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SUITABLE CANE THICKNESS RETAINED ON SUPERIOR GRAPEVINE AT WINTER PRUNING

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ABSTRACT

Mature Superior grapevine were pruned at dormant seasons of 2005 and 2006 leaving different cane shape and thickness on the vine to evaluate the suitable one which retained on the vine at winter pruning in order to obtain higher yield with good quality.

The data presented that retained thick round cane with about 13.5 mm gave a higher bud burst, fertility and yield/vine than leaving normal cane with diameter about 10.3 mm. Furthermore, leaving diverted flat cane to thinn round cane (9.2 mm) at winter pruning was suitable than flat cane on the vine. Since, these canes were higher bud fertility, fruitfulness and yield/cane. Whereas, leaving different cane thickness on the vine presented unpronounced effect of SSC, total acidity and SSC/acid ratio in berry juice of Superior grapes.

INTRODUCTION

Grapevine (*Vitis vinifera*, L.) is one of the most important fruit crop in Egypt and the world .The total cultivated area in Egypt reached about 159243 feddan, with more than 50% are grown in the new reclaim land according to the last statistics of the Ministry of Agriculture (2006).

Table grape production significantly increased depending on location, soil conditions and management such as pruning, trellis systems and cultural practices. It is well known that yield and berry quality of grapes are significantly influenced by the number of nodes retained per vine. Also, pruning severity is influenced by the physiology of the grapevine cultivar. In this respect, it is well known that, Flame and Ruby seedless grapes are pruned to spur system, since, the fruitful buds are located at the basal part of the canes. Whereas, Superior seedless, Thompson seedless grapevines bearing unfruitful buds at the basal part of the canes therefore, are pruned to cane system.

Superior seedless grape is one of the most important cultivars grown in Egypt. Since, it ripened early with excellent bunches and good berry flavor which are more suitable for marketing and exportation. The cultivated area of this cultivar reached about 16049 feddans in the newly reclaimed land according to the recent statistics of the Ministry of Agriculture (2006).

Pruning is an obvious management technique developed to regulate the balance between fruit production and vegetative growth of grapevines (Possingham, 1993). So, winter pruning had a limited factor for yield and berry quality.Several investigators reported that this cultivar pruned by leaving about 10-12 nodes for each cane (Howell and Striegler, 1998).Yet, the limited number of canes is depending on the vine growth and trellis system. So, under double (T) and (Y) systems we retain about 6-8 cane with 10-12 nodes/cane whereas, gable or baron system needs to leave about 10-12 canes with about 100-140 nodes/vine (Samra, 2000 and Soliman *et al.,* 2004).

Therefore, Superior seedless grape is one of the vigorous vines which produce canes of different thickness. The growers prefer to select normal cane with thickness about 10-12 mm on the vine at winter pruning .Sometime, these types of canes are un sufficient, so, to complete the number of canes with leaving thick or flat canes. In this respect, this study makes a focus on what the type of canes that could be taken to complete the number of cane left on the vine.

This study aimed to present the suitable cane thickness to be left on the vine at winter pruning to obtain higher yield with good cluster quality of Superior grape under Egyptian condition.

MATERIALS AND METHODS

This study was conducted during the two successive seasons of 2005 and 2006 in a private vineyard of Superior seedless grape at El-khatatba, El-Monofia gover norate. The vines were seven years old, grown in a sandy soil using drip irrigation system. Vines were spaced at 1.5 × 3.5 meters apart under Gabel trellis system.

For this study, 48 vines were selected, four vines per each treatment replicated three times were pruned at the first week of January leaving eight canes per each vine with 10-12 eyes/cane and 4 renewal spurs were also retained per vine. The treatments are included in Table (1) and Plate (1).

Table (1) The applied treatments:

No.	Cane shape	average Cane thickness
1	Normal	10.3 mm
2	Thick	13.5 mm
3	Flat	12.0 mm thickness 15.0 mm width
4	Diverted	9.2 mm

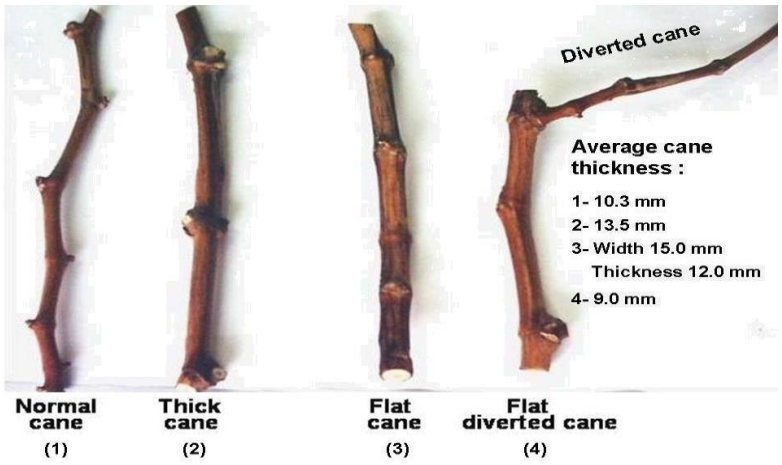

Plate (1): Shows different cane thickness which are retained on Superior grapevine at winter pruning.

