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Improvement of Physical and Chemical Properties of Thompson Seedless Grapes (H4 Strain) by Application of Brassinolide and Gibberellic acid

CrossMark

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THIS investigation was carried out during two successive seasons (2018 & 2019) in the vineyard of EL-Baramon experimental farm. Hort. Res. Inst. Mansoura, Dakahlia Governorate, Egypt. The experiment was conducted on Four/Five years-old Thompson seedless grapevines (H4strain). The vines were grown in a clay soil under surface irrigation system and cane pruning and trellised with Spanish baron system. The aim of this study was to reduce the compactness coefficient of clusters and improve the physical and chemical properties of cluster and berries in Thompson seedless grapes (H4strain). Gibberellic acid (GA_3) and Brassinolide (BL) were foliar applied alone or in combinations at three stages, before bloom, during bloom stage and after complete set of berries.

The Results show that spraying the vines with Gibberellic acid (GA_3) and Brassinolide (BL) alone or in combinations significant improved the cluster and berries traits, since they decreased the number of berries/cluster and increased the length and width of cluster consequently, decreasing the compactness coefficient of cluster. Also, clear improvements in cluster weight, yield and physical & chemical properties of berries were attained. The data also revealed that Gibberellic acid (GA_3) was more effective on improving physical properties of clusters and berries while Brassinolide was preferable on improving chemical properties of berries.

The best achievements were dedicated to Gibberellic acid (3/4 recommended dose) + 0.5 ppm Brassinolide followed by Gibberellic acid (1/2 recommended dose) + 1.0 ppm Brassinolide.

Keywords: Grapevines, Thompson seedless cv. (H4 Strain), Gibberellic Acid (GA_3), Brassinolide (BL), Compactness Coefficient of Cluster and Quality Traits.

Introduction

Grape is one of the most delicious, refreshing and nourishing fruits of the world. The berries are a good source of sugars and minerals as Ca, Mg, Fe, and vitamins as B1, B2 and C (Senthilkumar et al., 2018). Thompson seedless grape is the most important table grape cultivar grown in Egypt especially in Delta region. It is a table grape and for making raisins and also it is an important cultivar for export.

H4 is a strain of Thompson seedless. It widely spread in recent few years and the demand on this strain become very much for cultivation due to the high yield of vine as well as increase the weight of cluster. On the other hand, this strain produce clusters with high compactness and small size of berries thus effects negatively on the quality of the clusters during the marketing. Overcoming on these problems would lead to improve the market price for local consumption and exportation.

Quality improvement is an important gauge in viticulture which could be accomplished with the aid of various plant bioregulators. Among the

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used bioregulators, Gibberellic acid (GA_3) and Brassinosteroid (BRs) play a significant role for enhancing crop of grapes in terms of both quantity and quality that meet export requirements (Senthilkumar et al., 2018).

Although there are many studies concerning to the effects of exogenously applied gibberellins, there is no enough studies assessing the impact of Gibberellic acid (GA_3) and Brassinosteroid (BRs) on H4 strain. Gibberellic acid is greatly used in vineyards, all over the world, to increase cluster weight, berry weight and size on most grape cultivars which in turn increase the vines yield. It is also known to decrease the bunch compactness and tends to improve quality of berries (Jegadeeswari, 2010, Ola et al., 2012, Abd El-Baree et al., 2013, Fathi et al., 2013, El-Halaby et al., 2015, Koukourikou et al., 2015, Mohamed, et al., 2017, Rajni et al., 2017 and Senthilkumar et al., 2018).

Applications of (GA_3) lead to cell division and cell enlargement as well as increase the biosynthesis of proteins and producing new tissues promoting the water and nutrients absorption which will lead to increase the cluster length as well as, berry size and weight. (Dimovska et al., 2011, Abu- Zahra and Salameh, 2012, Dimovska et al., 2014 and Abada et al., 2015).The effect of (GA_3) depends on date of treatments, concentration applied and cultivar (Perez et al., 2000 and Casanova et al., 2009).

