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GA_3 Enhances the Chemical and Physical Properties, Yield and Reducing Compactness of H4 Grapevines

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Abstract

Thompson seedless is one of the most important table grape cultivars grown in Egypt. In recent years, the H4 strain has become widely cultivated because of its high yield. However, this strain produces clusters with high compactness and small berries; thus, negatively affecting the quality. A field experiment was carried out during the two successive seasons of 2018 and 2019 on Five years-old Thompson seedless cultivar (H4 strain) grapevines grafted on freedom rootstock. The investigation was designed to shed light on the effect of 10, 20, and 30 ppm GA_3 for thinning at the full bloom plus 20, 30, and 40 ppm GA_3 for sizing after fruit set on reducing cluster compactness and improving quality. Data indicated that the total chlorophyll content decreases when the GA_3 concentration increases, while GA_3 spraying for thinning and sizing treatments was higher than others for thinning only concerning pruning weight. The results also showed that the optimum GA_3 dose was 20 ppm at the full bloom for thinning, then spraying 30 ppm GA_3 for sizing (T6) to get high cluster weight, yield per vine, and low compactness, as well as highest TSS, TSS/acid ratio, and lowest acidity good quality. Overall, spraying 20 ppm GA_3 at the full bloom and 30 ppm GA_3 for sizing could be recommended to get the most suitable yield and quality.

***Keywords**:*Thompson seedless;Sultanina; compactness; GA_3; thinning; sizing

1. Introduction

Grape (*Vitis vinifera* L.) is one of the most important, commercial, popular, favorite, delicious, refreshing, and nourishing fruit crops worldwide. The berries are a good source of sugars, minerals, and vitamins **[1]**. Grape is the third leading fruit, with an annual production of 75.1 million metric tons **[2]**. In Egypt, it ranks fourth position after citrus (456082 fed), mango (304118) and olive (245142) fruit crops concerning the production area and consumption rates. In the last decade, Grape acreage exhibited a remarkable increase in Egypt, reaching 190486 feddans (80036 hectares) with a fruitful area of 174715 feddans (73409 hectares), producing 1590000 tons (9.13 ton/feddan) (Statistics of Ministry of Agriculture 2019)**.** Thompson seedless grape is the most table grape cultivar grown in Egypt for making raisins, local consumption, and export. In recent years, the H4 strain has become widely cultivated for both table and dried raisins because of its high yield. However, this strain produces clusters with high compactness and small berries, thus negatively affecting the clusters quality during the marketing **[3]**. Gibberellins (GAs) was first discovered in the 1930s on Bakanae rice disease infected by *Gibberella fujikuroi* fungus, causing excessive stem elongation [4](Silverstone and Sun, 2000). Several previous studies have documented the impacts of gibberellic acid (doses and timing) on berry thinning, sizing, and the quality improvement of seedless grapes**[4]**. Gibberellin spraying is necessary for attractive appearance in terms of compact and big size clusters and larger berries in

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seedless varieties[5]; furthermore, it is the most common reagent used in chemical thinning. Berry thinning reduces bunch weight, makes the bunches looser, and increases berry weight and soluble solids[6]. Gibberellic acid sprays at bloom and berry set effectively enhance growth, increasing cluster length, berry size, and thinning bunch berries in seedless grapes[7]. The optimum dose and time of application seemed to be beneficial for improving quality[8]. The application of gibberellins also decreases the bunch compactness and improves the berries' quality[9]. Gibberellic acid leads to cell division and enlargement, increases protein biosynthesis, produces new tissues, and promotes the absorption of water and nutrients[10]. Gibberellic acid spraying as a berry thinning option presents a promising alternative for individual berry thinning and requires less labor[11]. This method removes some berries, and the maintenance results in a better distribution of berries in rachis, decreasing bunch compactness. Therefore, the principal goal of this work is to evaluate the effect of GA_3 spraying for thinning and sizing in different phenological phases by detecting the optimum dose and application time to avoid compactness and improve the yield and fruit quality of Thompson seedless (H4 strain) grapevine clusters.

2. Experimental:

2.1. Experimental Grapevines and growing conditions

The present study was carried out during the two successive seasons of 2018 and 2019 on Five-year-old “Thompson” seedless cultivar (H4 strain) grapevines (*Vitis vinifera* L.) grafted onto freedom rootstock. The vines were grown in a private orchard located in the El-Khatatba region, Minufyia Governorate, with coordinates of (30°21′N 30°49′E). The tested vines were approximately uniform in vigor and healthy in appearance, grown at 2x3 meters apart (700 vines/feddan) in sandy soil under a drip irrigation system. The cane pruning was trained using a quadrilateral cordon trellis system and supported by the Spanish Parron system. Moreover, the experimental vines received the normal agricultural practices, fertigation, and pest control recommended by the Egyptian Ministry of Agriculture.

