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RESPONSE OF SUPERIOR SEEDLESS GRAPEVINES TO A COMPLEX OF SOME WINTER PRUNING TREATMENTS, TWO HYDROGEN CYANAMIDE SPRAYS AND THINNING OF SHOOTS AND BUNCHES

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ABSTRACT

In 2014 and 2015 years, mature Superior seedless grapevines were winter pruned on late Dec. to have 11 fruit canes (FCs) each with 14 buds (11 x14) (control, prevailing in the region), 7 FCs each with 14 buds (7 x 14), 8 FCs each with 12 buds (8 x 12) and 10 FCs each with 10 buds (10 x 10). All experimental vines were without renewal spurs. Two hydrogen cyanamide (HC) (5%) sprays were applied on all experimental vines; the first spray was on 31 Dec. on the basal sections of all FCs (buds 1-5), while the second HC spray was on 8 Jan. on the whole FCs. Control vines received only one spray on 8 Jan. By mid-March, thinning of shoots and bunches was practiced to leave 60 shoots and 30 bunches on each vine. The criteria of budburst, bud fertility, yield components, berry physical and chemical characteristics and vegetative growth were used to evaluate the tested treatments. The obtained results revealed that budburst (%) was greatly enhanced on the basal sections of FCs (buds 1-5), particularly with the shorter FCs. Also, bud fertility was increased on the basal sections. It could be recommended to winter prune Superior seedless grapevines to 10 FCs with 10 buds on each FC, and to spray HC (5%) twice, the first on the basal five buds on 31 Dec. and the second on the whole FCs on 8 Jan. and with shoot and bunch thinning by mid-March (60 shoots and 30 bunches/ vine). This complex gave the highest yield, bunch and berry quality and vegetative growth.

Key words: Superior seedless grapevines, winter pruning, hydrogen cyanamide, budburts, leaf/bunch ratio, yield.

INTRODUCTION

Grapes rank first among deciduous fruits in Egypt. Superior seedless (SS) is one of the important varieties for exportation. This variety has unfruitful basal buds on the canes. Therefore, SS vines are traditionally trained and pruned according to the cane pruning system with long fruit canes (usually 14 buds in length) and short renewal spurs (2 buds in length). This variety has a relatively higher chilling requirements (440 hs.) (Mohamed *et al*., 2010) compared to other grape cvs., grown in Egypt, as such, it responds well to HC sprays.

The cane pruning system practically has the following defects: (1) Higher cost of winter pruning. (2) The loss of good canes near the trunk to make renewal spurs (RSs), and (3). Lower budburst at the bases of FCs.

In a preceding study on SS grapevines, Mahmoud *et al.* (2015) and Sourial *et al.* (2015) cleared that using two HC sprays (5%): the first on the 5 basal buds of FCs on 31 Dec. and the second on the whole FCs on 8 Jan., obviously promoted budburst and vegetative growth on the basal sections of FCs (5 buds). Shoots on the basal sections became new canes after leaf shedding and could be used as new FCs. This makes no sence of using renewal spurs.

The present study was outlined to investigate the effect of a complex of winter pruning treatments, two HC sprays as well as shoot and bunch thinning on budburst, bud fertility, yield components, berry physical and chemical

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properties and vegetative growth of SS grapevines.

MATERIALS AND METHODS

This study has been carried out during the two consecutive seasons of 2014 and 2015 in a private vineyard at Cairo-Alexandria desert road (Km 62). Twenty-four grapevines of the cv. SS were used in this study. The vines were nearly 14 years old, nearly similar in vigor and trained according to the traditional cane pruning system on arbors (Baron type).

The vines were grown in sandy soil at the distance of 2 x 3 m (700 vines/ fad.). The vines received the usual horticultural practices, concerning organic manure, fertigation as well as foliar fertilization, pest and weed control.

The Tested Treatments

Winter pruning treatments

Four treatments were tested: (1) control, which is the usual cane pruning system adopted in the region, but without renewal spurs, each vine bore 11 fruit canes (FCs) each with 14 buds in length, (2) 7 FCs x 14 buds, (3) 8 FCs x 12 buds and (4) 10 FCs x 10 buds. All tested treatments were without renewal spurs. Winter pruning treatments were carried out by late Dec. in each season.

Hydrogen cyanamide sprays

FCs of all pruning treatments, except the control, received two hydrogen cyanamide (HC) sprays at 5%. The first spray was on the basal sections of FCs (buds from 1 to 5) and was carried out on 31 Dec. of each season, this was not adopted to control vines. The second HC spray was on the whole FCs of all treatments including the control and was performed on 8 Jan. of each season. The commercial HC material "Dormex" (49% HC) produced by AIZ Co. (previously SKW Co.) in Germany was used in this study.