Brassinosteroids (BRs) are a group of steroidal plant hormones that are necessary for normal plant development which were first separated from the pollen of *Brassica napus*, a close relative of mustard (Grove et al., 1979). Brassinolide (BL), castasterone (CS), and 24-epibrassinolide (24- epiBL) are among the naturally occurring Brassinosteroids (BRs) that are considered to be the most important ones because of their wide distribution and potent biological activity (Bartwal et al., 2013).

Brassinosteroids (BRs) influence a range of various processes of growth and genes, and affect the activities of complex metabolic pathways. An increase in crop production and quality has been observed when plants were exogenously treated with Brassinosteroids (BRs) at convenient developmental stages (Bartwal et al., 2013).

Brassinosteroids (BRs) catalyzes cell division and elongation, flower bud differentiation, carbohydrate stimulates and ATP activity subsequently, enhancing physiological status of plant, improving vegetative growth and directing trees to earlier harvest as well as increasing fruit yield and quality (Wang et al., 2004, Mussig, 2005, Gomes et al., 2006, Symons et al., 2006, Jegadeeswari et al., 2010, Gabr et al., 2011, Harindra Champa et al., 2014, Engin et al., 2015, Harindra Champa et al., 2015, Isci & Gokbayrak, 2015, Rajni et al., 2017, Asghari & Rezaei-Rad, 2018 and Senthilkumar et al., 2018). Being a growth promoter, Brassinosteroids (BRs) act synergistically and in an independent manner with auxins (Taiz and Zeiger, 2010) hence, it positively effects on important economically properties of berry. Furthermore, there is convincing clues that (BRs) improves ripening of grapes (Symons et al., 2006).

The aim of this investigation is estimate effect of exogenously applied Brassinolide (BL) alone or in combination with Gibberellic acid (GA_3), on reducing the compactness coefficient of clusters and improving quality attributes of Thompson seedless grapes (H4 strain) grafted on freedom rootstock.

Materials and Methods

This investigation was carried out during two successive seasons (2018 & 2019) in the vineyard at EL-Baramon experimental farm. Hort.Res. Inst., Mansoura, Dakahlia Governorate, Egypt. The experiment was conducted on Four/Five years-old Thompson seedless grapevines (H4 strain) grafted on freedom rootstock).The vines were grown in a clay soil under surface irrigation system, spaced at 2 x 3 meters using cane pruning and trained using quadrilateral cordon trellis system and supported by Spanish baron system. During January of each experimental season, vines were pruned as a cane-pruning by leaving 8 canes each of 12 eyes and 8 spur each of 2 eyes, the total bud load was about 112 buds. Seventy two vines uniform in vigor as much as possible were chosen for this study, all vines received the same cultural management recommended by ministry of agriculture. The experiment comprised Eight treatments arranged in a complete randomize blocks design, each treatment was replicated 3 times and each replicate included 3 vines and the same vines were used during the two seasons of study.

Gibberellic acid (GA_3) was used under trade mark Berelex (gibberellic acid 10%, Valent

Biosciences Co., USA) and applied on Thompson seedless grapevines (H4 strain) at three stages: (i) before bloom, when the clusters length reached about 10 cm long at rate (15 ppm) to increase its length (ii) during bloom stage at two time, at 10 % bloom and full bloom at rate (15 ppm) to cause an extent flower drop (iii) after berry set, at two time, when berries reached about (4-5 mm) at rate (20 ppm) and the second after 5 days later at rate (30 ppm) for sizing (as recommended ministry of agriculture).

Brassinolide (BL) was used under trade mark Blank, the active ingredient (Brassinolide 1%) and content Nitrogeen 8% and Phosphour 20% and applied as spraying application on all vines at rate (1.0 and 2.0 ppm) at the same time and stages which Gibberellic acid (GA_3) was sprayed. Crop load at all treatments was adjusted to 24 clusters/ vine after complete set of berries.

