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Effect of Spraying Jasmonicacid, Girdling and Their Combinationson Growth, Yield and Fruit Quality of Crimson Seedless Grapevine

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THIS study was carried out during two successive seasons (2016 and 2017) in a private vineyard orchard at Boktares village, Agacenter, Dakahlia Governorate, Egypt. The experiment was conducted on 5-years-old Crimson seedless grapevine cultivar. The vines were grown in a clay soil under surface irrigation system and cane trained using pergolla trellis system. The aim of work was study effects of jasmonic acid and girdling on yield andfruit quality of Crimson seedless grapevine. Jasmonic acid wasused as a foliar application at rate (10, 20, 40 ppm) at two times: after berry set and begging berry color (at veraison stage) alone or combination with girdling begging berry color at) veraison stage).

The Results showed that applications of jasmonic acid + girdling were effective for improving yield per vine, cluster weight, berry weight, volume, berry length and width, redberries & pink berries (as a visual assessment) soluble solids content, totalsugar, total anthocyanin in berry skin and total phenols while decreased total acidity and greenberry. Moreover, enhanced pruning wood weight, ripening wood and total carbohydrates in canes as compared with the controlduring both seasons. In addition increment internode length, internode thickness and trunk thickness.The promising results in this respect were obtained when the vines were sprayed with jasmonic acid 40 ppm+ girdling.

Keywords: Grapevines, Crimson Seedless, Jasmonic acid, girdling and chemical properties.

Introduction

The cultivation of grapes (*Vitis vinifera* L.) is spread throughout the world, with an estimated surface area of 7.8 million hectares in 2016, in 100 different countries. Grapes are consumed as both fresh and processed products, such as wine, jam, juice, grape seed extract, dried grapes, vinegar and grape seed oil. Global grape production in 2016 was estimated at 75.8 million tonnes of which 39% was produced in Europe, 34% in Asia, 9% in Africa and 18% in the Americas FAO-OIV Focus (2016). In Egypt, it considered the second major fruit crop after citrus it comes and because of its precious properties, this area increased in the last few years especially in the newly reclaimed lands, it reached about 196993 feddans with a total production about 1686706 tons according to latest the statistics of the (Ministry of Agriculture, 2016).

Crimson seedless cultivar is a late-season red seedless table grape. The fruit ripens in mid-September and weather permitting, can be held on the vine through mid-November. The skin is medium thick and its flesh is clear, firm and crisp. The berry's taste is sweet and natural. It has great market acceptance due to its excellent nutritional properties and its exportable value (Río-Segade et al., 2013). Some problems are related with the production of Crimson Seedless grapevines such as achieving the desired level of Poor red color and the excessive berry set which leads to compact big clusters with small berries which, leads to bunch rot (Dokoozlian and Peacock, 2001).

Jasmonic acid iscyclopentanone compounds and regarded as naturally occurring plant growth regulators (Sembner and Parthier, 1993). Jasmonic acid was first identified in the essential oils of jasmine (*Jasminumgr and iflorum* L.) and their chemical structures were subsequently determined Demol et al. (1962). Their biosynthesis starts with linolenic acid and proceeds through a number of stages involving lip oxidation, cyclization and b-oxidation (Creelman and Mullet, 1997)

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Jasmonic acid is considered as endogenous regulators that play important roles in regulating stress responses, plant growth and development (Aubert et al., 2015). Jasmonates are contributed in many important functions, including defense against insects and pathogens by inducing phytoalexin production,protection from abiotic stresses, impunity,and plant growth, suggesting that they have critical roles in plant physiology Avanci et al. (2010).

Jasmonic acidis biologically like to abscisic acid (ABA) and have been shown to exhibit a senescence-promoting activity in the leaves of many plant families (Yilmaz et al., 2007). Induced senescence by Jasmonic acid is described by a drastic loss of chlorophyll, the degradation inhibition of its biosynthesis and increases in the respiratory rate and in protease and peroxidase activities. (Koda, 1992). In addition, Wang and lin (2000) prove that Jasmonic acidenhanced the resistance of tissues against decay by enhancing their antioxidant system and their free radical scavenging capability and there is a positive correlation between antioxidant activity and anthocyanin content in berry skin.