Shoot and bunch thinning

By mid-March of each season, shoot and bunch thinning were practiced with all experimental vines to leave the most vigorous 60 shoots and the largest 30 bunches on each vine in the two seasons.

Evaluation of the tested treatments was performed through the following parameters.

Bud behavior

Budburst and bud fertility were followed up at each bud position on each FC.

Yield components and bunch characteristics

1. Yield/vine (kg) and hypothetic yield/fad. (ton).
2. Bunch weight (g), length (cm) and width (cm) as well as rachis weight (g).
3. Number of berries/ bunch.

Berry physical characteristics and chemical constituents of berry juice

Physical characteristics: 100- berry weight (g), weight and size of 100 berries juice, berry length and width (cm), berry firmness (g) and berry attaching force (g).

Chemical constituents of berry juice (TSS (%), acidity (%) and TSS/acid ratio)

Vegetative growth parameters

Numbers of leaves per vine by late Sept. = average number of leaves per shoot x 60 shoots/ vine, leaf/ bunch ratio, leaf area (cm^2) and fresh weight (g), leaf total chlorophyll content: using chlorophyll meter (SPAD 502, Osaka, Japan), which estimates SPAD value according to the method of Castelli *et al*. (1996) and weight of prunings (kg).

Experimental Design and Statistical Analysis

The complete randomized design was followed throughout the whole work. Each treatment was applied on six vines shared between three replicates. The obtained data were statistically analyzed using the SAS program and LSD test at the 5% level of probability was used to compare the treatments means according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Bud Behavior

Budburst

Effect of pruning treatments

From Tables 1 and 2, it is clear that winter pruning as 10 canes x 10 buds/ cane was the best treatment for budburst percentage being 95.20 and 92.99% in the first and second seasons, respectively. The pruning treatments of 7 FCs x 14 buds and 8 FCs x 12 buds produced intermediate budburst values between 85.83 and 86.60% through the two seasons. However, the least budburst values in both seasons came from the highest bud-load with long FCs (11 FCs x 14 buds) being 49.31 and 51.01% in the first and second seasons, respectively. It seemed that using shorter FCs helped to obtain higher budburst percentage.

Effect of bud position

The data reveal promotions in budburst (%) in the basal and middle positions of FCs on the expense of the distal position. This came true in both seasons and was apparently due to the additional HC spray on the basal sections of the FCs.

Effect of interaction (treat. × bud position)

The interaction cleared significantly higher budburst values for most of buds in the basal (1-5) and middle (6-10) sections with most of the tested pruning treatments compared to the treatment of 11 canes x 14 buds (control). The lower budburst of the latter treatment (11 canes x 14 buds) might have resulted from the big bud load (154 buds/ vine) and the long FCs (14 buds/ FC). It could also be observed that the intensive budburst on the basal sections was on the expense of budburst on the distal sections (buds from 11 to 14).

The data cleared that the best pruning treatment for SS grapevine is 10 fruit canes each bearing 10 buds, with the basal half of each FC sprayed with HC (5%) on 31 Dec. and the whole FCs sprayed with HC (5%) on 8 January.

The effect of HC in hastening and promoting budburst agreed with George and Nissen (1990), Rizk (1996), El-Shazly (1999), Tambe (2002), Lombard (2003), Muhtaseb and Ghnaim (2008), El-Alem *et al.* (2009), Ghorpade *et al.* (2010) and Vergara and Perez (2010) working on different grape cvs. Moreover, Mahmoud *et al.* (2015) cleared that budburst of the basal five of Superior Seedless grapevines were obviously increased by two HC sprays, the 1st on 31 Dec. and the 2nd on 8 Jan., both at 5%.

In trails to disclose HC effect, Perez *et al.* (2008) found that application of HC to grapevine buds produced oxidative stress and transient respiratory disturbances which are related to the breakage of endodormancy. The expression and activity of catalase is inhibited by HC. Enhancements in the level of H_2O_2 have also been associated to the breakage of endodormancy in grapevine buds. Also, Perez *et al.* (2009) cleared that HC inhibited the O_2 uptake in isolated grape bud mitochondria.