The treatments were conducted as the following:

- T1. Control (spraying tap water).
- T2. Gibberellic acid (i.e. recommended dose).
- T3. Brassinolide (BL) at 1.0 ppm.
- T4. Gibberellic acid (3/4 recommended dose) + 0.25 ppm Brassinolide (BL).
- T5. Gibberellic acid (1/2 recommended dose) + 0. 5 ppm Brassinolide (BL).
- T6. Brassinolide (BL) at 2.0 ppm.
- T7. Gibberellic acid (3/4 recommended dose) + 0.5 ppm Brassinolide (BL).
- T8. Gibberellic acid (1/2 recommended dose) + 1.0 ppm Brassinolide (BL).

The recorded measurements during the two experimental seasons

Yield

At harvesting time when soluble solids content (SSC%) of berries juice reached about 16-17 % in the untreated vines (Sabry et al., 2009), six clusters /vine were weighed and the average of cluster weight was multiplied by number of clusters/vine to calculate the average of yield/vine.

Physical properties of cluster and berries

A representating sample of 6 clusters/ vine was taken at harvest for the following measurements: Average cluster weight (g), average length and width of cluster (cm), average of 100 berry weight (g), average length (cm), diameter (cm) and shape index of berry. While, the coefficient of cluster compactness was calculated by dividing number of the cluster berries on the cluster length. Also, the percentage of berries set was calculated as follow:

$$\text{Berries set \%} = \frac{\text{Number of berries/cluster}}{\text{Number of total blossoms/cluster}} \times 100$$

Chemical properties of berries

- Juice soluble solids content (SSC %) was determined by using hand refractometer.
- Juice total acidity percentage (as g tartaric acid /100 ml juice) by titration against 0.1 N Na OH using phenolphthalein indicator as described by (A.O.A.C. 1980).
- SSC/acid ratio was calculated by dividing the percentage of SSC% by total acidity.
- Total sugars (%) were determined according to (Sadasivam and Manickam, 1996).
- Total carotenoids in berries skin (mg/g F.W.) were determined according to (Mackinny, 1941).

Statistical Analysis

The obtained results were statistically analysis according to (Snedecor and Chocran, 1980). The New LSD value at 5% level was used to compare the differences among various treatments.

Results

Berries set %, cluster weight and yield/vine or feddan

Data presented in (Table 1) indicate that, all treatments applied resulted in lower significant values with respect to percent of berries set as compared with control (spraying tap water) which attained the highest significant values of berries set during both seasons of study. Also, the data show that the vines which were sprayed with Gibberellic acid (i.e. recommended dose) (T2) gave the lowest values as compared to other tested treatments of berries set. There were non-significant differences between those sprayed with Gibberellic acid (3/4 recommended dose) + 0.25 ppm BL (T4) and Gibberellic acid (1/2 recommended dose) + 0. 5 ppm BL (T5) on side and between Gibberellic acid (3/4 recommended dose) + 0.5 ppm BL (T7) and Gibberellic acid (1/2 recommended dose) + 1.0 ppm BL (T8) on the other side on berries set (%) in both seasons. Also, the data in the same table reveled that all treatments induced significantly higher values of cluster weight, yield/vine and per/feddan as compared with control (spraying tap water) which, gave the lowest significant values during the two seasons of study. The data also show that the vines which were sprayed with Gibberellic acid (3/4 recommended dose) + 0.5 ppm BL (T7) and Gibberellic acid (i.e. recommended dose) (T2) gave the highest significant values of cluster weight, yield/vine and per/feddan with non-significant differences between of them followed by Gibberellic acid (1/2 recommended dose) + 1.0 ppm BL (T8) then Brassinolide (BL) at 2.0 ppm (T6) during the two seasons of study. The increment in yield per vine and per feddan may be due to the increment of cluster weight.