Jasmonic acid is presentday in low concentration in different plant parts including buds, shoots, leaves, flowers, berries, andseeds (Meyer et al., 1984) and largest amount in fruits. Jasmonic acid has been reported to modify chlorophyll degradation and anthocyanin content (Creelman and Mullet, 1997) aroma development and ethylene production (Lalel et al., 2003, Khan & Singh, 2007 and Kondo et al., 2007).

Girdling is a widely practiced techniquein fruit-bearing perennial deciduous plants, such as grapeCaspari et al.,(1998).Girdling which consists of removing a small section of phloem (about 4mm in width) from around the trunk to produce large berries of grapes intended for table use or to improve fruit ripening, by enhancing coloration or accumulation of total sugar by Williams and Ayars, (2005) and Abu-Zahra and Salameh, (2012).Also, girdling grapevine at berry softening stageincrement accumulation of carbohydrates in the parts above girdle and resulted in enhance development of color and SSC% and therefore hasten ripeningFawzi and Eman, (2003) and Omar and Girgis, (2005). To achieve this, girdling has to be performed at the onset of berry ripening orveraison, when rates of sugar accumulation in berries are highest (Roper and Williams, 1989). Rather et al. (2011) reported that girdling and growth regulator application is anattractive practice to improve berry ripening and berry quality in grape cv. Perlette. Moreover, girdling processinghas positively influenced yield and fruits development during ripening as well as it is appeared to impact the accumulation of juice SSC% in mature table grapes Ferrara et al. (2014). On the other hand ,thegirdling is expensive and occasionally results in the death of the girdled trunk (Weaver and Winkler, 1952).

This research aimed to study the effect offoliar application withjasmonic acid and girdling on yield and its components and fruits quality of Crimson seedless grapevines.

Materials and Methods

This investigation was carried out during (2016 and 2017) seasons in a private vineyard farm at Boktares village, Aga, Dakahlia Governorate, Egypt. The experiment was conducted on five years old Crimson seedless grapevines. Vines were cultivated at 2 x 2.5 meter in clay soil under surface irrigation system and cane trained under pergolla trellis system. During February of each experimental season, the tested vines were pruned to 7 canes with 12 buds beside 7renewal spurs with two buds. The total bud load was 98 buds. Seventy-two vines uniform in vigor as possible were chosen for this study, all vines received the same cultural managements recommended by ministry agriculture. The experiment consisted of eight treatments arranged in a complete randomize blocks design, each treatment include three replicates.

Jasmonic acid ($C_{12}H_{18}O_3$) was used as a foliar application at rate (10,20,40 ppm) on the vine at two times, after berry set and beginning berry color (at verasionstage) also,girdlingtreatment was carried out at veraison by removing a narrow ring of the bark (4 mm) entirely around the trunk.

The treatments were as the following:

- Control (T1).
- Spraying with jasmonic acid at 10 ppm (T2).
- Spraying with jasmonic acid at 20 ppm (T3).
- Spraying with jasmonic acid at 40 ppm (T4).
- Girdling(T5).
- Spraying with jasmonic acid at 10 ppm + girdling (T6).
- Spraying with jasmonic acid at 20 ppm + girdling (T7).
- Spraying with jasmonic acid at 40 ppm + girdling (T8).

Measurements

Yield (kg/vine)

At harvesting date when SSC % of berries reached about 16-17 % in control, six clusters / vine were weighted and the average cluster weight was multiplied by number of clusters/vine to calculation average yield/vine.

Physical properties

A sample of 6 clusters / vine was taken for determining:

- cluster weight (g)
- cluster length and width (cm)
- 100 berry weight (g)
- 100 berry volume (cm^3)
- Berry length and width (mm).
- Visual assessment parameters:

-Red berries%: The weight of red berries divided on total berries weight.

-Pink berries%: The weight of pink berries divided on total berries weight.

-Green berries%: The weight of green berries divided on total berries weight.

- Juice volume (cm^3): Fruit juice volume was measured using a graduated cylinder of 1000 ml, from 100 berries

Chemical properties:

- Soluble solids content (SSC %) was determined by using a hand refractometer (Model BX-1 and Brix 0-32%).
- Total acidity percentage was determined according to A.O.A.C. (1995).
- SSC/acid ratio was calculated by dividing the percentage of SSC on total acidity.
- Total sugars (%) were determined according to Sadasivam and Manickam (1996)
- Total anthocyanin of berries skin (mg/100g fresh weight) was calculated according to Husia et al. (1965).
- Total phenols(mg/g berries as gallic acid equivalent) was based onFolin-Ciocalteau reagent (zieslin and ben zaken 1993). An aliquot of plant material was extracted with 80% methanol and agitated for fifteen min at 70ºC. The extract was added to 2% sodium carbonate (Na_2co_3).after incubation for five min. Folin-Ciocalteaureagent was addedthesolution was again incubated for 10 min .Theabsorbance of the blue coller was measured by a spectrophotometer at 760nm and was expressed as ugGallic acid equivalent /g FW.

