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Impact of Methyle Jasmonate, Abscissic Acid and Ethephon on the Consistency of Flame Seedless Grapes at Harvest and Post-harvest

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BERRY color development of Flame Seedless grapes is considered one of the main maturity indices. Achieved the requested color at harvest is one of the main problems of Flame Seedless because berries fail to reach the requested level of red color. So, an experiment was carried out on Flame Seedless vines in a private vineyard in the governorate of Sharkia, Egypt. Bunches were sprayed with one of the following five treatments, 0 mg/l (as a control treatment), Methyle Jasmonate at 0.046 %, Ethephon at 0.24 g/l and at 0.14 g/l, Ethephon at 0.24 g/l + ABA at 0.015% and Ethephon at 0.24 g/l + Methyle Jasmonate at 0.046 %.

The single treatments were sprayed at veraison stage while the combined treatments were sprayed at veraison stage and then 5 days later. The combined treatment of (Ethephon + Methyle Jasmonate) was the best treatment, compared control treatment in both seasons, it improves berry color and increases the packable yield at the first harvest. The same treatment significantly increased anthocyanin content and total soluble solids percentage as well as TSS/acid ratio compared with control treatment in both seasons, respectively. Therefore, the combination between Ethephon and Methyle Jasmonate surpassed the other tested treatments in improving berry color and improving berry quality at harvest time. Moreover, the combined treatments with either Ethephon + Methyle Jasmonate was more effective in improving berry coloration and quality than Methyle Jasmonate individually.

Keywords: Flame Seedless, Color, Anthocyanin, Methyle Jasmonate, Abscisic acid and Ethephon.

Introduction

The grape (*Vitis vinifera* L.) is considered to be one of the world's most significant and common fruit crops. Grapes are one of the most widely cultivated fruit crops in Egypt.

Egypt's grape cultivation is spread geographically from Alexandria in the north to Aswan in the south, which, combined with the production of early and late ripening grapes, enables the prolonged availability of fresh table grapes from May to November. Egypt ranks fourth worldwide in the global production volume of table grapes, and has shown impressive growth in the past 5 to 10 years. In 2016, production of grapes in Egypt amounted to 1 691 194 tonnes on 184 254 feddan1 of cultivated land (FAO, 2018).

Flame Seedless is considered the main early ripening seedless table grape in Egypt. It is a robust grape cultivar with a heavy bearing ability which also remains well in storage. It is a hybrid of several cultivars of (*Vitis vinifera*), (Cardinal x Sultanina) x [(Red Malaga x Tifafihi Ahmer) x (Muscat of Alexandria x Sultanina)] (Akkurt et al., 2019). Flame Seedless was bred in the U.S.A. in 1973. Fresno, California Department of Agriculture Station. It has set the benchmark worldwide for table grape quality. This fast-growing early cultivar is ideal for hot sunny areas and provides early-season harvesting of sweet and

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large berries (Brooks et al., 1997). Flame Seedless has superior eating characteristics. Since, berry texture is crispy and firm, excellent flavor and high TSS percentage at harvest time. It take a special concern in Egypt because it is characteristics is favorable for local consume and exportation. It is desirable to reach the early market window of the European Union when prices are high.

The commercial value of table grapes is affected by their appearance, including berry color. Therefore, poor coloring of red table grapes is a problem facing the producers. Grown in worm climate zones, like Flame Seedless, is an issue and reduces the efficiency of grape production (Peppi et al., 2006). Berry color development at harvest is one of the main problems of this Flame Seedless berries which often fail to reach the desire color due to climatic changes during growing season generally and summer high temperature specially, it inhibit or delay the normal accumulation of anthocyanin pigment. Also, the treatment of GA_3 which normally used to improve berry quality and size can inhibit or delay coloring. Berry skin red color is a result of anthocyanin pigment accumulation and biosynthesis in grape berries cells (Yamane et al., 2006).

Careful, suitable management of vegetative growth, crop and treatment of Ethephon and / or ABA achieve the requested color of Flame Seedless (Schrader et al., 1994, Canin et al., 2007). But, although using all the standard cultural practices, grape bunches remain week and poor in color (Schrader et al., 1994 and Spayed et al.,2002).