2.2. Treatments and experimental design:

This experiment contained thirteen treatments in three replicates represented by two vines for each replicate arranged as follows:

Control: spraying water only
T1: 10 ppm GA_3 for thinning + 20 ppm GA_3 for sizing
T2: 10 ppm GA_3 for thinning + 30 ppm GA_3 for sizing
T3: 10 ppm GA_3 for thinning + 40 ppm GA_3 for sizing
T4: 10 ppm GA_3 for thinning without sizing
T5: 20 ppm GA_3 for thinning + 20 ppm GA_3 for sizing
T6: 20 ppm GA_3 for thinning + 30 ppm GA_3 for sizing
T7: 20 ppm GA_3 for thinning + 40 ppm GA_3 for sizing
T8: 20 ppm GA_3 for thinning without sizing
T9: 30 ppm GA_3 for thinning + 20 ppm GA_3 for sizing
T10: 30 ppm GA_3 for thinning + 30 ppm GA_3 for sizing
T11: 30 ppm GA_3 for thinning + 40 ppm GA_3 for sizing
T12: 30 ppm GA_3 thinning without sizing

Thinning and berry sizing were applied during two different phenological stages. The first was the thinning treatments at 70-80% full bloom (on the first week and the second week of May) and the second was the berry sizing treatment, applied when the berries were at 6-7 mm diameter (on the third and fourth week of May and repeated after four days) at the same doses for the first and the second seasons, respectively.

All sprayed solutions were prepared and diluted to tested concentrations with tap water just before application on the farm (1L/vine). Triton B emulsifier at a rate of 0.1 % was used as a wetting agent during application. Spraying was done until the runoff point using a hand pressure sprayer. The experiment was applied to 78 homologized vines arranged in a randomized complete blocks design in three replicates for each treatment with two vines in each replicate.

2.3. Measurement of experimental data

2.3.1. Leaf chlorophyll content:

Leaf content of total chlorophyll was taken in June and measured by nondestructive Minolta chlorophyll meter SPAD 502 of the apical 5th leaf, according to Wood *et al.* [12] .

Pruning weight is an indicator of vegetative growth and vigor in grapevine, and traditionally, it is manually determined, according to *Ferrer et al.*[13].

2.4. Yield and its components

At the harvest time of each season on July 15th, the clusters per vine were recorded. Six clusters/replicate were randomly harvested when the average TSS % attained about 16-17% in the untreated vines and were taken to measure the yield components as follows: The total number of clusters was calculated by counting the clusters at harvest time on each vine. Cluster weight (g) was estimated by the weight of a representative sample of six clusters per replicate. Yield (kg/vine), six clusters from each replicate were weighted, and the average cluster weight was multiplied by the number of clusters/vine to calculate the average yield as kg/vine. The average yield as tons per feddan, was measured using yield per vine and the number of vines per feddan (700 vines).

2.5. *Physical characteristics of clusters*

Actress random samples of six bunches per replicate were harvested at ripening to determine the average of ripening when TSS reached about 16-17%. The following characteristics were determined. Average cluster length and cluster width (cm). Compactness coefficient was calculated by dividing the number of the cluster berries by the cluster length as described by Winkler *et al.* (1974). Compression force was measured using a pressure tester (Force-Gouge ModelIGV-O.SA.Shimpo instruments).

2.6. *Chemical characteristics of berries:*

Total soluble solids (TSS %) it was estimated by the Carlziss hand refractometer. Total titratable acidity (%) was determined by titrating juice against NaOH (0.1N) using phenolphthalein (ph. ph) as an indicator. The acidity was expressed as tartaric acid (%) according to the method of AOAC **[14]** . Total soluble solids /acid ratio was calculated for all the samples by using the following formula: TSS /acid ratio = TSS % / total acidity %.

Statistical analysis

The differences between the tested treatment groups and the control group were analyzed in a completely randomized block design according to the method described by Gomez and Gomez**[15]** . The obtained data of both seasons were subjected to analysis of variance (ANOVA) using the CoStat Computer Software program version 6.311. The treatment means were compared using Duncan's multiple range test with a probability of 0.05 according to Duncan **[16]**.

3. Results and Discussion

3.1. Effects of GA_3 spray on vegetative growth

Data presented in Figure (1) concerned with the effect of GA_3 foliar application on vegetative growth parameters represented by leaf chlorophyll content and pruning weight. The results show a significant increase in vegetative traits associated with the application of GA_3 compared with control.

Data presented in Figure (1a) concerned the effects of GA_3 thinning and sizing applications on leaf chlorophyll content. The data clarified that leaf chlorophyll was significantly higher for untreated vines (control). Then the application of 10 ppm GA_3 thinning Without sizing (T4) came in the second order. Meanwhile, (T6) 20 ppm GA_3 thinning + 30 ppm GA_3 sizing recorded the lowest values of chlorophyll contents. Other treatments exhibited intermediate values between the pre-mentioned applications, and a similar trend was found during the two studied seasons. These data proved that total chlorophyll content decreases when the GA_3concentration increases.

As for pruning weight (kg/vine), Figure (1b) indicated that spraying 10 ppm GA_3 thinning + 40 ppm GA_3 sizing (T3) resulted in the highest significance of this trait, followed by T2, T10, and T11 without any significant differences among them in both seasons. Contrarily, the minimum average pruning weight was recorded with (T12) when spraying GA_3 at a concentration of 30 ppm thinning without GA_3 sizing. Moreover, treatments of GA_3 for thinning without sizing, such as (T4 and T8) resulted in intermediate pruning weight. Generally, it could be concluded that GA_3 spraying for thinning and sizing treatments was higher than others for thinning only concerning pruning weight.