At dormant seasonsparameters:

Determinations as follows:

- Internode thickness, it was determined from the third base internode and expressed in (cm) by using a caliper.
- The internode length, it was determined from the third base internode and expressed in (cm) by using a meter.
- Trunk thickness was determined by using a vernier caliper and expressed in (cm)
- Total carbohydrates in canes (g/100gm dry weight) were determined according to Hedge and Hofreiter (1962)
- wood ripening: twelve shoots of the current seasons growth were tagged for each replicated to follow up the rate of wood ripening which calculated by dividing length of the ripened part by the total length of the shoot according to Rizk and Rizk (1994)
- Pruning wood weight: Weight of pruning wood was determined during winter pruning periodin both seasons of study and the data were recorded as g/vine

Statistical analysis

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

Results and Discussion

Yield and physical properties of cluster

Results in Table1 showed that spraying Crimson seedless grapevines with jasmonic acid 40 ppm+ girdling recorded the highest values of yield/vine (12.24 and 12.36kg),cluster weight (680.0 and 686.6g), cluster length (21.06 and 20.9cm) and width (13.8 and 14.1cm) followed in a descending order by jasmonic acid 20 ppm + girdling as compared with theother treatments during 2016 and 2017 seasons, respectively . While, the control recorded the lowest values of yield/vine (9.77 and 10.18kg), cluster weight (543.3 and 555.6g), cluster length (17.1 and 17.2cm) and width (11.0 and 11.5cm)in 2016 and 2017 respectively.

In this respect thetreatments which contain girdling alone orin combination with jasmonic acid (T5), (T6), (T7) and (T8) improved yield/ vine, cluster weight, cluster length and width than the treatments contain jasmonic acidalone during both seasons. Non-significant differences between jasmonic acid 40 ppm+ girdling and jasmonic acid

20 ppm+ girdling in yield/vine, cluster weight, cluster length and width. Also,Non-significant differences between control and jasmonic acid 10 ppm on yield and physical properties of cluster during bothseasons.

The increment in bunch weight as results of using Jasmonic acid and girdling might be due to the increases of plant hormones and carbohydratesand may be also reflected on its length byAvanci et al. (2010) and Og˘uzhanSoltekin (2015).

These results are in agreement with those obtained by Abd El-Wahab (2006) reported that girdling trunk at verasion stage increased yield per vine. Also, Abu-Zahra (2010) found that girdling the canes at berry set significantly enhanced cluster weight.Og˘uzhanSoltekin (2015) who found that vines had girdled to accomplish for enhancing yield as well as cluster weight, cluster length and width of Red Globe grapevine. Moreover, Aly et al. (2015) reported that the treatment foliar application of potassium, boron and girdling gave the highest cluster weight and yield per vine. In addition, SabryGehan et al. (2011) found that foliar Jasmine oil at 0.2% gave the highest yield and its componentsofFlame seedless grapevine.

Physical properties of berries

Results in Table 2 indicated that spraying Crimson seedless with Jasmonic acid 20 and 40 ppm in combination with girdling significantlyincreased 100 berry weight,volume, berry length and width as compared with the control.Treating the vines withjasmonic acid 10 ppm gave non-significant deference in 100 berry weight, volume, berry length and width as compared with control during the two seasons.Meanwhile, jasmonic acid 40 ppm+ girdling gave thehighest significantly values in this respect followed in a descending order by jasmonic acid 20 ppm+ girdlingfollowed by jasmonic acid 10 ppm + girdling.On the other hand, the controlgave the lowest weightof 100 berry, volume, berry length and widthduring 2016 and 2017 seasons.

Regardingof 100 berry juice,datapresented in same Table revealed thatjasmonic acid 20 ppm+ girdling gave the highest valuesof 100 berry Juice in both seasonsfollowed byjasmonic acid 10 ppm + girdlingfollowed by jasmonic acid 40 ppm+ girdlingas compared withother treatments.