Physical properties of clusters

The effects of applied treatments on physical properties of clusters during the two studied seasons are shown in (Table 2). It is evident that all treatments used improved the cluster traits as compared with control. Using Gibberellic acid (i.e. recommended dose) and Brassinolide at 1.0 & 2.0 ppm alone or in combinations between them significantly decreased cluster compactness and significantly increased cluster length and width which subsequently produced looser clusters. Also, the data show that the vines which sprayed Gibberellic acid (i.e. recommended dose) (T2) gave the lowest significant values of compactness coefficient of cluster as compared with control

TABLE 1. Effect of spraying Gibberellic acid (GA_3) and Brassinolide (BL) on berries set, cluster weight and the yield of Thompson seedless grapes (H4 strain) in 2018 and 2019 seasons

	Measurements	Berries set (%)		Cluster weight (g)		Yield/vine (kg)		Yield /feddan (ton)	
	Treatments	2018	2019	2018	2019	2018	2019	2018	2019
T1	Control	16.29	17.24	795	790	19,08	18.96	13.36	13,27
T2	Gibberellic acid (GA_3) (i.e. recommended dose)	11.28	11.46	890	898	21.36	21.54	14.95	15.08
T3	Brassinolide (BL) at (1.0 ppm)	14.9	15.18	820	826	19.68	19.83	13.78	13.88
T4	GA_3 (3/4 recommended dose) + 0.25 ppm (BL)	12.43	13.28	846	847	20.30	20.34	14.21	14.24
T5	GA_3 (1/2 recommended dose) + 0.5 ppm (BL)	13.18	13.80	832	840	19.97	20.16	13.98	14.11
T6	Brassinolide (BL) at (2.0 ppm)	14.12	14.72	855	850	20.53	20.40	14.37	14.28
T7	GA_3 (3/4 recommended dose) + 0.5 ppm (BL)	11.76	12.33	897	906	21.54	21.74	15.08	15.22
T8	GA_3 (1/2 recommended dose) + 1.0 ppm (BL)	12.00	12.92	882	885	21.17	21.24	14.82	14.87
	New LSD at 5%	1.14	0.90	8.0	9.0	0.20	0.25	0.18	0.19

vines (T1) which, gave the highest significant values in this respect. Also, data clearly show non- significant differences among Gibberellic acid (i.e. recommended dose) (T2), Gibberellic acid (3/4 recommended dose) + 0.5 ppm BL (T7) and Gibberellic acid (1/2 recommended dose) + 1.0 ppm BL (T8) treatments on compactness coefficient of cluster. Also, data show that Gibberellic acid (3/4 recommended dose) + 0.5 ppm BL (T7) treatment gave the highest significant values of cluster length and width as compared with control (T1) which, gave the lowest significant values with non-significant differences among most treatments under studied.

Gibberellic acid (GA_3) and Brassinolide (BL) treatments alone or in combinations between them significantly improved cluster appearance of Thompson seedless grapes (H4 strain) by increasing berry mass and rachis length. Apart from cluster thinning, the elongation of rachis resulted in less compact clusters, thus improving the grape appearance.

Physical properties of berries

As shown in (Table 3) it is clear that spraying Thompson seedless grapevines (H4 strain) with Gibberellic acid (i.e. recommended dose) and Brassinolide (BL) at 1.0 & 2.0 ppm alone or in combinations between them induced a positive impact on physical properties of berries in terms, 100 berry weight, berry length and berry diameter

TABLE 2. Effect of spraying Gibberellic acid (GA_3) and Brassinolide (BL) on compact coefficient of cluster, cluster length and width of Thompson seedless grapes (H4 strain) in 2018 and 2019 seasons

	Measurements	Compact coefficient of cluster		Cluster length (cm)		Cluster width (cm)	
	Treatments	2018	2019	2018	2019	2018	2019
T1	Control	14.92	15.22	32	30	12.7	13.3
T2	Gibberellic acid (GA_3) (i.e. recommended dose)	10.05	10.03	37	37	16.7	17.0
T3	Brassinolide (BL) at (1.0 ppm)	11.59	11.35	35	34	15.3	15.7
T4	GA_3 (3/4 recommended dose) + 0.25 ppm (BL)	10.88	10.48	36	37	16.3	16.7
T5	GA_3 (1/2 recommended dose) + 0.5 ppm (BL)	11.01	10.81	36	36	15.7	16.3
T6	Brassinolide (BL) at (2.0 ppm)	10.78	10.97	37	36	16.0	16.0
T7	GA_3 (3/4 recommended dose) + 0.5 ppm (BL)	10.18	10.28	38	37	17.3	17.7
T8	GA_3 (1/2 recommended dose) + 1.0 ppm (BL)	10.35	10.40	37	37	16.7	16.7
	New LSD at 5%	0.32	0.52	1.40	1.20	0.9	1.0