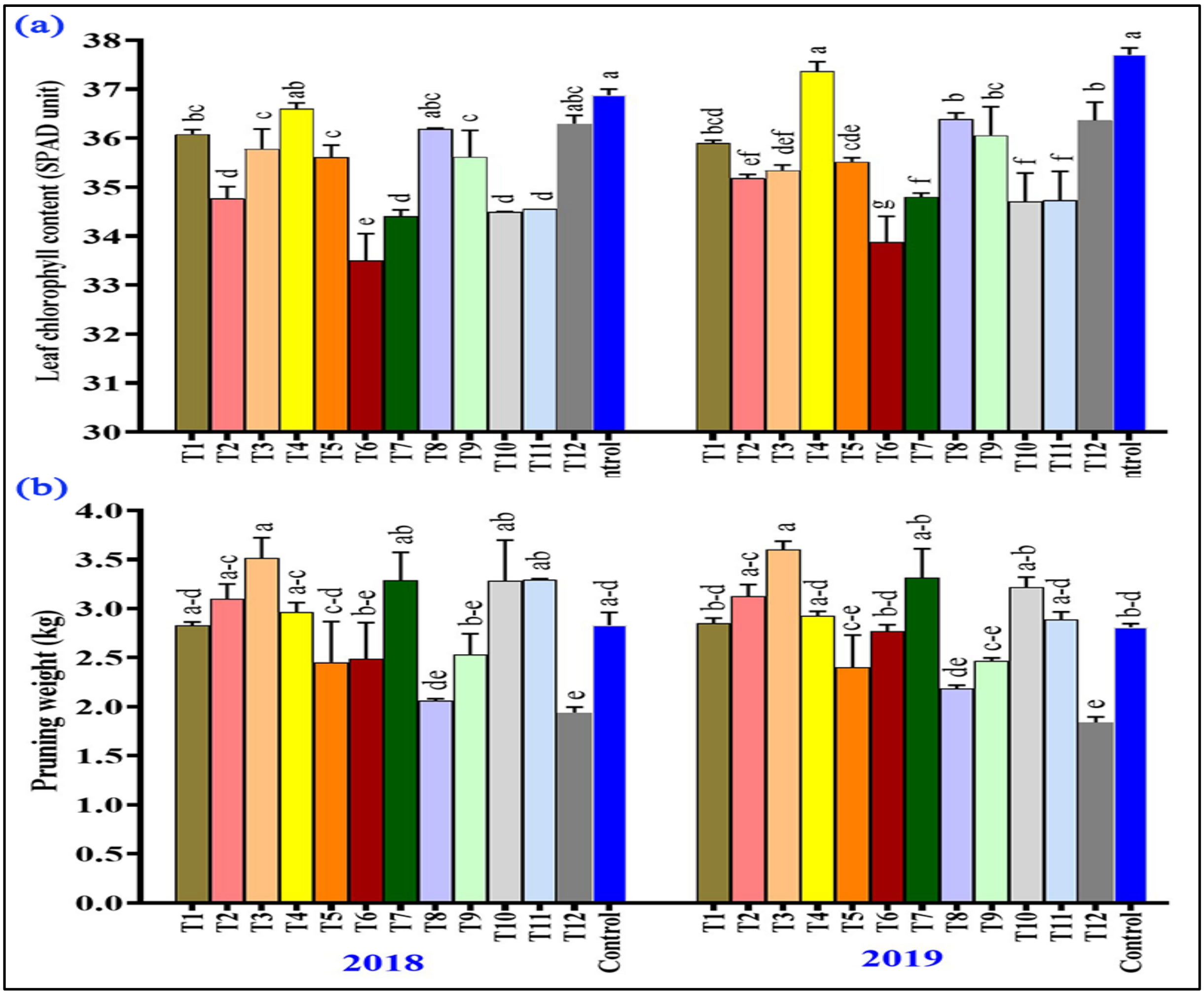

Figure 1: Effect of GA3 spray on pruning weight during 2018 and 2019 seasons. Control, T1: 10 ppm GA3 thinning + 20 ppm GA3 sizing, T2: 10 ppm GA3 thinning + 30 ppm GA3 sizing, T3: 10 ppm GA3 thinning + 40 ppm GA3 sizing, T4: 10 ppm GA3 thinning Without sizing, T5: 20 ppm GA3 thinning + 20 ppm GA3 sizing, T6: 20 ppm GA3 thinning + 30 ppm GA3 sizing, T7: 20 ppm GA3 thinning + 40 ppm GA3 sizing, T8: 20 ppm GA3 thinning Without sizing, T9: 30 ppm GA3 thinning + 20 ppm GA3 sizing, T10: 30 ppm GA3 thinning + 30 ppm GA3sizing, T11: 30 ppm GA3 thinning + 40 p pm GA3sizing and T12: 30 ppm GA3 thinning Without sizing.

Our results align with **Zheng *et al.*** [17] , who reported that the application of GA_3 increased leaf chlorophyll content in the Kyoho grapevine. GA_3 has been reported to increase vegetative growth, including leaf area and chlorophyll content[18].The increment in pruning weight as affected by the low concentration of GA3 might be due to enhancing the vegetative growth leading to efficient photosynthesis and carbohydrates accumulation, increasing canes fresh and dry weight. On the other hand, **Dokoozlian and Peacock** [19] found no reduction in pruning weights as affected by applications of GA_3 over 4-years.