TABLE 1. Effect of sprayingJasmonicacid,girdling and their combinationsonyield and some physical properties of cluster of Crimson seedless grapevineduring 2016 and 2017 experimental seasons.

Treatments		Yield (kg/vine)		Cluster weight (g)		Cluster length (cm)		Cluster width (cm)	
		2016	2017	2016	2017	2016	2017	2016	2017
T1	Control	9.77	10.18	543.3	555.6	17.1	17.2	11.0	11.5
T2	Jasmonic acid 10 ppm	9.94	10.35	563.0	565.0	17.5	17.5	11.4	11.7
T3	Jasmonic acid 20 ppm	10.25	11.03	569.6	581.0	18.2	18.5	12.2	12.6
T4	Jasmonic acid 40 ppm	10.81	11.11	590.0	595.6	18.3	18.5	12.6	12.7
T5	Girdling	11.38	11.92	609.6	617.0	19.53	19.3	13.0	13.2
T6	Jasmonic acid 10 ppm + Girdling	11.05	11.17	625.3	620.6	19.6	19.7	13.5	13.4
T7	Jasmonic acid 20 ppm + Girdling	11.70	12.05	650.0	645.6	20.13	20.٧	13.5	13.6
T8	Jasmonic acid 40 ppm + Girdling	12.24	12.36	680.0	686.6	21.06	20.٩	13.8	14.1
New L. S. D. at 5%		0.61	0.75	9.48	17.74	0.38	0.47	0.40	0.33

TABLE 2. Effect of spraying Jasmonic acid, girdling and their combinationson some physical properties of berries of Crimson seedless grapevine during 2016 and 2017 experimental seasons.

	Treatments	100 berry weight (g)		100 berry volume (cm^3)		Berry length (mm)		Berry width (mm)		Juice of100 berry(cm^3)	
		2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
T1	Control	359.6	393.3	329.3	370.0	23.6	26.0	18.6	19.0	229.3	240.3
T2	Jasmonic acid 10 ppm	365.0	395.0	332.0	371.33	24.0	27.0	19.0	20.0	237.0	241.0
T3	Jasmonic acid 20 ppm	380.0	401.0	360.0	377.6	24.6	26.07	20.0	20.6	239.0	250.0
T4	Jasmonic acid 40 ppm	400.0	412.3	380.0	391.0	26.0	26.6	20.0	20.6	245.0	258.33
T5	Girdling	438.0	438.6	401.3	415.0	26.0	29.0	23.0	24.0	250.0	260.0
T6	Jasmonic acid 10 ppm+Girdling	440.3	449.3	405.0	427.66	27.0	29.0	22.3	24.0	261.0	276.0
T7	Jasmonic acid 20 ppm +Girdling	470.0	472.0	410.0	442.3	29.0	30.0	23.0	24.0	271.3	275.0
T8	Jasmonic acid 40 ppm +Girdling	492.0	494.3	450.0	459.0	30.3	31.5	25.0	26.0	266.6	273.33
New L. S. D. at 5%		12.4	13.0	16.9	9.75	2.86	1.3٭	1.05	1.3٭	17.91	14.8

These results are harmony with those reported by Kriedemann and Lenz (1972) who found that alternatively, changes in the hormone balance of the vine after girdling may have a role on increasing berry volume.Moreover , Roper and Williams (1989) who reported that the enhancing in berry size as a result of using girdling treatment may bedue to better carbohydrate accumulation above the girdle as the transport of sugars from leaves to the berries.On the other hand, Abd El-Wahab (2006), Abu-Zahra (2010) and Abu-Zahra and Salmeh (2012) who mentioned that girdling the trunk recorded the highest values for berry weight, volume, length and diameter. And, Og˘uzhan Soltekin (2015) reported that girdled Red Globe grapevines were accomplish for improving desirable increases in berry diameter and length. Also, Sabry Gehan et al. (2011) showed that spraying with Jasmine oil at 0.2% recorded the highest values of these characteristics of berries. Bassem (2015) concluded that applications of Salicylic Acid (SA) at 4 mM and JA at 10 mM had a positive effect on cluster properties and improving berry quality.