as compared to control. Also, the data indicated that Gibberellic acid (i.e. recommended dose) (T2) and Gibberellic acid (3/4 recommended dose) + 0.5 ppm BL (T7) applications showed the highest significant values of 100 berry weight as compared with control (T1) and other treatments with non-significant differences between of them followed by Gibberellic acid (1/2 recommended dose) + 1.0 ppm BL (T8) then Brassinolide (BL) at 2.0 ppm (T6) treatments in both seasons. It is obvious from the obtained data that the single or combined application with Gibberellic acid (GA_3) and Brassinolide (BL) significantly increased both berry length and diameter as compared with control vines (T1) during the two seasons of study. Also, the data indicated that non- significant differences between most treatments under studied of berry length and diameter. Similar trend was obtained from berry shape index in both seasons. Using Gibberellic acid (GA_3) alone or in combinations with Brassinolide (BL) was superior in improving physical properties of clusters and berries than using Brassinolide (BL) at 1.0 ppm during the two seasons of study.

Chemical properties of berries

Data from (Table 4) show clearly that all treatments used significant increased juice soluble solids content %, SSC/Acid ratio%, total

TABLE 3. Effect of spraying Gibberellic acid (GA_3) and Brassinolide (BL) treatments on berries physical properties of Thompson seedless grapes (H4 strain) in 2018 and 2019 seasons

	Measurements	100 Berry weight (g)		Berry length (cm)		Berry diameter (cm)		Berry shape index	
	Treatments	2018	2019	2018	2019	2018	2019	2018	2019
T1	Control	187	195	1.76	1.9	1.46	1.53	1.20	1.24
T2	Gibberellic acid (GA3) (i.e. recommended dose)	238	242	2.23	2.23	1.73	1.76	1.29	1.27
T3	Brassinolide (BL) at (1.0 ppm)	202	208	2.03	2.00	1.63	1.63	1.24	1.22
T4	GA_3 (3/4 recommended dose)+ 0.25 ppm (BL)	216	218	2.13	2.16	1.70	1.73	1.25	1.25
T5	GA_3 (1/2recommended dose) + 0.5 ppm (BL)	210	216	2.1	2.13	1.66	1.63	1.25	1.30
T6	Brassinolide (BL) at (2.0 ppm)	220	228	2.16	2.2	1.7	1.73	1.27	1.27
T7	GA_3 (3/4 recommended dose)+ 0.5 ppm (BL)	235	238	2.26	2.3	1.76	1.76	1.28	1.30
T8	GA_3(1/2 recommended dose) + 1.0 ppm (BL)	228	230	2.23	2.23	1.76	1.73	1.26	1.28
	New LSD at 5%	5.0	7.0	0.07	0.09	0.07	0.08	0.07	0.06

TABLE 4. Effect of spraying Gibberellic acid (GA_3) and Brassinolide (BL) on berries chemical characters of Thompson seedless grapes (H4 strain) in 2018 and 2019 seasons

