with long pruning showed a significant reduction in juice TSS percentage, an increase in total acidity content of the berry juice in comparison with short pruning in Flame seedless grapevines.

Table 6. Effect of vine bud load on berry adherence strength (g), T.S.S % and Acid ratio percentage of Melody (Blagratwo) seedless table grape cultivar during 2018 and 2019 seasons

Bud load	Berry adherence strength (gf)	T.S.S %	Acid ratio (%)
Season 2018			
Bud load 60 Buds	334.00c	17.72a	0.60c
Bud load 72 Buds	545.00b	17.55b	0.62b
Bud load 78Buds	567.33a	17.29c	0.65a
Season 2019			
Bud load 60 Buds	373.00c	17.67a	0.61c
Bud load 72 Buds	532.67b	17.50b	0.63b
Bud load 78 Buds	568.67a	17.00c	0.67a

* Values in each column under each season that are preceded by the same letter do not differ substantially according to Tukey test at the 5% level.

Observing T.S.S/Acid ratio and total anthocyanin in berry skin, data presented in **Table 7** showed that TSS/acid ratio and anthocyanin content of berry skin were significantly affected by different bud load/vine in both seasons. Vines pruned with 60 bud/vine showed significantly the

highest values of these parameters (29.53 and 38.99) in the 1st season and (28.96 and 41.02) in the 2nd season, respectively followed by vines pruned with bud load of 72bud/vine (28.30 and 36.97) in 2018 season and (27.77 and 40.91) in 2019 season respectively, whereas bud load of 78 bud/vine significantly induced the least values of these ones in both seasons. Thus, it could be postulated that TSS/acid ratio and anthocyanin content of berry skin least values due to increasing of bud load /vine after pruning. In other words, decreasing bud load increased the current season's TSS/acid ratio and anthocyanin content of berry skin and then this may be attributed to the reduction of competition between bud load and vine yield.

Table 7. Effect of vine bud load on T.S.S/Acid ratio percentage, and total Anthocyanin (mg/100g fresh weight) of Melody (Blagratwo) seedless table grape cultivar during 2018 and 2019 seasons

Bud load	T.S.S/Acid ratio (%)	Total Anthocyanin (mg/100g fresh weight)
Season 2018		
Bud load 60 Buds	29.53a	38.99a
Bud load 72 Buds	28.30b	36.97a
Bud load 78 Buds	26.60c	30.74b
Season 2019		
Bud load 60 Buds	28.96a	41.02a
Bud load 72 Buds	27.77b	40.91a
Bud load 78 Buds	25.37c	34.98b

* Values in each column under each season that are preceded by the same letter do not differ substantially according to Tukey test at the 5% level.

The results are in harmony with (Porika et al 2015) revealed that, all the vines which were pruned at low bud level registered highest TSS/acid ratio. (Ghobrial 2018) cleared that, the highest bud/load per cane had a negative impact on berry quality. On the other hand, vines pruned with optimum cane length gave significantly presented the optimum results, as it achieved an appropriate balance between vegetative growth aspects, yield, bunch and berries quality attributes on Autumn Royal. (Abo-ELwafa 2021) showed that the vines pruned at the lowest levels of nodes /vine improved TSS/acid ratio in berries of Prime Seedless grapevines. (Abbas et al 2008) who revealed that vines with heavy bud load showed a significant reduction in TSS/acid ratio.

Whereas, increasing pruned vine bud/load give the least content of anthocyanin content. These results coincided with those of (Abbas et al 2008, Abdle Hamid et al 2015, Ghobrial 2018) who reveal that vines with heavy bud load showed a significant reduction in

TSS/acid ratio, anthocyanin content in berry skin and in comparison, with short pruning and found that the greatest content of anthocyanin were cleared with reducing bud load/vine.

4 Conclusion

From the present study, it could be recommended that Melody (Blagratwo) Seedless table grape cultivar vines could be pruned with a bud load of 72 buds per vine as it achieved an appropriate balance between vegetative growth aspects, yield, cluster, and berry physical and quality attributes.

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