Bud fertility

Effect of pruning treatments

Tables 3 and 4 show that shorter pruning; *i.e.* FCs 10 and 12 buds in length gave significantly higher bud fertility (%) compared with FCs 14 buds in length. The shorter FCs (10 and 12 buds in length) recorded 42 and 43% bud fertility in the 1st season, respectively, compared to 21.28% for canes 14 buds in length on vines bearing 11 FCs. The corresponding values in the 2nd season were 28.64% for both FCs 10 and 12 buds in length and 16.32% for FCs 14 buds in length on vines bearing 11 FCs.

Effect of bud position

The data showed higher fertility values for buds on the middle section of FCs (buds from 6 to 10) being 43.68 – 59.19% in the first season and 36.57 – 59.96% in the second season. The basal section, particularly the three basal buds, revealed, as usual for SS vines, very low fertility (%) being 0.00, 6.27 and 25.77 in the first season and 0.00, 0.00 and 12.52% in the second season. The distal section (buds 11-14) also recorded lower fertility values compared with the middle section, being from 7.14 to 29.95% in the first season and from 7.14 to 16.39% in the second season. Such low fertility (%) in the distal section of FCs might have relation to the lower budburst (%) of those sections due to the great promotion of budburst on the basal sections by the additional HC spray on them.

Table 1. Response of budburst (%) on Superior Seedless grapevines to some winter pruning treatments and hydrogen cyanamide sprays and to bud position on the fruit canes (first season, 2014)

Pruning treatments No. of FCs × No. of buds/ cane	Bud position (BP) on fruit cane																	Treat. av.
	1 basal	2	3	4	5	av. 1-5	6	7	8	9	10	av. 6-10	11	12	13	14	av. 11-14	
11 × 14 (cont.)	52.38	42.95	57.14	52.38	57.14	52.39	66.66	61.90	52.38	47.61	33.33	52.37	42.85	42.85	47.61	38.09	42.85	49.31
7 × 14 + HC sprays	100	90.40	80.90	90.40	61.80	84.70	80.90	80.90	85.70	66.60	100	82.82	85.70	100	95.20	95.20	94.02	86.60
8 × 12 + HC sprays	95.80	95.80	91.60	91.60	83.30	91.62	83.30	91.60	83.30	87.50	87.50	86.64	70.80	70.80	-	-	70.80	83.02
10 × 10 + HC sprays	96.60	96.60	90.00	96.60	93.30	94.62	96.60	100	93.30	96.60	93.30	95.96	-	-	-	-	-	95.20
Bud position av. (BP)	86.19	81.43	79.91	82.74	73.88	-	81.86	83.60	78.67	74.57	78.53	-	66.45	71.21	71.40	66.64	-	-
LSD at 0.05	T = 4.92						Bud position (BP) = 9.21						Interaction Treat. X Bud posit. = 18.42					

- All treatments were without renewal spurs – Budburst was determined when bud opening was ended.

- The basal 5 buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2013 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2014.

Table 2. Response of budburst (%) on Superior Seedless grapevines to some winter pruning treatments and hydrogen cyanamide sprays and to bud position on the fruit canes (second season, 2015)

Pruning treatments No. of FCs × No. of buds/ cane	Bud position (BP)																	Treat. av.
	1 basal	2	3	4	5	av. 1-5	6	7	8	9	10	av. 6-10	11	12	13	14	av. 11-14	
11 × 14 (cont.)	42.85	47.61	47.61	52.37	57.14	49.51	71.42	66.66	61.90	52.37	47.61	59.99	52.37	33.33	42.85	38.09	41.66	51.01
7 × 14 + HC sprays	90.47	90.47	95.23	90.47	71.42	87.61	80.94	85.71	95.23	80.94	90.47	86.65	95.23	80.94	80.94	80.94	84.51	86.39
8 × 12 + HC sprays	91.66	95.83	95.83	83.33	91.66	91.66	95.83	75.00	95.83	87.50	79.16	86.66	83.33	75.00	-	-	79.16	85.83
10 × 10 + HC sprays	93.33	93.33	96.66	93.33	96.66	94.66	90.00	86.66	93.33	96.66	90.00	91.33	-	-	-	-	-	92.99
Bud position av. (BP)	79.58	81.81	83.83	79.87	79.22	-	84.55	78.50	86.57	79.37	76.81	-	58.73	63.09	32.69	59.51	-	-
LSD at 0.05	T = 3.51						Bud position (BP) = 6.56						Interaction Treat. X Bud posit. = 13.13					

- All treatments were without renewal spurs – Budburst was determined when bud opening was ended.

- The basal 5 buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2014 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2015.