Maintaining the perfect balance between high fruit quality and harvest timing at ideal sugar levels is one of the most difficult conditions for efficient production of Flame Seedless. Furthermore with reasonably high yields, this balance is retained, resulting in notable profitability. The coloration of table grape berries is mainly related to anthocyanin accumulation. These pigments are responsible for all degrees of red color in grapes and other fruits. The accumulation of anthocyanin pigments starts at veraison stage and regulated especially by Abscisic acid (Ban et al., 2003 and Owen et al., 2009).

Ethephon (2-chloroethyl phosphonic acid) speed the ripening process of many fruits, including red table grapes. It produces ethylene when it starts to degraded. Ethephon (Ethrel 480 g Ethephon /l) as a trade name commonly are used on poor colored red table grape cultivars to improve berry color development at the beginning of fruit ripening (Dokoozlian et al., 1995). Ethephon treatment can accelerate berry softening, which decrease the value of exported table grapes (Peppi et al., 2007a). Many previous studies suggested that the exogenous treatment of Abscisic acid (ABA) increases the anthocyanin content in red table grape berries (Peppi et al., 2006, 2007a, Cantin et al., 2007 and Peppi et al., 2008). ABA was found more effective in enhancing grape berry color development than Ethephon (Peppi et al., 2006, Cantin et al., 2007 and Roberto et al., 2012). ProTone is the commercial product used as a source of ABA treatments, it contained 10% of effective material ABA , but it still expensive in comparison with Ethephon product.

Few studies suggest using the external using of Methyle Jasmonate to enhance the improving of anthocyanin content (Khan & Sing, 2007, Belhadj et al., 2008 and Portu et al., 2015). Colorsave is the used commercial product used as a source of Methyle Jasmonate treatments, which contained 15.5% of Methyle Jasmonate.

The recommended practices for achieving suitable berry color such as, girdling, Ethephon spraying and foliage management improve berry color of Flame Seedless berries (Schrader et al., 1994), but in many times, it may remain unacceptable colored. This can be seen in subtropical or worm areas (Kliewer, 1970, Schrader et al., 1994, and Spayd et al., 2002). Therefore, it was important to find other co-effective practices able to improve berry color without resulting excessive berry softening. Also at harvest time, although Flame Seedless vines were subjected to the recommended cultural practices, many berries inside the bunch were still green or not colored. These berries reduce the commercial value of the bunches and needs to be handy eliminated by scissor. This practice is costly and needs clever workers. Harvestable yield and harvesting time are also decreased. There is a need to identify appropriate management strategies that can enhance the color of the berry, without causing undue softening of the berry.

The purpose of this experiment was to determine and evaluate the effect of spraying Methyle Jasmonate either alone or in combination in compare with Ethephon and / or ABA on improving color development, increasing the amount of packable or harvestable grape yield and minimizing number of poor colored berries of Flame Seedless table grape cv. apart from their impact on the other parameters of berry quality at harvest time.

Materials and Methods

During the two successive seasons of 2019 and 2020, the present investigation was conducted on 9-year-old Flame Seedless grapevines grown in a private vineyard at Governorate of Sharkia,, (30.7327° N, 31.7195° E) Egypt. The experimental vines were chosen to be acceptable and almost equal in growth ability and received the usual cultural practices uniformly (nutrition, irrigation, fertilization and pest management). The vines selected were planted in sandy soil under a drip irrigation system at a distance of 2 x 3 m and trellised under the Spanish Baron system. In the winter of each season, vines were trained according to the cane pruning method and pruned to leave about 50 buds/vine, i.e. 10 fruit canes/vine x5 buds/cane). All experimental vines were adapted to 30 bunches/vine after fruit set, and all bunches were tipped to approximately 16 cm length. Ethrel 480 SL™ is the commercial product of Ethephon and contains 480 g Ethephon /liter. ProTone SL™ is the commercial product of Abscisic acid (ABA) and contains 10٪ ABA. Whereas, colorsave™ is the commercial product of Methyle Jasmonate and contains 15.5% Methyle Jasmonate.