3.2. Effects on yield and its components

It is evident from the obtained data in Figure (2) clarified that using different concentrations of GA_3 either for thinning or sizing exhibited significant increments respecting the number cluster, yield/vine, and yield/feddan of “Thompson seedless” grapevines (H4 strain) during both seasons. Also, these effects had taken a similar trend during the two studied seasons. Moreover, all studied traits showed that the differences reached highly significant levels except for the number of clusters/vine. The data in Figure (2a) appeared that spraying vines with 20 ppm GA_3 for thinning with 30 ppm GA_3 for sizing (T6) gave the highest number of clusters/vines compared with the rest treatments without any significant variation in the first season and with minor effects in the second season. The fewest clusters resulted from vines treated with the lowest concentration of GA_3 for thinning without sizing treatment (T4) and control, especially in the second season.

Concerning the effect of GA_3 spray on the cluster weight, Figure (2b) shows that the highest weight recorded on clusters produced from vines treated with 20 ppm GA_3 for thinning and 30 ppm GA_3 for sizing treatment (6). In comparison, the lightest clusters resulted from control vines. The results showed a surpassing of the applied 20 GA_3 ppm for thinning with different concentrations for sizing; others used 10 or 30 ppm GA_3 with or without sizing application and control. In addition, with the same concentration of GA_3 for thinning, the medium concentration for sizing (30 ppm) gave values higher than the low and the high (20 and 40 ppm) ones or without sizing application. Our results agree with **Hassan and Behary** [20], who reported that the best treatment was the application of GA_3 at 20 ppm on Early Sweet grapevines. They attributed the beneficial effects of GA_3 to the positive impact on increasing cluster weight.

As for yield per vine, data in Figure (2c) showed that vines thinned with 20 ppm GA_3 and sized with 30 ppm GA_3 (T6) resulted in the highest yield as kg/vine, followed by (T5), which thinned and sized with the same concentration (20 ppm GA_3) in both seasons of study. Similar results with the Perlette cultivar were obtained by **Abou-Zaid and Eissa,** [21]. They reported that the application of 25 ppm GA_3 gave the best results concerning cluster weight, which significantly increased yield/vine. Regarding the effect of GA_3 treatments on total estimated yield as a ton per feddan as presented in Figure (2d), the results indicated that foliar application of 20 ppm GA_3 for thinning and 30 ppm for sizing (T6) gave the highest yield in the two seasons. Meanwhile, the control treatment (untreated vines) showed the lowest yield ton/ feddan during both studied seasons. According to data, the results take similar directions of cluster weight and yield per vine.

In general view, the obtained results indicated that spraying of GA_3 either for thinning or sizing significantly enhanced the yield and its components represented by the cluster weight, yield/vine, and yield/feddan of "Thompson seedless" grapevines. Additionally, the highest yield above control was recorded with T5 and T6 in 2018 and 2019. On the other hand, the lowest comparable results were obtained from T4 and T12.