Table 3. Response of bud fertility (%) on Superior Seedless grapevines to some winter pruning treatments and hydrogen cyanamide sprays and to bud position on the fruit canes (first season, 2014)

Pruning treatments No. of FCs × No. of buds/ cane	Bud position (BP) on fruit cane																	Treat. av.
	1 basal	2	3	4	5	av. 1-5	6	7	8	9	10	av. 6-10	11	12	13	14	av. 11-14	
11 × 14 (cont.)	0.00	0.00	14.28	23.80	33.33	14.28	42.85	47.61	42.85	28.57	28.57	38.09	19.04	4.76	4.76	9.52	7.61	21.28
7 × 14 + HC sprays	0.00	14.28	23.80	66.66	47.61	30.47	66.66	66.66	66.66	57.14	42.85	59.99	33.33	23.80	14.28	4.76	15.23	37.66
8 × 12 + HC sprays	0.00	4.16	25.00	50.00	50.00	25.83	62.50	62.50	62.50	58.33	50.00	59.16	37.50	41.66	-	-	39.58	42.00
10 × 10 + HC sprays	0.00	6.66	40.00	43.33	53.33	28.66	53.33	60.00	60.00	60.00	53.33	57.33	-	-	-	-	-	43.00
Bud position av. (BP)	0.00	6.27	25.77	45.94	46.06	-	56.33	59.19	58.25	51.01	43.68	-	29.95	23.40	9.47	7.14	-	-
LSD at 0.05			T = 4.99				Bud position (BP) = 9.34						Interaction Treat. X Bud posit. = 18.67					

- All treatments were without renewal spurs – Bud fertility was determined at time of flowering.
- The basal buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2013 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2014.

Table 4. Response of bud fertility (%) on Superior Seedless grapevines to some winter pruning treatments and hydrogen cyanamide sprays and to bud position on the fruit canes (second season, 2015)

Pruning treatments No. of FCs × No. of buds/ cane	Bud position (BP)																	Treat. av.
	1 basal	2	3	4	5	av. 1-5	6	7	8	9	10	av. 6-10	11	12	13	14	av. 11-14	
11 × 14 (cont.)	0.00	0.00	0.00	14.28	23.80	7.61	23.80	38.09	42.85	33.33	23.80	32.37	9.52	4.76	4.76	9.52	7.14	16.32
7 × 14 + HC sprays	0.00	0.00	14.28	19.04	33.33	13.33	42.85	66.66	76.18	66.66	33.33	57.13	19.04	4.76	4.76	4.76	8.33	27.54
8 × 12 + HC sprays	0.00	0.00	12.50	16.66	33.33	12.49	50.00	62.50	54.16	54.16	29.16	49.99	25.00	20.83	-	-	22.91	28.64
10 × 10 + HC sprays	0.00	0.00	23.33	36.66	40.00	19.99	56.66	53.33	66.66	56.66	60.00	58.60	-	-	-	-	-	28.64
Bud position av. (BP)	0.00	0.00	12.52	21.66	32.61	-	43.33	55.14	59.96	52.70	36.57	-	16.39	10.11	9.38	7.14	-	-
LSD at 0.05			T = 3.59				Bud position (BP) = 6.72						Interaction Treat. X Bud posit. = 13.45					

- All treatments were without renewal spurs – Bud fertility was determined at time of flowering.
- The basal buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2014 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2015

Effect of interaction (treat. × bud position)

The interaction was significant in both seasons. The highermost fertility percentages were observed in the middle sections of FCs of the following pruning treatments (7 FCs × 14 buds), (8 FCs × 12 buds) and (10 FCs × 10 buds) which revealed bud fertility from 50.00 to 66.66% in the 1st season and from 25.16 to 76.66% in the 2nd season. The middle section of the treatment (11 FCs × 14 buds) recorded bud fertility from 14.28 to 47.61% in the 1st season and from 23.80 to 42.85% in the 2nd season. The combinations between the tested pruning treatments and buds of the basal and distal sections indicated, in most cases, much lower values.

Previous reports on HC sprays revealed its positive effect on bud fertility, particularly, with higher concentrations (El-Shazly, 1999 on Thompson Seedless cv.). Fawzi (2012), working on Superior Seedless cv., found that bud fertility was increased with cane length from 9 to 12 and 14 buds/ cane. Bud fertility was increased from the base to middle and decreased again toward the tip.