Measurements		SSC (%)		Total acidity (%)		SSC/Acid ratio (%)		Total sugars (%)		Total carotenoides (mg/g FW of berry skin)	
	Treatments	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
T1	Control	16.4	16.2	0.622	0.638	26.38	25.41	14.82	14.36	3.4	3.2
T2	Gibberellic acid (GA3) (i.e. recommended dose)	17.6	17.2	0.576	0.598	30.60	28.82	15.68	15.21	4.1	4.2
T3	Brassinolide (BL) at (1.0 ppm)	18.8	18.6	0.522	0.532	36.09	35.06	16.89	16.58	5.6	5.7
T4	GA_3 (3/4 recommended dose) + 0.25ppm (BL)	17.8	17.6	0.564	0.572	31.59	30.79	15.92	15.46	4.8	4.4
T5	GA_3 (1/2 recommended dose) +0.5ppm (BL)	18.2	18.0	0.544	0.556	33.47	32.39	16.45	16.18	5.0	4.7
T6	Brassinolide (BL) at (2.0 ppm)	19.2	19.4	0.476	0.460	40.34	42.17	17.47	17.82	6.2	6.5
T7	GA_3 (3/4 recommended dose) + 0.5 ppm (BL)	18.5	18.4	0.536	0.545	34.51	33.79	16.64	16.56	5.4	5.3
T8	GA_3 (1/2 recommended dose) + 1.0 ppm (BL)	19.0	19.2	0.490	0.470	38.77	40.85	17.18	17.42	5.8	6.2
	New LSD at 5%	0.4	0.3	0.016	0.020	1.63	1.77	0.35	0.42	0.6	0.5

sugars % and total carotenoides in berry skin while, these treatments reduced total acidity % in berries juice as compared with control. The treatment of Brassinolide (BL) at 2.0 ppm (T6) gave in both seasons not only the highest values in soluble solids content, SSC/Acid ratio%, total sugars and total carotenoides in berries skin but also the lowest total acidity as compared with other treatments followed by the treatment of Gibberellic acid (1/2 recommended dose) + 1.0 ppm BL (T8) and non- significant differences between of them in both seasons of the study. The results also revealed that the differences between the applications of Brassinolide (BL) at 1.0 ppm (T3) and Gibberellic acid (3/4 recommended dose) + 0.5ppm BL (T7) on soluble solids content, total acidity % SSC/Acid ratio% and total sugars % were insignificant. Using Brassinolide (BL) at (1.0 or 2.0 ppm) alone or in combination with Gibberellic acid (GA_3) was more effective than using Gibberellic acid (GA_3) alone in improving chemical properties of berries during the two seasons of study.

Discussion

The present study proved that the application of Gibberellic acid (GA_3) and Brassinolide (BL) alone or in combinations significant enhanced the clusters and berries traits, as they reduced the number of berries /cluster and increased length and diameter of clusters consequently, decreased the compactness coefficient of clusters. Also, they enhanced cluster weight, yield and physical & chemical properties of berries.

The beneficial effects of Gibberellic acid (GA_3) on cluster weight, yield per vine and per feddan as well as improving physical properties on cluster and berries may be due to that GA_3 increases cell division and cell enlargement as well as elevating the biosynthesis of proteins and producing new tissues that improves the water and nutrients absorption is consequently, reflected on increase the cluster length, as well as, berry size and weight of berries and cluster, thus increasing the yield. (Dimovska et al., 2011, Abu- Zahra & Salameh, 2012, Dimovska et al., 2014 and Abada et al., 2015).

Application of GA_3 before bloom, during bloom stage and after berries set was more effective in enhancing the cluster traits, since it causes a marked blossom thinning consequently, reducing berries set and berries number. Also, by it increasing length and width of cluster significantly which, decreased the compactness coefficient thus, improving the grape appearance. These results are in agreement with those obtained by (El-Salhy et al., 2009, Abu-Zahra, 2010 and Koukourikou et al., 2015).

Similar results were reported by other researchers. Abu-Zahra, (2010) investigated the effect of (GA_3) on yield and fruit quality of Thompson seedless and reported that spraying the vines with (GA_3) enhanced yield and quality parameters such as soluble solids content and decreasing total acidity. Taleb and Naser, (2012) reported that using (50 ppm) GA_3 was influential in increasing the total soluble solids and decreasing total titratable acidity significant in Black Magic grape. Highest TSS (%) was observed with (50 ppm) GA_3 applied at berry set stage when berries reached about 4 mm in length in Perlette cultivar under Iran condition Zahedi et al. (2013).

Chaitakhob et al., (2014) who reported that spraying the vines with (GA_3) at 50% full bloom and at fruit set stage (pea size) increased bunch length, width and increased the berry length/ width ratio as well as increased the TSS, reduced acidity and increased TSS/ Acidity ratio significantly in Perlette grapes.