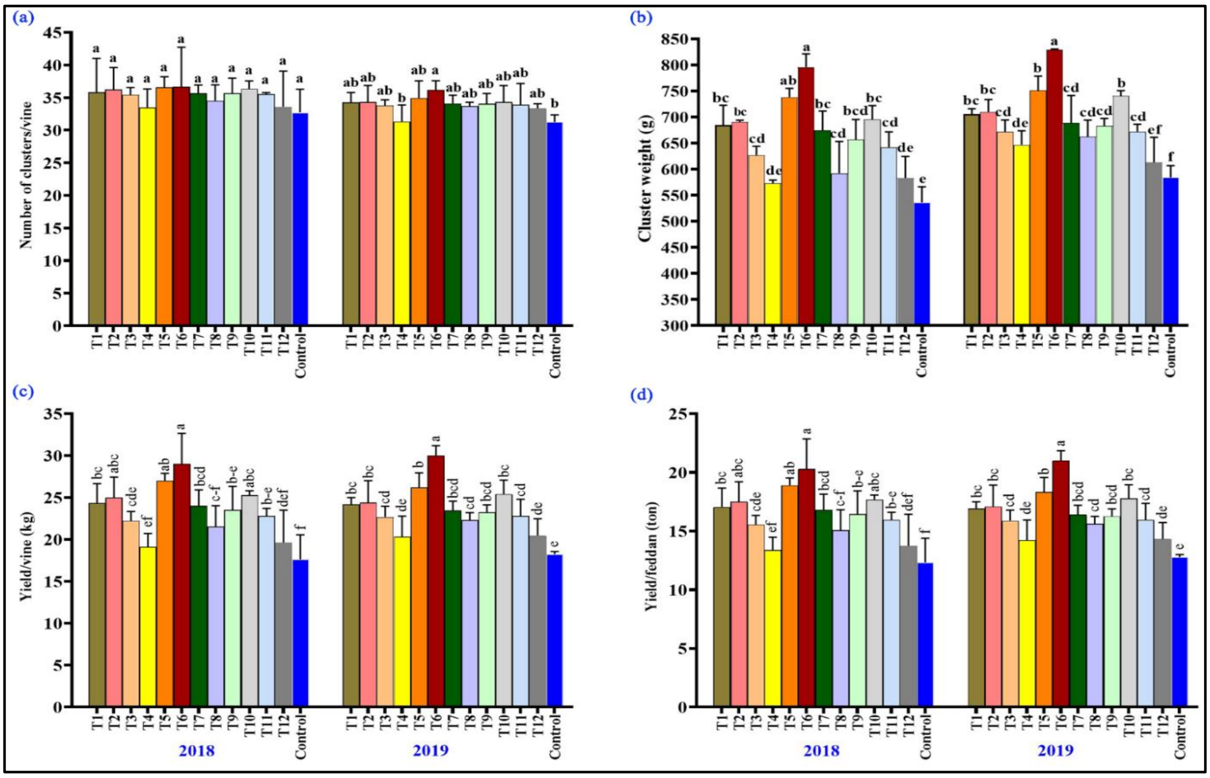

Figure 2: Effect of GA_3 on yield and its components during 2018 and 2019. **(a)** number of clusters/vine, **(b)** cluster weight, **(c)** Yield/vine, and **(d)** Yield/feddan. **Control**: water spray, **T1**: 10 ppm GA3 thinning + 20 ppm GA3 sizing, **T2**: 10 ppm GA3 thinning + 30 ppm GA3 sizing, **T3**: 10 ppm GA3 thinning + 40 ppm GA3 sizing, **T4**: 10 ppm GA3 thinning Without sizing, **T5**: 20 ppm GA3 thinning + 20 ppm GA3 sizing, **T6**: 20 ppm GA3 thinning + 30 ppm GA3 sizing, **T7**: 20 ppm GA3 thinning + 40 ppm GA3 sizing, **T8**: 20 ppm GA3 thinning Without sizing, **T9**: 30 ppm GA3 thinning + 20 ppm GA3 sizing, **T10**: 30 ppm GA3 thinning + 30 ppm GA3 sizing, **T11**: 30 ppm GA3 thinning + 40 ppm GA3 sizing and **T12**: 30 ppm GA3 thinning without sizing.

The obtained results came in the same line as those reported by **Ibrahim *et al.*** [8] with Thompson seedless and **El-Akad *et al.*** [22] with Ruby seedless cultivar**.** They found that spraying seedless grape cultivars with GA_3 increased yield and cluster weight. Spraying GA_3 at 20 ppm (when the berry size reached 3 mm) was the most effective treatment in this respect. The results agree with a previous report on two seedless varieties, *i.e.,* Thompson and Belgrade, studied by **Dimovska *et al.*** [23]. They reported that GA_3 was the main factor in the increase in berry, cluster weight, and yield. They showed that applying gibberellic acid at twenty mg/L increased the cluster and berry weight. An increase in berry mass results from enhanced cell division and cell expansion. So, the mass of the cluster was significantly increased. The direct effect of GA_3 is stimulating cell division and enlargement, and increasing fruit size was previously indicated by **Kondo and Fukuda** [24]**.** This might be related to the role of GA_3 as it decreased the berry set and increased the size of the remaining berries. Moreover, the application of GA_3 either enhanced bunch weight or improved total yield.

3.3. Effects GA_3 foliar spray on cluster length, width, compactness and compression force

The presented data in Figure (3) showed the impact of spraying GA_3 for thinning and sizing on cluster quality measurements represented by cluster length, width, and compactness. It is evident from Figures (3a and b) that all treatments increased cluster length and cluster width in comparison with control. The highest cluster length and width values were coupled with (T6) when grape vines sprayed 20 ppm GA_3 thinning plus 30 ppm GA_3 for sizing in the two studied seasons. On the other hand, the lowest averages for these characteristics were recorded with the control treatment. According to the current data, the cluster length and width were significantly affected by GA_3 treatments in the two study seasons. The cluster length and width of the Thompson seedless grapevine were increased by increasing foliar application of GA_3, as proved by Marzouk and Kassem [25]**.** The increase of cluster length and breadth with the application of GA_3 before blooming to seedless grapes might be due to cell division and multiplication, which promotes the elongation and expansion of the rachis to provide a more robust framework for the grape cluster, finally resulting in increment of cluster dimensions. Such results align with **Khalil [26]** on Flame seedless grapevines. They concluded that GA_3 sprayed twice caused an increase in cluster length and decreased the number of berries per cluster, reflecting a reduction in compactness. Similar results were also reported by **Dokoozlian** [19], who applied GA_3 on ‘Crimson seedless’ grapevines at 80% bloom stage.

Concerning the efficacy of different GA_3 thinning and sizing concentrations on compactness, Figure (3c) data proved the positive correlation between the number of berries/clusters and the compactness coefficient value. Since compactness is one of the most negative traits in grape clusters, treatments that reduce this trait are considered suitable for improving quality. In light of the obtained results, Figure (3c) shows the superiority of gibberellic spray at 20 ppm for thinning with 30 and/or 20 ppm for sizing treatments (T6 and T5) over the rest treatments. On the other hand, the highest compactness values resulted from control clusters and that produced from vines treated with 30 ppm GA_3 without sizing treatment. The results are in harmony with **Casanova *et al.*** [27] in Emperatriz’s seedless grape. Also, **Hed *et al.*** [28] reported that a high rate of 25 ppm GA_3 significantly reduced cluster compactness in Vignoles grapes. Moreover, **Gouda and El-Zahraa** [29] with the Thompson seedless table grape, concluded that the GA_3 reduced the compactness of bunches because it plays an essential role in berries thinning, getting clusters with less compactness and with high quality. Also, **Dimovska *et al.*** [23] and **Radwan *et al.*** [30] came to similar results. They reported that using GA_3 significantly increased the cluster length and decreased compactness.