Yield Components

Data in Tables 5 and 6 clear that the yield per vine, generally ranged 16.93 – 22.50 kg in the first season and 16.38 – 20.90 kg in the second season. The least values were recorded by the control (11 canes × 14 buds), while the three other pruning treatments showed higher values compared to control and insignificant differences among them in both seasons. However, the treatment of (10 canes × 10 buds) was insignificantly higher in both seasons than the other two treatments. The increase over the control by those three treatments was from 20.50 to 32.90% in the first season and from 21.43 to 27.60% in the second season.

The hypothetic yield per fad., was 11.85 and 11.47 tons for the control in the 1st and 2nd seasons, respectively and amounted to 14.28 – 15.75 tons/ fad., in the 1st season and to 13.92 – 14.63 tons/fad., in 2nd season, for the other three treatments.

The average bunch weight recorded 563.75 and 545.40 g in the 1st and 2nd seasons, respectively, with the control, while amounted to 680.33 – 745.25 g in the 1st season and 662.16 – 697.13 g in the 2nd season by the other three pruning treatments. The differences between each of the latter treatments and the control were significant in both seasons, while the differences among them were insignificant.

The number of berries per bunch recorded 124.33 and 139.33 with the control in the 1st and 2nd seasons, respectively, while the numbers of berries/bunch for the other three treatments ranged 144.33 – 163.33 in the 1st season and 161.66 – 175.66 berries in the 2nd season, without significant differences among them in both seasons.

The rachis weight, generally, ranged from 15.46 to 21.40 g in the 1st season and from 17.26 to 21.06 g in the 2nd season. The least values were recorded by the control in both seasons and the uppermost values were for the treatments (8 × 12) and (10 × 10). The same trend was observed for bunch length and bunch width.

Thus, it could be observed that the increases in yield (per vine and per fad.) with the three treatments of 7 × 14, 8 × 12 and 10 × 10 compared to the control (11 × 14) were mostly due to analogical increments in bunch weight due to having greater numbers of berries.

The obtained berries results were in line with El-Shazly (1999) and El-Alem *et al.* (2009), both on Thompson Seedless grapevines, who found that HC sprays are efficient tool to promote the vine yield. In addition, Rizk-Alla and El-Zyat (2005) declared that Superior Seedless grapevines with canes 12 and 10 buds in length gave higher yield per vine than vines with longer or shorter canes.

Berry Physical Characteristics and Juice Chemical Constituents

Tables 7 and 8 clear that the two pruning treatments of 8 × 12 and 10 × 10 significantly increased 100-berry weight compared to 11 × 14 and 7 × 14, but in the 1st season only.

Table 5. Response of yield components and bunch characteristics of Superior Seedless grapevines to a complex of some winter pruning treatments, hydrogen cyanamide sprays and thinning of shoots and bunches (first season, 2014)

Pruning treatments No. of FCs × No. of buds/ cane	Yield/ vine		Hypothetic yield/ fad.		Bunch weight		Number of berries/ bunch	Rachis weight (g)	Bunch length (cm)	Bunch width (cm)
	(kg)	± (%)	(ton)	± (%)	(g)	± (%)				
11 × 14 (cont.)	16.93	-	11.85	-	563.75	-	124.33	15.46	18.66	8.90
7 × 14 + HC sprays	20.40	+20.50	14.28	+20.51	680.33	+20.57	144.33	18.13	22.33	10.90
8 × 12 + HC sprays	21.60	+27.59	15.12	+27.60	718.66	+27.49	156.66	20.46	23.06	11.50
10 × 10 + HC sprays	22.50	+32.90	15.75	+32.90	745.25	+32.10	163.33	21.40	22.16	10.60
LSD at 0.05	2.61	-	1.83	-	90.18	-	17.31	1.22	3.22	0.96

- All treatments were without renewal spurs.
- The basal buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2013 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2014.
- By mid-March, 2014, shoots of each vine were thinned to leave the most vigorous 60 shoots, while bunches of each vine were thinned to leave the largest 30 bunches.
- ± (%) = increase or decrease (%) in relation to cont. (11 FCs x 14 buds).