Also, Dimovska et al. (2014) reported that application of (20 ppm) GA_3 at 7-10 days before blooming and 7-10 days after blooming increased bunch weight, length and width of Flame seedless grapes. It also affected berry length, width, and weight and berry shape index significantly.

El-Halaby et al. (2015) declared that spraying Flame seedless grapevines with (GA_3) seven times, significantly reduced the berries set, reduced cluster compactness and accelerated the ripening with clearly good berries quality compared to untreated vines.

The positive effect of Brassinosteroids, (BRs) on improving physical and chemical properties of cluster and berries may be attributed to their major role on stimulating cell division and extension, flower bud differentiation, carbohydrate assimilation, photosynthesis, ethylene biosynthesis, nucleic acid and protein synthesis and ATP activity subsequently, improved vegetative growth, physiological status and directed trees to earlier harvest as well as increased fruit yield and quality (Sasse, 2003, Wang et al., 2004, Mussig, 2005, Gomes et al., 2006, Symons et al., 2006, Jegadeeswari et al., 2010 Gabr et al., 2011, Harindra Champa et al.,2014, Harindra Champa et al., 2015, Isci and Gokbayrak, 2015, Engin et al., 2015, Rajni et al., 2017, Asghari and Rezaei-Rad, 2018 and Senthilkumar et al., 2018).

Also, the positive effect of Brassinolide (blank), on reduce the compactness coefficient of clusters and improving physical and chemical properties of cluster and berries may be attributed to it content (nitrogeen 8% and phosphour 20%). Nitrogen has much function in all division, the synthesis of proteins, protoplasm, enzymes and organic compounds as nucleoproteins, amino acid and chlorophyll (Nijjar, 1985). The effect of nitrogen at bloom stage it producing new tissues that improves the water and nutrients absorption induce more vegetative growth that shifted the balance of competition between blossom clusters and vegetative organs in favor of the latter which led to falling some flowers consequently, decreased the compactness coefficient of clusters (El-Halaby et al. 2015). Also, phosphorour plays an important role in the photosynthesis and translocation of sugars and carbohydrates storage within the vine and it is necessary in stimulating cell division, the formation of nucleic acids (DNA) and ADP/ATP energy transfer in photosynthesis (Nijjar, 1985). Our data are in agreement with those found by Zhou-Yushu et al. (2003) who reported that berry size of Kyoho grapes was increased with the application of homobrassinolide at 2-3 days before flowering, at full bloom and 14 days after full bloom. Also, Symons et al. (2006) showed that using brassinosteroid (BRs) on grape berries clearly enhanced the final sugar level of the flesh, and significant accelerated the ripening.

Harindra Champa et al. (2014) reported that spraying clusters with (1.0 ppm) brassinosteroid (BRs) significant increased cluster and berry weight, berry length and breadth. It also increased TSS content when vines were sprayed with brassinosteroid at (0.5 and 1.0) ppm.

Asghari and Rezaei-Rad (2018) reported that exogenous brassinosteroid substantially enhanced 'Thompson seedless' berries quality attributes, natural phytochemicals, antioxidants and biochemical compounds.

With respect to combined effect of gibberellic acid (GA_3) and brassinosteroid (BRs) on improving physical and chemical properties of cluster and berries, Warusavitharana et al. (2008) found that spraying the vines with GA_3 at (10 ppm) at pre-bloom stage, (15 ppm) at initiation of flowering, (25 ppm) at 3-4 mm berry diameter stage in combination with (1.0 ppm) brassinosteroid gave the maximum values for bunch characters in three year old Thompson seedless grapes.

Habibi et al. (2010) reported that using (50 ppm) GA_3 + (1.0 ppm) brassinosteroid significantly increased the berry weight and diameter of Bangalore blue grapes.

Jegadeeswari et al. (2010) reported that combined treatment with GA + BR+ PPFM (Pink Pigmented Facultative Methylobacteria) recorded the maximum values of total soluble solids and total sugars and gave lower acidity content in Muscat cultivar.