At the veraison stage and/or five days later, the following spraying treatments were applied to bunches using a back sprayer unit to provide full coverage. The concentrations used are suggested by the manufacturers:

- Control treatment (sprayed with water).
- Methyle Jasmonate at 0.046 % (equal 3 ml/l from the used commercial product Colorsave™) at veraison stage.
- Ethephon at 0.24 g/l (equal 0.5 ml/l from the used commercial product Ethrel ™) at veraison stage and at 0.14 g/l (equal 0.3 ml/l from the commercial product Ethrel ™), five days later.
- Ethephon at 0.24 g/l (equal 0.5 ml/l from the used commercial product Ethrel ™) at veraison stage + ABA at 0.015 % (equal 1.5 ml/l from the commercial product Proton ™), five days later.
- Ethephon at 0.24 g/l (equal 0.5 ml/l from the used commercial product Ethrel ™) at veraison stage + Methyle Jasmonate at 0.046 % (equal 3 ml/l from the used commercial product Colorsave ™), five days later.

For both seasons, the tested treatments were applied at veraison stage when approximately 90 % of berries became soft and about 10% of the bunches started to be colored. Bunches were harvested when achieved the minimum requirement, berries of each bunch became red (more than 90% of berries/bunch) and the total soluble solids reached approximately16° Brix (market minimum requirement) at any procedure. In relation to total number of bunches /vine (30 bunches), the packable yield and its percentage were calculated. Harvestable bunches were collected two times during harvesting time. The selected bunches for determinations were chosen from each vine (replicate) and the yield/vine (kg) was registered. Five bunches per replication were randomly selected for determining : bunch weight (g), number of berries/bunch and 100 berry weight (g) as well as berry polar diameter and length (cm) using Vernier caliper.

Using a fruit Push Pull Effegi penetrometer system (Model FD 101) supplemented with a plunger penetrator 2 mm in diameter, berry firmness was measured. By using a hook instead of the plunger, berry separation force was measured. Berry firmness and berry separation force were expressed in Newtons (N). Berry length and berry diameter were estimated using a Vernier caliper and then the berry shape index was then determined, i.e. length/width. In addition, after being extracted from 100 berries representing each replication, the berry chemical constituents in berry juice were determined. Using a hand refractometer, the total soluble solids percentage (TSS percent). In the presence of phenolphythalyne as an indicator, the titratable acidity percentage was measured by titration against sodium hydroxide (0.1 N). The total acidity of the juice per 100 ml of juice was expressed as g tartaric acid. TSS/acid ratio was then calculated (AOAC, 2006). Samples of berries (whole berry) were lyophilized until a constant weight was obtained. Cholorimetric determination of the anthocyanin content (OD 535 nm) was performed according to the method defined by (Caleb et al., 2013). The following formula determined the total content of anthocyanin attributed to cyanidin-3-glucoside:

$$\text{Total anthocyanin (mg per 100g)} = \frac{[(\text{Absorbance*Dilution factor})}{(\text{Sample weight*5.99})]} \times 100$$

Postharvest quality

Boxed grapes were kept 5 days as a shelf life held at 20 ˚C for 5 days to simulate retail market shelf life conditions and then grape quality was recorded. Boxed grapes visual appearance was rated according to (Cantin et al., 2007), as follows:

(1) excellent, (2) acceptable, or (3) commercially unacceptable.

The condition of Rachis was classified as follows: (1) healthy, means green and healthy rachis and pedicels, (2) mild, means good rachis and visible browning of pedicels, (3) moderate, means browning of pedicels and secondary rachis, or (4) extreme, primary secondary rachis and pedicels are concomitantly brown (Crisosto et al., 2002). Post harvest separation force was measured after 5 days as a shelf life as mentioned before.

Statistical Analysis

This experiment was set up with 5 treatments in a fully randomized block design and each treatment was applied to five vines (five replicates). According to Snedecor and Cochran (1982), the collected data was subjected to variance analysis (ANOVA) using the CoStat programme. The individual comparisons between the values obtained were carried out at a 5 percent level using LSD.