The rachis elongation provides adequate space for berries preventing them from the press on each other. In this respect, **Gao *et al.*** [17] suggested that the cluster length is responsible for bunch compactness; thus, spraying GA_3 is a suitable approach to get good elongation and reduce the bunch compactness. They reported that the effect of gibberellins on bunch elongation depends on cultivars and the concentration of GA_3, which greatly affected bunch elongation. Generally, the effective concentration of GA_3 for thinning or sizing was linked with the moderate averages; meanwhile, the lower or higher concentrations had an inhibitory effect. This might be due to the influential role of GA_3 as a plant growth regulator on thinning and cell enlargement, which led to reducing the number of berries per cluster, as well as the elongation of the cluster axis cells, resulted increasing in berry size and decreasing in compactness coefficient in the cluster, which improves the cluster and berries qualities.

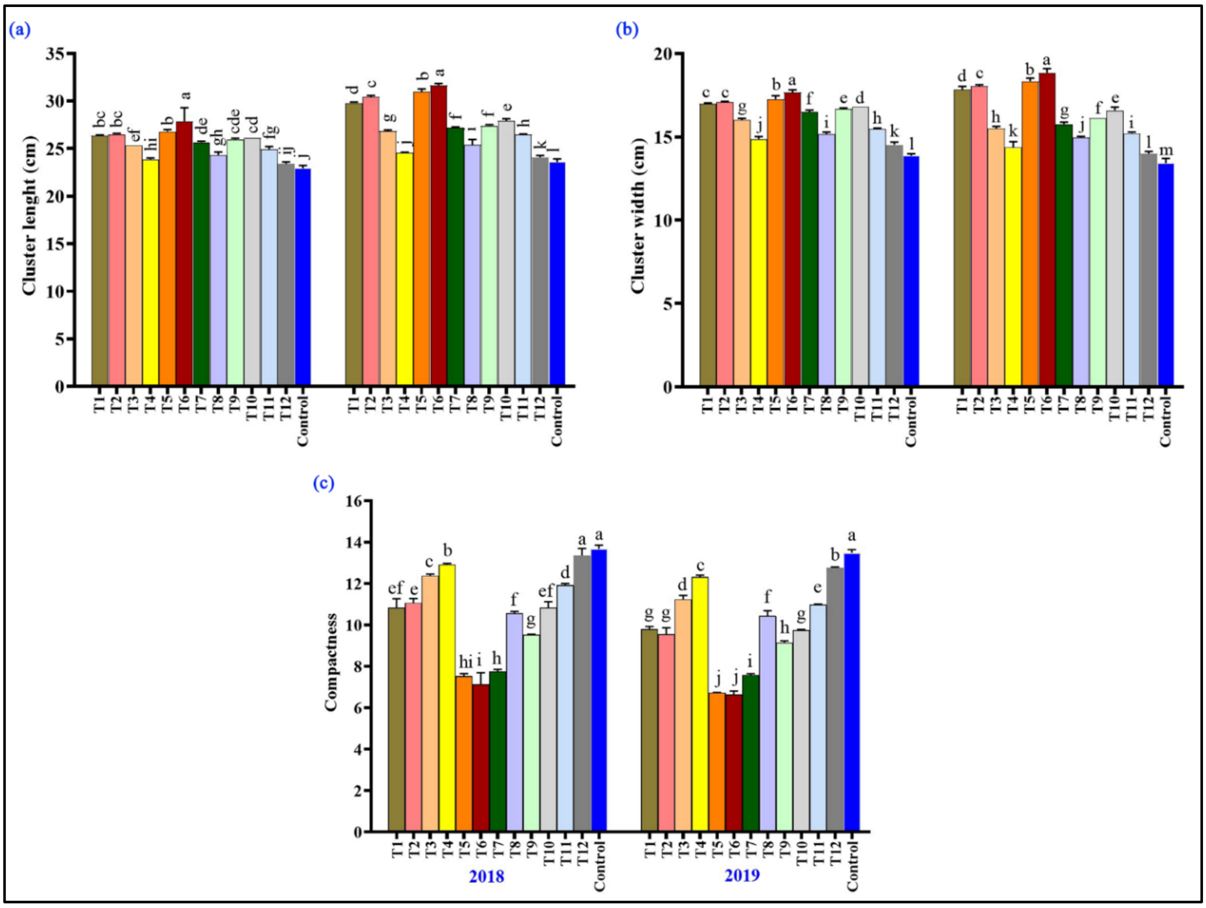

Figure 3: Effect of GA_3 on cluster characteristics during 2018 and 2019. **(a)** Cluster length, **(b)** cluster width, and **(c)** cluster compactness. **Control**: water spray, **T1**: 10 ppm GA3 thinning + 20 ppm GA3 sizing, **T2**: 10 ppm GA3 thinning + 30 ppm GA3 sizing, **T3**: 10 ppm GA3 thinning + 40 ppm GA3 sizing, **T4**: 10 ppm GA3 thinning Without sizing, **T5**: 20 ppm GA3 thinning + 20 ppm GA3 sizing, **T6**: 20 ppm GA3 thinning + 30 ppm GA3 sizing, **T7**: 20 ppm GA3 thinning + 40 ppm GA3 sizing, **T8**: 20 ppm GA3 thinning Without sizing, **T9**: 30 ppm GA3 thinning + 20 ppm GA3 sizing, **T10**: 30 ppm GA3 thinning + 30 ppm GA3 sizing, **T11**: 30 ppm GA3 thinning + 40 ppm GA3 sizing and **T12**: 30 ppm GA3 thinning without sizing.