Padashetti et al. (2010) reported that spraying the vines with GA_3 (50 ppm) + BRs (1.0 ppm) twice at fruit set stage increased bunch weight, berry weight, reducing sugar (%) and TSS of Thompson seedless grapes.

Conclusion

From this study it can be concluded that there is a possible of using Brassinolide (BL) as a partial substitute of Gibberellic acid (GA_3) of Thompson seedless grapevines (H4 strain) to overcoming the compactness coefficient of cluster and improve physical and chemical properties of berries. This investigation confirmed that application of Gibberellic acid (3/4 recommended dose) + 0.5 ppm Brassinolide followed by Gibberellic acid (1/2 recommended dose) + 1.0 ppm Brassinolide treatments was preferable for achieving significant values of physicals and chemicals properties of cluster and berries and more effective in improving the cluster traits and grape appearance consequently, improves the market price for Thompson seedless (H4 strain).

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تحسين الصفات الطبيعية والكيمائية لعنب الطومسون سيدلس (سلالة H4) باستخدام البرسينولايد وحامض الجبريليك

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أجريت هذه الدراسة خلال موسمي (٢٠١٨ & ٢٠١٩) في مزرعة البرامون التابعة لمعهد بحوث البساتين بالمنصورة - محافظة الدقهلية على كرمات عنب الطومسون سيدلس (سلالة H4) المطعوم على أصل الفريدم عمرها (٤ - ٥) سنوات ومنزرعة في تربة طينية وتروى بنظام الري بالغمر ومنزرعة على مسافة ٢×٣ م ومرباه بالطريقة القصبية وتحت نظام التدعيم البارون . وكان الهدف من هذه الدراسة هو تقليل معامل تزاحم العنقود وتحسين الصفات الطبيعية والكيميائية للعنقود والحبات لهذة السلالة. حيث تم الرش بكل من حامض الجبريليك ومادة البرسينولايد بصورة منفردة أو معا في ثلاث مراحل (قبل التزهير، خلال مرحلة التزهير وبعد تمام العقد) . وقد أوضحت النتائج أن الرش بحامض الجبريليك ومادة البرسينولايد بصورة منفرة أو معا كان له تأثير معنوي في تحسين صفات العنقود والحبات مقارنا بالكنترول ، حيث أدى ذلك الى خفض في نسبة عقد الحبات وزيادة طول وعرض العنقود وبالتالي انخفض معامل تزاحم العنقود وتحسين مظهر وشكل العنقود . كما أظهرت النتائج أيضا زيادة وزن العنقود والمحصول للكرمة وللفدان وكذلك وزن وطول وعرض الحبات وأيضا تحسين صفات الجودة في الحبات مثل المواد الصلبة الذائبة ونسبة المواد الصلبة الذائبة الى الحموضة والسكريات الكلية والكاروتينات الكلية وكذلك خفض نسبة الحموضة في عصير الحبات . وكان لاستخدام حامض الجبريليك أفضل الأثر في تحسين الصفات الطبيعية للعنقود والحبات بينما كان استخدام مادة البرسينولايد أكثرفاعلية في تحسين الصفات الكيميائية للحبات . وقد أعطت معاملة (٣/٤ الجرعة الموصي بها من حامض الجبريليك + ٥,. جزء فى المليون من مادة البرسينولايد) يليها معاملة (١/٢ الجرعة الموصي بها من حامض الجبريليك + ١ جزء في المليون من مادة البرسينولايد) أفضل النتائج والتي نوصى باستخدامها وذلك لتقليل معامل التزاحم وتحسين صفات وشكل العنقود والحبات وكذلك الصفات الكيميائية وبالتالي تحسين القيمة التسويقية لصنف عنب الطومسون سيدلس (سلالة H4) .

الكلمات الدالة :العنب ، صنف الطومسون سيدلس (سلالة H4) ، حامض الجبرليك ، مادة البرسينولايد ، معامل تزاحم العنقود ، صفات الجودة .