Results and Discussion

Yield/vine, weight of a bunch and number of berries/bunch

The data obtained in Table 1, indicate the negligible effects of the evaluated treatments in both seasons on yield/vine and bunch weight. Total number of berries/bunch was affected significantly in the second season only. This result is in line with those of (Peppi et al., (2007b) and Roberto et al., (2012) they reported that no significant differences among Ethephon and ABA treatments were obtained in terms of berry mass.

Weight of 100 of berries

The recorded data in Table 1, strong significant effects of the used treatments on total number of berries / bunch in both seasons compared with control treatment and with significant differences between the used treatments.

Packable number of bunches at first harvest and its percentage

As shown in Table 1, the tested treatments affected packable number of bunches at first harvest and its percentage significantly in both seasons. The treatment of Ethephon + Methyle Jasmonate was more effective in increasing the packable number of bunches at first harvest significantly, in both seasons with significant differences with the other treatments. The treatment of Ethephon + ABA ranked the second in both seasons. The treatment of Ethephon combined with Methyle Jasmonate advanced the harvest date of Flame Seedless grapes by increasing the packable yield at first harvest compared to other treatments.

The treatment of spraying Ethephon combined with Methyle Jasmonate increased percentage of packable number of bunches at first harvest by 73.2 and 70.0 % hiegher than control treatment in both seasons, respectively. Also, it improve percentage of packable number of bunches at first harvest by 26.1 and 25.7 % compared with raked two treatment (Ethephon combined with ABA) in both seasons, respectively. In the same trend, the treatment of spraying Ethephon combined with Methyle Jasmonate increased percentage of packable number of bunches at first harvest by 65.8 and 70.0 % compared with treatment of spraying Ethephon twice in both seasons, respectively. The beneficial impact of Methyle Jasmonate has been recorded for fruit color and quality (Khan and Singh (2007), Flores et al., (2015). This means that the treatment of Methyle Jasmonate with Ethephon helps to improve fruit quality, early harvest, and reduce the number of harvest times, which increases the economic return for grape growers.

Separation force (N)

Data in Table 2, indicate that the procedure tested substantially decreased the force of separation in both seasons. The highest separation force (7.41, 7.16 N and 7.63, 7.45 N) were recorded for control and Methyle Jasmonate treatments, respectively in both seasons. Where as, the lowermost separation force (5.32 and 5.17 N) was recorded for the treatment of spraying (Ethephon twice at 0.5 ml/l and at 0.3 ml/l). The other tested treatments gained intermediate separation forces. Ethephon reduced separation force significantly either when it sprayed individiwally or in combination with Methyle Jasmonate or ABA. This reduction because Ethephon can speed berries to be soften (Pires and Martins, 2003) while many studies suggest that ABA increase anthocyanin content without changing berries maturation process (Peppi et al., 2006, Cantin et al., 2007). The same trend was recorded after the shelf life (Cantin, et al.,2007).

Berry firmness (N)

As shown in Table 2, in both seasons, the tested treatments significantly decreased berry firmness. The treatment of spraying Ethephon twice significantly reduced berry firmness gaining

TABLE 1. Influence of Methyle Jasmonate, Abscisic acid and Ethephon on yield/vine, packable number of bunches at first harvest and its percentage, bunch weight (g), total number of berries/bunch and weight of 100 berries(g) of Flame Seedless grapes during 2019 and 2020 seasons

Treatments	Yield/ vine (Kg)		Packable number of bunches at first harvest		% Packable number of bunches at first harvest		Bunch weight (g)		Total number of berries/ bunch		Weight of 100 berries (g)	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Control (water spraying)	12.32	12.01	3.96	4.50	13.2	15.0	407.6	400.3	125.3	121.6	323.2	320.1
Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	12.15	11.88	10.3	11.2	34.4	37.4	402.3	393.1	120.4	117.3	328.1	323.8
Ethephon twice at 0.24 g/l (equal 0.5 ml/l from the commercial product)+ at 0.14 g/l (equal 0.3 ml/l from the commercial product)	12.06	11.82	15.63	15.0	52.1	50.0	393.9	390.8	114.6	110.6	330.6	331.6
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product) + ABA at 0.015 % (equal 1.5 ml/l from the commercial product)	12.41	12.12	18.09	17.8	60.3	59.3	411.3	404.0	123.7	120.7	334.3	337.4
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product) + Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	12.10	11.91	25.92	25.5	86.4	85.0	397.1	393.5	118.5	114.9	331.8	333.5
LSD at 0.05	NS	NS	2.10	2.35	4.15	7.80	NS	NS	NS	7.21	6.46	5.14