3.4. Effect of GA3 foliar spray on chemical characteristics

Figure (4a) clearly shows that GA_3 significantly increased the TSS % at 20 ppm for thinning plus 30 ppm GA_3 for sizing in T6 during the 2018 and 2019 seasons. Also, spraying GA_3 at 20 ppm for thinning and sizing (T5) came in the second rank. Moreover, (T1) recorded the third rank concerning TSS% in both seasons without significant differences. On the other hand, the control treatment produced the lowest values.

The obtained results agree with **Anjum *et al.*** [31] on the Sultanina grapevine cultivar. They showed that TSS was significantly higher by GA_3 application. In contrast, the acidity was less with applying the high GA_3 concentration. Moreover, **Mohsen** [32] stated that different GA_3 significantly differed in TSS. The highest TSS was obtained from 30 mg GA_3. The TSS tended to reduce with the high GA_3, and the application of 120 mg recorded the lowest TSS. The reduction in TSS with increment in the applied GA_3 appears to be due to the accumulation of carbohydrates. Regarding the total acidity %, Figure (4b) demonstrates an opposite trend compared with TSS%. The Juice of control vines was the most acidic among all treatments in both seasons. It scored the highest acidity % during the two seasons. However, the lowest acidity resulted from 20 ppm GA_3 treatment for thinning plus 30 ppm for sizing (T6) in both seasons. **Alrashdi *et al.*** [33] found that TSS was not affected by the GA_3 treatment. Acidity increased by GA_3 spray compared to control. TSS/acid ratio increased by spray GA_3 compared to control. Moreover, **Abdel-salam *et al.*** [34]showed that GA_3 spraying significantly increased acidity and reduced TSS compared to control. TSS/acidity ratio showed a similar trend in the TSS % Figure (4c). The highest values resulted from T6, followed by T5. The results of the TSS/acidity ratio as affected by foliar application of GA_3 could be arranged in ascending order as (control, T4, T8, T11, T3, T7, T10, T9, T2, T1, T5, and T6), respectively in both seasons. Our results agree with [35], who reported that GA_3 increased TSS, TSS/acid ratio, and decreased acidity in the Red globe grape. On the contrary, **Khalil** [26] reported a significant decrease in TSS content by using GA_3 compared to the control, while the acidity was unaffected. Also, **Abu-Zahra and Salameh** [10] found that GA_3 caused an increment of TSS while decreased titratable Acidity in Black Magic mature grapes. In light of the obtained results regarding the effect of the studied treatments on the chemical quality characteristics of Thomson seedless grapes, it can be said that the gibberellic spray has a significant impact by increasing the percentage of total soluble solids, as well as total soluble solids to acidity ratio and reducing the acidity percentage.