Visual assessment parameters (red, pink and green berries)

Visual assessment (red, pink and green berries percentage) in Crimson seedless as affected by different treatments girdling with jasmonic acid in both seasons were shown in Table 3. The treatments which contain girdling andjasmonicacid (T6), (T7) and (T8) improved red and pink berry color than the treatments contain girdling alone and jasmonic acid alone during the two seasons of study. Grapevines were treated with jasmonic acid 40 ppm+ girdling and jasmonic acid 20 ppm + girdling did not gave only the highest significantly increment in red and pink berries percentage but also the lowest significantly decrement of green berries percentage as compared to othertreatments during both seasons of study. On the other hand, thecontrol increased green berries percentage and decreased red and pink berries percentageas compared with the other treatments in both seasons.

TABLE 3. Effect of spraying Jasmonic acid, girdling and their combinations on berry color (red, pink and green berries) of Crimson seedless grapevine during 2016 and 2017 experimental seasons.

Treatments		Red berries (%)		Pink berries (%)		Green berries (%)	
		2016	2017	2016	2017	2016	2017
T1	Control	54.6	57.4	15.4	20.6	30.0	22.0
T2	Jasmonic acid 10 ppm	60.0	63.0	15.6	22.0	24.4	15.0
T3	Jasmonic acid 20 ppm	67.0	70.0	19.0	22.0	14.0	8.0
T4	Jasmonic acid 40 ppm	69.0	69.6	20.0	21.6	11.0	8.8
T5	Girdling	68.0	67.0	16.5	19.0	15.5	14.0
T6	Jasmonic acid 10 ppm+Girdling	70.0	72.0	20.0	18.0	10.0	10.0
T7	Jasmonic acid 20 ppm +Girdling	73.0	76.4	20.0	19.6	7.0	5.0
T8	Jasmonic acid 40 ppm +Girdling	75.0	77.0	22.0	20.4	3.0	2.6
New L. S. D. at 5%		4.9	4.91	2.44	1.9	5.4	3.9

These results agreement withRibéreau-Gayon et al. (2000) who reported that there were five common anthocyanins found in grapes and their structure such as:Malvidin purple-red, Delphinidin pink, Peonidin purple-blue, Cyanidin red, Petunidin purple. Induced senescence by jasmonic acid is characterized by a drastic loss of chlorophyll, the degradation of the inhibition of its biosynthesis, and increases in the respiratory rate and in protease and peroxidase activities.Moreover, Gonzalez-Neves et al. (2005) found that the amount of cyanidin- 3- glucoside, peonidin-3-glucoside and the acylated derivatives of these anthocyanins where higher in fresh grape skins than wines and crushed grapes.Jasmonic acid is biologically like to abscisic acid (ABA) and have been shown to exhibit a senescence-promoting activity in the leaves of many plant families (Yilmaz et al., 2007)

Winkler et al. (1974) showed that girdling grapevines gave increase of berry color development and to stimulate rapid ripening in grapes.Also, Downey et al. (2006) who found that grape berry color development had been reported to be influenced by a number of factors such as cultivar, cultural practices, location as well as girdling. In addition, Karim et al. (2012) reported that the percentage of red berries and pink berries were significantly increased in the second picking compared with the first picking in both seasons of Crimson seedless. Also, Crupi et al., (2016) who mentioned that girdling gave the highest content of malvidin and peonidin (mainly responsible for the color stability of the skins) of seedless red table grape.

Chemical properties of berries:
SSC%, acidity and SSC/acid ratio

Results in Table 4 clearly indicated that grapevines were treated with girdling + jasmonic acid were increased of SSC%, SSC /acid ratio and decreased total acidity as compared with untreated in both seasons of the study. Treating the vines withjasmonic acid 40 ppm+ girdlinggave the highest significantly values in SSC% (19.06 and 19.5 %) and gave the lowest values in total acidity (0.51 and 0.45%) compared with the other treatments in 2016 and 2017 seasons respectively. While, the control gave the lowest values in SSC % which recorded (17.0 and 17.3%) and gave thehighest values in total acidity (0.70 and 0.66%) in 2016 and 2017 seasons, respectively.

TABLE 4. Effect of spraying Jasmonic acid, girdling and their combinations on SSC, acidityand SSC/Acid ratio of Crimson seedless grapevine during 2016 and 2017 experimental seasons.