the lowermost berry firmness (4.21 and 4.43 N) in both seasons, respectively. Control treatment and Methyle Jasmonate individual spray recorded the highest berry firmness force (6.13, 6.00 and 6.21, 6.08 N), without significant differences between them in the two seasons respectively. This result was agree with reported by (Cantin et al. 2007).

Visual appearance and Rachis browning after shelf life

Data in Table 2, indicate that the treatments tested significantly affected the visual appearance and browning of the rachis during both seasons. After the shelf life period, the treatments of Methyle Jasmonate only and control treatment had recorded the worest visual appearance (commercially unacceptable), while the treatment of spraying Ethephon twice had an acceptable visual appearance, This result is in line with (Pires and Martins, 2003). The treatments of Ethephon in combination with Methyle Jasmonate or ABA recorded excellent visual appearance (Cantin et al., 2007). The same trend was found with rachis browning. Methyle Jasmonate only and control treatments had recorded the best rachis color (healthy). While, the treatment of Ethephon twice recorded a moderate state of rachis (browning of secondary rachis and pedicels). Treatments of Ethephon in combination with Methyle Jasmonate or combined with ABA cleared noticeable browning of pedicels and rachis in a good condition.

Berry Dimensions and Berry Shape Index

As shown in Table 3, berry length, diameter and berry shape index were insignificantly affected in both seasons by the tested treatments.

Complete percentage of soluble solids (TSS percent)

The findings obtained in Table 4, indicate that the treatments tested increased the TSS percentage substantially in both seasons. The treatment of spraying (Ethephon twice) and (Ethephon combined with Methyle Jasmonate) had recorded the highest TSS percentage without significant differences between them in the two seasons. This means that double spraying of Ethephon alone or Ethephon combined with Methyle Jasmonate were more effective on TSS percentage than spraying each of them individually. The treatment of spraying Ethephon combined with Methyle Jasmonate increased TSS percentage by 17.9 and 11.0 % compared with control treatment in both seasons, respectively. These results are in line with (Peppi et al., 2006 and Osman & Mohsen 2015).

TABLE 2. Influence of of Methyle Jasmonate, Abscisic acid and Ethephon on separation force (N) at harvest and postharvest, berry firmness, visual appearance and rachis browning of Flame Seedless grapes during 2019 and 2020 seasons.

Treatments	Separation force (N)		Berry firmness (N)		Separation force after shelf life (N)		* Visual appearance after shelf life		** Rachis browning after shelf life	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Control (water spraying)	7.41	7.63	6.13	6.21	7.13	7.04	3.88	3.64	1.21	1.34
Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	7.16	7.45	6.00	6.08	6.64	6.76	3.21	3.30	1.63	1.70
Ethephon twice at 0.24 g/l (equal 0.5 ml/l from the commercial product)+ at 0.14 g/l (equal 0.3 ml/l from the commercial product)	5.32	5.17	4.21	4.43	4.20	4.11	2.52	2.63	3.87	3.74
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product) + ABA at 0.015 % (equal 1.5 ml/l from the commercial product)	6.76	6.46	5.30	5.39	5.94	5.80	1.32	1.37	2.54	2.48
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product) + Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	6.84	6.90	5.42	5.53	6.03	5.91	1.10	1.18	2.36	2.30
LSD at 0.05	0.95	0.65	0.51	0.53	0.40	0.26	0.29	0.23	0.17	0.38

*Visual appearance parameter was evaluated by using the following score: (1) excellent, (2) acceptable, and (3) commercially unacceptable.
** Rachis (Stem) browning parameter symptoms were evaluated by using the following score
: (1) healthy, (2) slight, (3) moderate, and (4) severe.