Table 6. Response of yield components and bunch characteristics of Superior Seedless grapevines to a complex of some winter pruning treatments, hydrogen cyanamide sprays and thinning of shoots and bunches (second season, 2015)

Pruning treatments No. of FCs × No. of buds/ cane	Yield/ vine		Hypothetic yield/ fad.		Bunch weight		Number of berries/ bunch	Rachis weight (g)	Bunch length (cm)	Bunch width (cm)
	(kg)	± (%)	(ton)	± (%)	(g)	± (%)				
11 × 14 (cont.)	16.38	-	11.47	-	545.40	-	139.33	17.26	19.16	9.76
7 × 14 + HC sprays	19.89	+ 21.43	13.92	+ 21.36	662.16	+ 21.41	161.66	19.70	21.80	10.80
8 × 12 + HC sprays	20.85	+ 27.29	14.60	+ 27.29	695.40	+ 27.51	175.66	21.63	23.33	11.83
10 × 10 + HC sprays	20.90	+ 27.60	14.63	+ 27.55	697.13	+ 27.82	175.66	21.06	21.86	11.00
LSD at 0.05	2.86	-	2.00	-	95.04	-	28.18	2.54	1.89	1.19

- All treatments were without renewal spurs.
- The basal buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2014 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2015.
- By mid-March, 2015, shoots of each vine were thinned to leave the most vigorous 60 shoots, while bunches of each vine were thinned to leave the largest 30 bunches.

± (%) = increase or decrease (%) in relation to cont. (11 FCs x 14 buds).

Table 7. Response of berry characteristics and juice chemical constituents of Superior Seedless grape to a complex of some winter pruning treatments, hydrogen cyanamide sprays and thinning of shoots and bunches (first season, 2014)

Pruning treatments No. of FCs × No. of buds/cane	100- berry weight (g)	Juice from 100 berries		Berry length (cm)	Berry width (cm)	Berry firmness (g)	Berry attaching force (g)	TSS (%)	Acidity (%)	TSS/acid ratio
		Weight (g)	Size (ml)							
11 × 14 (cont.)	405.33	362.66	392.33	2.1	1.5	482.66	681.33	19.16	0.88	21.77
7 × 14 + HC sprays	431.33	391.33	422.66	2.2	1.8	501.33	758.00	19.33	0.90	21.48
8 × 12 + HC sprays	495.66	451.33	481.33	2.4	2	501.00	765.66	19.66	0.83	23.69
10 × 10 + HC sprays	526.33	490.66	514.33	2.4	2	495.33	800.00	19.33	0.85	22.74
LSD at 0.05	31.96	30.71	53.31	0.26	0.21	NS	50.91	NS	NS	NS

- All treatments were without renewal spurs.
- The five basal buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2013 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2014.
- By mid-March, 2014, shoots of each vine were thinned to leave the most vigorous 60 shoots, while bunches of each vine were thinned to leave the largest 30 bunches.

Table 8. Response of berry characteristics and juice chemical constitunets of Superior Seedless grapevines to a complex of some winter pruning treatments, hydrogen cyanamide sprays and thinning of shoots and bunches (second season, 2015)

Pruning treatments No. of FCs × No. of buds/ cane	100- berry weight (g)	Juice from 100 berries		Berry length (cm)	Berry width (cm)	Berry firmness (g)	Berry attaching force (g)	TSS (%)	Acidity (%)	TSS/acid ratio
		Weight (g)	Size (ml)							
11 × 14 (cont.)	391.73	365.36	376.66	2.03	1.60	485.00	668.33	20.50	0.86	23.84
7 × 14 + HC sprays	409.43	388.20	389.00	2.13	1.73	503.33	706.66	20.83	0.92	22.66
8 × 12 + HC sprays	395.60	366.80	378.00	2.33	1.83	500.66	776.66	19.83	0.80	24.80
10 × 10 + HC sprays	396.80	368.56	379.00	2.43	1.93	503.33	746.66	20.66	0.84	24.46
LSD at 0.05	12.19	18.74	NS	0.09	0.15	11.41	64.15	NS	0.07	NS

- All treatments were without renewal spurs.
- The five basal buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2014 – the whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2015.
- By mid-March, 2015, shoots of each vine were thinned to leave the most vigorous 60 shoots, while bunches of each vine were thinned to leave the largest 30 bunches.

Weight and size of juice from 100 berries showed higher values with the pruning treatment of 10 × 10, but in the 1st season only.

Berry length and width as well as the berry attaching force were significantly higher with pruning treatments of 7 × 14, 8 × 12 and 10 × 10 compared to the control (11 × 14), but in the first season only. In the second season, only the treatment of 10 x 10 surpassed others for berry length, width and attaching force, while the treatment of 8 × 12 showed increments only with berry width and attaching force.

As for chemical constituents of the berry juice, data in the 1st season revealed insignificant differences between all pruning treatments regarding juice TSS, acidity and TSS/ acid ratio. However, in the 2nd season the pruning treatments of control (11 × 14) and 7 × 14 indicated higher acidity values compared with 8 × 12 or 10 × 10, but the differences between all treatments in TSS and TSS/ acid ratio were insignificant.