Treatments		SSC (%)		Acidity (%)		SSC/Acid ratio	
		2016	2017	2016	2017	2016	2017
T1	Control	17.0	17.3	0.70	0.66	24.29	26.26
T2	Jasmonic acid 10 ppm	17.06	17.5	0.69	0.65	24.5	26.97
T3	Jasmonic acid 20 ppm	17.4	17.66	0.65	0.61	26.7	28.6
T4	Jasmonic acid 40 ppm	17.6	17.9	0.62	0.61	28.08	29.43
T5	Girdling	18.06	18.4	0.60	0.57	29.78	32.1
T6	Jasmonic acid 10 ppm+Girdling	18.3	18.6	0.57	0.55	32.1	33.89
T7	Jasmonic acid 20 ppm +Girdling	18.5	18.7	0.55	0.50	33.76	37.67
T8	Jasmonic acid 40 ppm + Girdling	19.06	19.5	0.51	0.45	37.39	43.31
New L. S. D. at 5%		0.50	0.54	0.02	0.03	1.14	3.56

These results are in line with those reported by Rivas et al. (2008) who reported that girdling treatments increased the leaf soluble sugar content and all antioxidant enzyme activities. They also found close relation between leaf soluble sugar and antioxidant enzyme. In addition, El-Hussanny (2009), Abu Zahra (2010), Abd El-Razek et al. (2010) and Abu Zahra &Salmeh (2012) they found that trunk girdling increased SSC percentage, SSC/acid ratio. Also, Belal et al.(2016) found that girdling and leaf basal removal under removing the terminal quarter of the cluster gave the highest values in SSC percentage, SSC/acid ratio and reducing total acidity. Moreover, Crupi et al. (2016) mentioned that girdling was able to improve the soluble solids content over titrable acidity (SSC /TA), a ratio strictly related to the quality perception by the consumer. Also, Bassem (2015) and SabryGehan et al. (2011) found that treated grapevine with Jasmine oil at 0.2% increased juice SSC percentage, SSC/acid ratio andreducing acidity content.

Total sugar, total anthocyanin and total phenols

Results in Table 5 showed that all treatments which contain girdling alone orwith jasmonic acid such as (T5), (T6), (T7) and (T8) improved total sugars in berry and total anthocyanin in berry skinthan treatments contain jasmonic acidalone. The treatment of jasmonic acid 40 ppm+ girdling gave the highestvalues in total sugars and total anthocyanin in berry skincompared with the other treatments in 2016 and 2017 seasons, respectively. While,the control gave the lowest valuesin total sugarsand total anthocyanin in berry skinin 2016 and 2017 seasons, respectively.

Regarding to total phenols in Crimson seedless grapevine as influenced by different treatments girdling with jasmonic acid in both seasonswere shown in the same Table. The treatment of jasmonic acid 40 ppm+ girdling gave the highest values in total phenols in berries followed by jasmonic acid 40 ppm alone.While, thecontrol gave the lowest value of total phenols in berries in 2016 and 2017 seasons, respectively.

The results are in agreement with Abd El-Wahab, (2006), El-Hussanny, (2009), Abu Zahra (2010), Abd El-Razek et al. (2010) and Abu Zahra & Salmeh (2012) who found that trunk girdling increased total sugar and enhancing berry colorations. Girdling increased total phenolic content and Lphenylalanine ammonia lyase activity in fruits (Kubota et al., 1993). Also, (Harsimranjit et al., 2008) It has been reported that girdling increased the levels of total and individual anthocyanin in berry skin of Crimson seedless grapes.

TABLE 5. Effect of spraying Jasmonic acid, girdling and their combinationsontotal sugar, reducing sugar, total anthocynine and total phenols of Crimson seedless grapevineduring 2016 and 2017 experimental seasons .