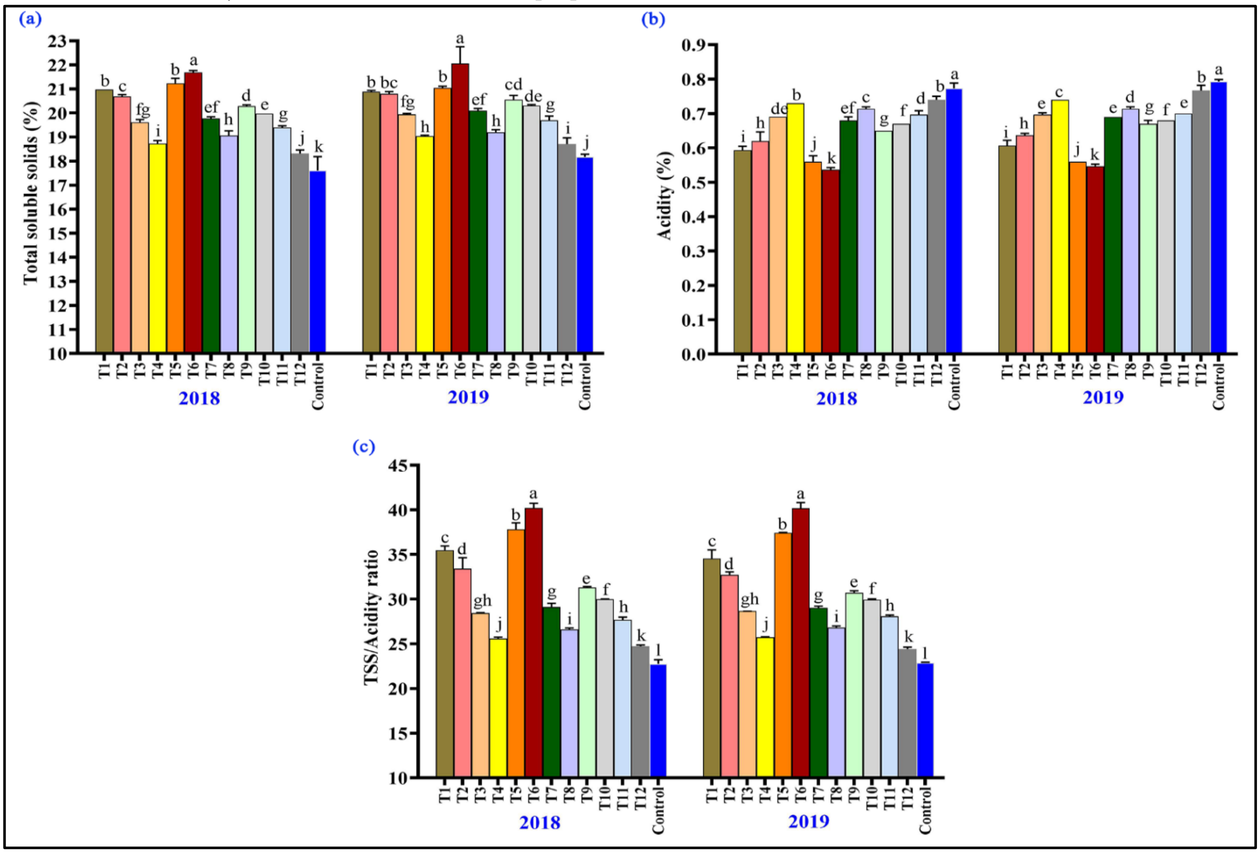

Figure 4: Effect of GA_3 on chemical characteristics during 2018 and 2019. **(a)** Total soluble solids (TSS), **(b)** Acidity, and **(c)** TSS/Acidity ratio. **Control**: water spray, **T1**: 10 ppm GA3 thinning + 20 ppm GA3 sizing, **T2**: 10 ppm GA3 thinning + 30 ppm GA3 sizing, **T3**: 10 ppm GA3 thinning + 40 ppm GA3 sizing, **T4**: 10 ppm GA3 thinning Without sizing, **T5**: 20 ppm GA3 thinning + 20 ppm GA3 sizing, **T6**: 20 ppm GA3 thinning + 30 ppm GA3 sizing, **T7**: 20 ppm GA3 thinning + 40 ppm GA3 sizing, **T8**: 20 ppm GA3 thinning Without sizing, **T9**: 30 ppm GA3 thinning + 20 ppm GA3 sizing, **T10**: 30 ppm GA3 thinning + 30 ppm GA3 sizing, **T11**: 30 ppm GA3 thinning + 40 ppm GA3 sizing and **T12**: 30 ppm GA3 thinning without sizing.

4. Conclusion

In the light of the obtained results, spraying 20 ppm GA_3 at full bloom for thinning and 30 ppm after fruit set repeated twice at 3 days intervals for sizing showed positive effects on growth, yield, and quality of Thompson seedless grapevines (H4 strain). This reflects the application of GA_3 on H4 strain grapevines to maintain homeostasis between high yield and good quality. Therefore, it could be recommended to get a high yield, reduced cluster compactness and improve the clusters morphological and chemical characteristics of the clusters and berries.

5. Conflicts of interest:

There are no conflicts to declare".

6. Formatting of funding sources

There is no fund was received for this research.

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All members of Horticulture Department, Faculty of Agriculture, Al-Azhar University, Nasr City, Cairo 11651.

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الملخص العربي

الجبريلين يحسن الخصائص الكيماوية والطبيعية والمحصول ويقلل التزاحم في كروم العنب (سلالة H4)

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اجريت تجربة حقلية خلال موسمين تتاليين عامي 2018 و 2019 على كرمات العنب البناتي (سلالة H4) عمر خمس سنوات و المطعومة على أصل فريدوم ومنزرعة في بستان خاص يقع في منطقة الخطاطبة ، محافظة المنوفية ، مصر. تم تصميم البحث لدراسة تأثير الرش بالجبريلين بتركيز 10 و 20 و 30 جزء في المليون للخف عند قمة التزهير بالإضافة إلى الرش بتركيز 20 و 30 و 40 جزء في المليون للتحجيم بعد مرحلة العقد وذلك لتقليل تزاحم العنقود وتحسين جودته. أوضحت النتائج أن محتوى الكلوروفيل الكلي ينخفض عند زيادة تركيز الرش بالجبريلين ، بينما كان رش الجبريلين للخف والتحجيم أعلى من غيره للخف فقط فيما يتعلق بوزن خشب التقليم. وأظهرت النتائج أيضًا أن الرش بتركيز 20 جزءًا في المليون للخف ثم الرش 30 بتركيز جزء في المليون للتحجيم كان هو التركيز الامثل لزيادة وزن العنقود، والمحصول الكلي للكرمات ، وتقليل تزاحم الحبات في العنقود ، بالإضافة إلى زيادة نسبة من المواد الصلبة الكلية ، نسبة المواد الصلبة / الحموضة ، وتقليل النسبة المئوية للحموضة. ويمكن التوصية برش 20 جزء في المليون من الجبريلين للخف عند قمة التزهير و 30 جزء في المليون للتحجيم لتقليل التزاحم وزيادة المحصول وتحسين الجودة للحصول في العنب البناتي (سلالة H4) .

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