El-Shazly (1999), on Thompson Seedless grapevines found that HC spray enhanced cluster weight, length and diameter, weight and volume of juice from 100 berries, TSS and total sugars, while reduced total acidity. As regards winter pruning, Rizk-Alla and El-Zyat (2005) on Superior Seedless grapevines found that vines with cane length 8 buds/ cane, followed by those with 10 and 12 buds/cane gave the greatest bunch and rachis weights and number of berries per bunch, weight and size of berry compared with longer fruit canes. TSS and TSS/ acid ratio were increased at the short cane length, while acidity was decreased.

Vegetative Growth

Tables 9 and 10 show the effect of tested treatments on number of leaves per vine, leaf: bunch ratio, leaf area, leaf fresh weight, leaf total chlorophyll content and weight of prunings in the first and second experimental seasons.

The number of leaves per vine recorded the least values (1480 and 1280 in the first and second seasons, respectively), with the control (11 FCs × 14 buds/ cane). The other three tested treatments (7 × 14), (8 × 12) and (10 × 10) recorded from 2420.00 to 2540.00 and from 1986.33 to 2040.00 leaves/ vine in the 1st and 2nd seasons respectively, without significant differences between each of them and the control.

The leaf/ bunch ratio recorded 49.33 and 42.66 in the first and second seasons, respectively with the control (11 FCs × 14 buds/ cane). The other three pruning treatments; *i.e.,* (7 × 14), (8 × 12) and (10 × 10) recorded values between 80.66 and 84.66 leaves per bunch in the first season and between 66.21 and 68.00 leaves per bunch in the second season. The three treatments surpassed the control by 63.51 – 71.62% in the first season and by 55.20 – 59.39% in the second season. The differences between each of the latter three treatments and the control were significant in both seasons, but the differences between each other were insignificant.

The other three leaf characteristics; *i.e.,* leaf area, leaf fresh weight and leaf total chlorophyll content revealed statistically equal values with all tested treatments, including the control. This was true in both experimental seasons.

The weight of prunings was much lower with the control (1.22 and 1.63 kg in the first and second seasons, respectively) in comparison with the other three treatments; *i.e.,* (7 × 14), (8 × 12) and (10 × 10). The latter three treatments recorded from 1.76 to 2.08 kg in the first season and from 1.88 to 2.26 kg in the second season, without significant differences between them, in most cases, in the two seasons. The latter three treatments surpassed the control by 44.27 – 70.50% in the first season and by 38.16 – 65.81% in the second season.

Data concerning vegetative growth were, general, in agreement with that of El-Shazly (1999) on Thompson Seedless grapevines, who cleared that HC sprays at 3 or 5% increased leaf area and average shoot length. Rizk-Alla and El-Zyat (2005) on Superior Seedless grapevines found that fruit canes of 10 buds in lengths showed significant increases in shoot length, leaf number, leaf area and weight of prunings than longer fruit canes.

Table 9. Response of leaf characteristics and weight of winter prunings of Superior Seedless grapevines to a complex of some winter pruning treatments, hydrogen cyanamide sprays and thinning of shoots and bunches (first season, 2014)

Pruning treatments No. of FCs × No. of buds/ cane	Number of leaves/vine	Leaf: bunch ratio		Leaf area (cm^2)	Leaf fresh weight (g)	Leaf total chlorophyll content (SPAD value)	Weight of prunings	
		value	± (%)				(kg)	± (%)
11 × 14 (cont.)	1480.00	49.33	-	51.33	4.31	39.18	1.22	-
7 × 14 + HC sprays	2420.00	80.66	+ 63.51	53.66	4.28	40.29	1.76	+ 44.27
8 × 12 + HC sprays	2540.00	84.66	+ 71.62	52.00	4.38	40.05	2.03	+ 66.40
10 × 10 + HC sprays	2540.00	84.66	+ 71.62	52.66	4.40	40.33	2.08	+ 70.50
LSD at 0.05	97.87	2.67	-	NS	NS	NS	0.33	-

- All pruning treatments were without renewal spurs.
- The basal 5 buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2013.
- The whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2014.
- By mid-March, 2014, shoots of each vine were thinned to leave the most vigorous 60 shoots, while bunches of each vine were thinned to leave the largest 30 bunches.
- ± (%) = increase or decrease (%) in relation to cont. (11 FCs x 14 buds).

Number of leaves / vine = av. number of leaves / shoot x number of shoots / vine (60).