Treatments		Total sugars (%)		Total anthocyanin (%)		Total phenols (mg/g betties as gallic acid eouivalent)	
		2016	2017	2016	2017	2016	2017
T1	Control	12.23	12.13	31.23	35.1	262.2	278.66
T2	Jasmonic acid 10 ppm	12.4	12.5	32.6	36.6	287.8	367.0
T3	Jasmonic acid 20 ppm	12.5	13.06	34.16	38.66	342.37	376.0
T4	Jasmonic acid 40 ppm	13.16	14.1	35.53	43.43	423.1	429.6
T5	Girdling	13.56	14.13	36.76	40.46	270.9	287.0
T6	Jasmonic acid 10 ppm+Girdling	13.8	14.36	37.26	40.00	304.7	371.0
T7	Jasmonic acid 20 ppm + Girdling	14.13	14.43	38.3	46.16	393.5	389.0
T8	Jasmonic acid 40 ppm + Girdling	14.16	14.73	41.26	49.16	435.2	432.0
	New L. S. D. at 5%	1.07	0.77	1.66	1.47	32.97	27.43

Perez et al. (1997) reported that jasmonic acid to immature green strawberries has increased respiration, ethylene production, and transitory induction of anthocyanin biosynthesis and degra-dation of chlorophyll, suggesting a role of in ripening of this fruit.Also,Wang and lin (2000) proved that jasmonic acid increased the resistance of tissues against decay by enhancing their antioxidant system and their free radical scavenging capability and there is a positive correlation between antioxidant activity and total phenolic or anthocyanin content.Moreover, Aubert et al. (2015) found that a positive influence of jasmonic acid could be attributed toenhancing the biosynthesis of such pigments. Jasmonates are contributed in many important functions, including defense against insects and pathogens by inducing phytoalex in production, impunity, and plant growth, suggesting that they have critical roles in plant physiology Avanci et al (2010). Also, Sabry Gehan et al. (2011) revealed that spraying with Jasmine oil concentrations especiallyat 0.2%oil + 3% dormex increased total anthocyanin of berry skin.

At dormant seasonparameters

Pruningwood weight (g), ripening wood (%) and total Carbohydrates incanes (%)

Results in Table 6 showed that all treatments contain girdling (T5), (T6), (T7) and (T8) improved pruning wood weight, ripening wood and total carbohydrates in canes than treatments contain jasmonic acid aloneduring bothseasons. Non significantly differences among all treatments which contain girdling in first season while in second season jasmonic acid 40 ppm+ girdling recorded the highest significantly value of pruning wood weight, ripening wood and total carbohydrates in canes as compared to the other treatments. Meanwhile, there were non-significantly differences between the control and jasmonic acid 10 ppm on pruning wood weight, ripening wood and total carbohydrates in canes during both seasons.

The results are in agree with Williams and Ayars (2005) and Abu Zahra and Salmeh (2012). Abd El-Wahab (2006) who reported that girdling trunk at version stage alone or with all berry thinning treatments increased total carbohydrates in canes. Moreover Sabry Gehan et al., (2011) indicated that a significant increase in coefficient of wood ripening as a result of spraying with jasmine oil alone as compared to the control.

Internode length, thickness and trunk thickness

It is clear from the obtained results in Table 7 that all treatmentsused in this study gavenon-significantly differences in internode length and thickness and trunk thickness in first seasonbut in the second year, girdlingalone (T5) recorded the highest values in internode length, internode thickness and trunk thickness followed by jasmonic acid 10 ppm+ girdling followed by

jasmonic acid 20 ppm+ girdling .While, jasmonic acid 10 ppm gave the lowest values ininternode length, internode thickness and trunk thickness during the second season.

The enhancing effect ofinternode length, thickness and trunk thickness in second season could be attributing the increment in ripening wood and total carbohydrates in canes (Table 6) as result of enhancing the nutritional incanes of the vines as result of using girdling.

These results were in line by De Schepper et al. (2010) reported that since these time lags correlated with the soluble carbohydrate content, it seems that daily dynamics in stem

TABLE 6. Effect of spraying Jasmonic acid, girdling and their combinationsonpruningwood weight, ripening wood and total carbohydrates in canes ofCrimson seedless grapevineduring 2016 and 2017 experimental seasons.

Treatments		Pruning weight (Kg)		Ripening wood (%)		Total carbohydrates (gm/100gm dry weight)	
		2016	2017	2016	2017	2016	2017
T1	Control	1.86	1.93	77.6	78.2	16.2	17.3
T2	Jasmonic acid 10 ppm	1.93	1.96	78.76	78.33	16.53	17.33
T3	Jasmonic acid 20 ppm	2.03	2.03	78.5	79.33	16.96	17.6
T4	Jasmonic acid 40 ppm	2.00	2.1	78.46	80.53	17.23	17.6
T5	Girdling	2.13	2.6	81.06	83.23	17.43	18.06
T6	Jasmonic acid 10 ppm+Girdling	2.4	2.2	82.8	85.23	17.43	18.16
T7	Jasmonic acid 20 ppm +Girdling	2.36	2.8	84.46	86.5	17.86	18.46
T8	Jasmonic acid 40 ppm +Girdling	2.53	3.0	85.43	89.6	18.2	19.06
New L. S. D. at 5%		0.55	0.18	7.02	3.18	0.54	0.36

TABLE 7. Effect of spraying Jasmonic acid, girdling and their combinationson internode length, thickness and trunk thickness of Crimson seedless grapevine in 2016 and 2017 experimental seasons .