Titratable Acidity (TA percent)

It is evident from Table 4, that during the two experimental seasons, the overall titratable acidity percentage of berry juice decreased significantly in the studied treatments. The highest titratable acidity percentage was recorded for control treatment, while the lowermost percentages were recorded for Ethephon treatments either sprayed twice or combined with Methyle Jasmonate in the two seasons. The resulted findings are in line with Osman and Mohsen (2015).

TSS/acid ratio

Data shown in Table 4, indicate the substantially improved TSS/acid ratio in berry juice during the two experimental seasons of the studied treatments. Spraying Ethephon twice gained the highest TSS/ acid ratio in the two studied seasons while, control treatment recorded the lowermost value. The obtained results are in line with (Canin et al., 2007).

Anthocyanin content

With regard to anthocyanin content , significant differences were noticed among the tested treatments in both seasons (Table 4). It could be noticed that spraying with Ethephon combined with Methyle Jasmonate and Ethephon combined with ABA gained the highest anthocyanin content in both seasons, followed by the treatment of spraying Ethephon twice. It is reported by the superior effect of spraying with ABA than Ethephon alone (Peppi and Retamales, 2010, Vilojoen et al., 2010). Spraying Methyle Jasmonate alone had a little effect on anthocyanin content, and consequently berry color. This result is in line with Khan & Singh (2007) and Belhadi et al. (2008).

The treatment of spraying (Ethephon combined with Methyle Jasmonate) increased anthocyanin content by 83.7 and 82.4 % compared with control treatment which recorded the lowest anthocyanin content (356.2 and 360.3 mg/kg) in the two seasons, respectively. It is worthy to notice that combined spraying either by Ethephon + Methyle Jasmonate or Ethephon + ABA were more effective in increasing anthocyanin content and improving berries color than spraying Methyle Jasmonate individually in both seasons. Positive influence of Methyle Jasmonate on the content of berry anthocyanin was stated by Khan & Singh (2007), Flores et al. (2015) and Portu et al. (2015).

TABLE 3. Influence of of Methyle Jasmonate, Abscisic acid and Ethephon on berry length, berry diameter, berry shape index of Flame Seedless grapes during 2019 and 2020 seasons.

Treatments	Berry length (cm)		Berry diameter (cm)		Berry shape index	
	2019	2020	2019	2020	2019	2020
Control (water spraying)	1.73	1.72	1.80	1.82	0.96	0.95
Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	1.76	1.77	1.87	1.86	0.94	0.95
Ethephon twice at 0.24 g/l (equal 0.5 ml/l from the commercial product) + at 0.14 g/l (equal 0.3 ml/l from the commercial product)	1.71	1.70	1.82	1.84	0.94	0.92
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product + ABA at 0.015 % (equal 1.5 ml/l from the commercial product)	1.75	1.78	1.89	1.85	0.95	0.96
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product) + Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	1.74	1.75	1.86	1.88	0.93	0.93
LDS at 0.05	NS	NS	NS	NS	NS	NS

TABLE 4. Influence of of Methyle Jasmonate, Abscisic acid and Ethephon on TSS%, acidity, TSS/acid ratio, anthocyanin (mg/kg) of Flame Seedless grapes during 2019 and 2020 seasons.

Treatments	TSS (%)		Acidity (%)		TSS/acid ratio		Anthocyanin (mg/kg)	
	2019	2020	2019	2020	2019	2020	2019	2020
Control (water spraying)	14.00	14.60	0.73	0.71	19.20	20.60	356.2	360.3
Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	14.80	15.00	0.70	0.70	21.10	21.40	481.4	493.5
Ethephon twice at 0.24 g/l (equal 0.5 ml/l from the commercial product) + at 0.14 g/l (equal 0.3 ml/l from the commercial product)	16.80	16.50	0.63	0.61	26.70	27.10	612.5	618.1
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product + ABA at 0.015 % (equal 1.5 ml/l from the commercial product)	16.00	16.00	0.68	0.66	23.50	24.20	620.3	631.4
Ethephon at 0.24 g/l (equal 0.5 ml/l from the commercial product) + Methyle Jasmonate at 0.046 % (equal 3 ml/l from the commercial product)	16.50	16.20	0.65	0.64	25.40	25.30	652.1	657.3
LDS at 0.05	0.69	0.93	0.04	0.04	1.84	1.71	34.8	44.1