Table 10. Response of leaf characteristics and weight of winter prunings of Superior Seedless grapevines to a complex of some winter pruning treatments, hydrogen cyanamide sprays and thinning of shoots and bunches (second season, 2015)

Pruning treatments No. of FCs × No. of buds/cane	Number of leaves/vine	Leaf: bunch ratio		Leaf area (cm^2)	Leaf fresh weight (g)	Leaf total chlorophyll content (SPAD value)	Weight of prunings	
		value	± (%)				(kg)	± (%)
11 × 14 (cont.)	1280.00	42.66	-	53.83	4.95	41.23	1.36	-
7 × 14 + HC sprays	1986.33	66.21	+ 55.20	53.33	4.91	41.46	1.88	+ 38.16
8 × 12 + HC sprays	2040.00	68.00	+ 59.39	53.83	4.86	41.70	2.13	+ 56.72
10 × 10 + HC sprays	2032.66	67.75	+ 58.81	53.33	4.82	42.13	2.26	+ 65.81
LSD at 0.05	128.45	4.28	-	NS	NS	NS	0.13	-

- All pruning treatments were without renewal spurs.
- The basal 5 buds were sprayed with hydrogen cyanamide (5%) on 31 Dec., 2014.
- The whole fruit canes were sprayed with hydrogen cyanamide (5%) on 8 Jan., 2015.
- By mid-March, 2015, shoots of each vine were thinned to leave the most vigorous 60 shoots, while bunches of each vine were thinned to leave the largest 30 bunches.
- ± (%) = increase or decrease (%) in relation to cont. (11 FCs × 14 buds).
- Number of leaves / vine = av. number of leaves / shoot x number of shoots / vine (60).

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استجابة كروم العنب سوبيريور سيدلس لتوليفة من معاملات التقليم الشتوي والرش مرتين بسيانواميد الأيدروجين وخف الأفرخ والعناقيد

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في عامي ٢٠١٤ و ٢٠١٥ تم التقليم الشتوي لكروم العنب صنف سوبيريور سيدلس البالغة في أواخر شهر ديسمبر وذلك بترك ١١ قصبة ثمرية كل منها بطول ١٤ عين (١١ × ١٤) (الكنترول وهي المعاملة السائدة في المنطقة)، وكانت باقي معاملات التقليم هي: ٧ قصبات ثمرية كل منها بطول ١٤ عين (٧ × ١٤)، ٨ قصبات ثمرية كل منها بطول ١٢ عين (٨ × ١٢) و١٠ قصبات ثمرية كل منها بطول ١٠ عين (١٠ ×١٠)، وكانت جميع الكروم تحت التجربة بدون دوابر تجديدية، تم استخدام رشتين من سيانواميد الأيدروجين بتركيز ٥% علي جميع الكروم تحت التجربة (عدا الكنترول) وكانت الرشة الأولي في ٣١ ديسمبر علي الأجزاء القاعدية لجميع القصبات الثمرية (العيون من ١ – ٥) لجميع المعاملات عدا الكنترول، بينما كانت الرشة الثانية بسيانواميد الأيدروجين (٥%) في ٨ يناير علي كل القصبات الثمرية بما في ذلك الكنترول، وفي منتصف مارس تم خف الأفرع والعناقيد بترك ٦٠ فرخ و ٣٠ عنقود لكل كرمة، ولتقييم نتائج الدراسة استخدمت بعض الصفات مثل نسبة تفتح البراعم ونسبة البراعم الثمرية، المحصول ومكوناته، الخواص الطبيعية للحبات والخواص الكيماوية للعصير وكذلك صفات النمو الخضري، وأشارت النتائج المتحصل عليها إلي أن نسبة تفتح البراعم زادت بشكل كبير علي الأجزاء القاعدية للقصبات الثمرية (العيون من ١ – ٥) وخاصة مع القصبات الثمرية الأقل طولاً، وقد زادت نسبة خصوبة البراعم علي الأجزاء القاعدية، ويمكن التوصية بالتقليم الشتوي لكروم العنب صنف سوبيريور سيدلس لـ ١٠ قصبات × ١٠ عيون لكل قصبة والرش مرتين بسيانواميد الأيدروجين ٥% الأولى على الخمس عيون القاعدية في ٣١ ديسمبر والثانية على كل القصبات في ٨ يناير مع خف الأفرخ والعناقيد في منتصف مارس (٦٠ فرخ و٣٠ عنقود لكل كرمة)، وقد نتج عن هذه التوليفة أكبر محصول مع أعلى جودة للعنقود والحبات وصفات النمو الخضري.

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