Treatments		Internode length(cm)		Internode thickness(cm)		Trunk thickness (cm)	
		2016	2017	2016	2017	2016	2017
T1	Control	6.36	6.46	1.23	1.26	4.40	4.53
T2	Jasmonic acid 10 ppm	6.22	6.25	1.10	1.13	4.35	4.46
T3	Jasmonic acid 20 ppm	6.21	6.25	1.10	1.13	4.56	4.63
T4	Jasmonic acid 40 ppm	6.23	6.28	1.10	1.16	4.33	4.50
T5	Girdling	6.65	6.8	1.3	1.32	4.50	4.76
T6	Jasmonic acid 10 ppm+Girdling	6.63	6.70	1.26	1.30	4.57	4.67
T7	Jasmonic acid 20 ppm +Girdling	6.63	6.73	1.16	1.23	4.53	4.66
T8	Jasmonic acid 40 ppm +Girdling	6.63	6.8	1.26	1.30	4.33	4.50
New L. S. D. at 5%		N.S	0.25	N.S	0.10	N.S	0.28

diameter variations were influenced by changes carbohydrate content statusas result using girdling. Eltom et al. (2013) who mentioned that girdling was the highest significant difference in shoot length, shoot thickness and number of nodes along these shoots as compared to the control. Also, SabryGehan et al. (2011) found that spraying Jasmine oil at 0.2% gave the highest values of growth parameters and shoot length.

Conclusion

From the previous results it can be concluded that sprayingCrimson seedless grapevineswith jasmonic acid 40 ppm at two times (after berry set and at veraison stage) in combination with girdling (at veraison stage) considered a promising treatment for improvingyield, physical and chemical properties of cluster and berries in addition, enhanced pruning wood weight, ripening wood and total carbohydrates in canes

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تأثير الرش بحمض الجاسمونك والتحليق على النمو و المحصول و جودة الثمار فى العنب الكريمسون سيدلس

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- أجريت هذه الدراسة خلال موسمى ٢٠١٧ & ٢٠١٦ فى مزرعة خاصة فى قرية بقطارس التابعة لمركز أجا محافظة الدقهلية على كرمات عنب كريمسون سيدلس عمرها ٥ سنوات ومنزرعة فى تربة طينية وتروى بنظام الرى بالغمر ومنزرعة على مسافة ٢ x٢,٥ م ومرباة بالطريقة القصبية وتحت نظام تدعيم التكاعيب .

تمت معاملة كرمات العنب بالرش بحمض الجاسمونك على مرتين الأولى بعد العقد والثانية عند بداية التلوين مع اجراء التحليق عند بداية التلوين بهدف تحسين المحصول ومكوناته وصبغة الانثوسيانين فى قشرة الحبة وجودة الحبات على صنف الكريمسون سيدلس.

- وقد أظهرت النتائج أن الرش بحمض الجاسمونك مع اجراء عملية التحليق كان له تاثير ايجابى على المحصول ووزن العنقود كماحسن وزن وحجم وطول وعرض الحبة مع زيادة اللون الاحمر والوردى للحبة وأعطت النتائج أيضا زيادة فى صبغة الانثوسيانين فى قشرة الحبة والسكريات فى الحبة والكربوهيدريت فى القصبات وكذلك قللت الحموضة فى الثمار ونسبة الحبات الخضراء وايضا كان لها اثر واضح على زيادة نضج الخشب ووزن خشب التقليم وسمك كل من السلامية والجذع .

-و كانت أفضل النتائج معاملة عنب الكريمسون بالرش بحمض الجاسمونك بتركيز ٤٠ جزء فى المليون بعد العقد وعند بداية التلوين مع اجراء عملية التحليق عند بداية التلوين التي نوصي باستخدامها تحت مثل هذه الظروف.