Conclusion

It could be concluded that Methyle Jasmonate could be a promising material in the field for improving berry quality, enhancing berry anthocyanin content, increasing the packable yield at first harvest in comparison with Ethephon or ABA treatments this means, advance harvest date. Also, Methyle Jasmonate improved grape quality pre harvest and postharvest after shelf life period. However, Methyle Jasmonate did not affect rachis (stem) browning or visual appearance during shelf life. It could be recommended, using Methel Jasmonate combined with Ethephon to improve berry anthocyanin content and keeping the quality after harvesting.

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Conflict of interest

There is no conflict of interest during this experiment.

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تأثير الميثايل جاسمونات والأثيفون وحامض الأبسيسيك على جودة ثمار العنب صنف فليم سيدلس وقت الحصاد وبعده

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يعتبر مدى تطور اللون فى ثمار العنب صنف فليم سيدلس كأحد علامات ودلالات النضج والصلاحية للقطف من أهم مشاكل هذا الصنف؛ حيث لاتصل الثمار الى درجة اللون المناسبة للقطف فى كثير من الأحيان، ولذلك تم إجراء هذه التجربة لمدة موسمين متتاليين (٢٠١٩& ٢٠٢٠) على شجيرات عنب فليم سيدلس عمر ٨ سنوات ومنزرعة على مسافة ٢,٠ × ٣,٠ متر في تربة رملية تحت نظام الري بالتنقيط بمزرعة عنب خاصة بمحافظة الشرقية، مصر. تم رش العناقيد بالميثايل جاسمونات و بالإثيفون و/ أو حمض الأبسيسيك من خلال الخمس معاملات التالية:

(رش بالماء كمعاملة مقارنة) ، ميثايل جاسمونات بتركيز ٠,٠٤٦ ٪ ، إثيفون مرتان بتركيز ٠,٢٤ جم/ لتر ثم بتركيز ٠,١٤ جم/لتر، ٠,٢٤ جم /لتر إثيفون + ٠,٠١٥ ٪ حامض أبسيسيك ، ٠,٢٤ جم/لتر إثيفون + ٠,٠٤٦ ٪ ميثايل جاسمونات .

وقد تم رش المعاملات الفردية عند بداية ظهور اللون (veraison) بينما تم إجراء المعاملات المزدوجة عند بداية ظهور اللون وبعد ٥ أيام من المعاملة الأولى، وأظهرت النتائج المتحصل عليها أن رش شجيرات العنب لصنف فليم سيدلس بالمعاملة المزدوجة (الإثيفون + ميثايل جاسمونات) كانت أفضل المعاملات حيث أدت إلى تقليل النسبة المئوية للحموضة الكلية، وفي نفس الوقت أدت لزيادة معنوية في محتوى الحبات من صبغة الأنثوسيانين بالمقارنة بالشجيرات غير المعاملة خلال موسمي الدراسة على التوالي، كما أدت إلى زيادة النسبة المئوية للمواد الصلبة الذائبة ونسبتها إلى الحموضة (TSS/acid ratio) بالمقارنة بمعاملة الكنترول خلال موسمي الدراسة ، وأظهرت النتائج أن المعاملة المزدوجة بالإثيفون والميثايل جاسمونات أدت إلى زيادة النسبة المئوية للمحصول القابل للجمع عند بداية الحصاد، وتحسين صفات جودة الحبات عند القطف، وأظهرت النتائج أيضا أن المعاملة المزدوجة)الأثيفون +الميثايل جاسمونات (كانت أكثر فعالية فى تحسين تلوين وجودة الثمار ونسبة المحصول القابل للجمع عند اول حصاد عن رشها منفردة.