Bud behaviour :

Date of bud burst were recorded, percentage of bud fertility and fruitfulness were determined and estimated according to (Samra, 2001) as follow:

1- Date of bud burst

2. Bud burst % $= \frac{\text{No. of bursted buds/vine}}{\text{Total No. of buds /vine}} \times 100$

3. Bud fertility % $= \frac{\text{No. of clusters /vine}}{\text{Total No. of buds /vine}} \times 100$

4. Fruitfulness % $= \frac{\text{No. of fruitful bud /vine}}{\text{No. of burst buds /vine}} \times 100$

At harvest when the berries from the clusters reached nearly full colour (greenish–yellow) and when soluble solids percent in berry juice was about 14-15% according to Food and Agriculture Organization of the United Nations (2003). Clusters of each cane thickness were counted and four clusters per each replicate were taken and transported to the laboratory of Pomology Dept., Mansoura Univ. to determine average cluster weight and yield/cane (kg).

1- Average cluster weight (gm).
2- Yield per cane (kg): it was estimated using number of cluster's per each cane × average cluster weight (gm).

Samples of 100 berries from each replicate were taken to determine berry physical and chemical characteristics :

1- Average berry weight (gm).
2- Soluble solid content in berry juice using a hand refractometer.
3- Total titratable acidity in berry juice, since, it estimated as tartaric acid according to (A.O.A.C, 1985).
4- SSC / acid ratio in berry juice.

Total carbohydrate :

Samples in the middle of the canes were taken at dormant season to determine total carbohydrates (g/100g dry weight) using phenol sulphoric acid method as described by Smith *et al.* (1956).

Statistical analysis :

The present data was statistically analyzed according to the methods described by Snedecor and Cochran (1980) and the means were compared statistically using Duncan's multiple range at 5% level of probability.

RESULTS AND DISCUSSION

This study was undertaken to evaluate retained of different canes thickness on bud behaviour, yield and berry quality of Superior grapes. The obtained data are presented and discussed as follow:

I. Bud behaviour :

1. Date of bud burst :

It is clear from Table (2) that date of bud burst of Superior grape was affected by cane shape and thickness. In this respect, leaving both thick and flat canes induced bud burst later than normal or diverted canes. Since, these canes bursted their buds later with about 9-11 days than normal canes as mean of two seasons .Whereas, date of bud burst was not affected with leaving normal or diverted canes since, it bursted their bud in the same time.

Table (2): Effect of cane shape and thickness on date and percent of bud burst of Superior seedless grape.

Cane characters		Date of bud burst			Bud burst %		
Shape	**Thick**	**2005**	**2006**	**Mean**	**2005**	**2006**	**Mean**
Normal	**10.3 mm**	14 Feb.	18 Feb.	16 Feb.	74.4	80.7	77.6 a
Thick	**13.5 mm**	23 Feb.	27 Feb.	25 Feb.	79.3	77.6	78.5 a
Flat	**15.0 mm**	26 Feb.	28 Feb.	27 Feb.	70.0	69.3	69.7 b
Diverted	**9.2 mm**	16 Feb.	18 Feb.	17 Feb.	71.9	71.3	71.7 b
L.S.D at 5 %		---	---	---	5.93	5.12	5.52

2- Bud burst % :

Table (2) presented that normal or thick canes retained on Superior vine gave a higher significant percent of bud burst than obtained from flat or diverted canes. Furthermore, leaving thick cane which was about 13.5 mm produced a higher bud burst than the other cane thickness which left on the canes. Whereas, leaving flat cane at winter pruning gave a lower bud burst than the other thickness of the canes. Since, this treatment gave about 69.7% of bud burst, but about 78.5 % for thick cane. In this respect, Bowed and Kliewer (1990) found that thick canes gave a better bud burst than thinner cane of Cabernet Sauvignon grapevine.

3- Bud fertility and fruitfulness % :

From Table (3), it is clear that the effect of cane shape and thickness on bud fertility and fruitfulness percentages were almost similar to those obtained from bud burst. Since, thick canes gave higher significant bud fertility and fruitfulness than the other cane thickness left on the vine. Furthermore, leaving normal or diverted cane to thinner cane (9.2mm) gave a higher significant bud fertility and fruitfulness than leaving flat cane. Whereas, no significant differences on bud fertility and fruitfulness were obtained for normal or diverted canes left on the cane of Superior vine. Whereas, leaving flat cane on the vine produced a lower significant bud fertility and fruitfulness during both season of the study.

From this data, it is clear that leaving thick canes on Superior grapevine at winter pruning produced a higher bud fertility and fruitfulness, but bursted their buds later than normal cane. Furthermore, diverted flat cane to thinner cane (9.2 mm) also gave a higher percent of bud fertility and fruitfulness than flat cane. The increment attributed in bud fertility and fruitfulness from thick cane may be due to that this cane had a higher content of total carbohydrates at dormant seasons (Table 7). Similarly, Biochev

(1972) showed that thick canes were more productive than those on thinner in canes. Moreover, El-Mogy (2006) mentioned that leaving 84 buds / vine with thickness 1.5:2 cm of spur thickness gave a higher percent of fruiting. While the lowest one was detected in vine which had 39 buds/vine with ‹ 1.0 cm spur thickness.

Table (3) : Effect of cane shape and thickness on bud fertility and fruit fullness of Superior seedless grape.

Cane character		Bud fertility %			Fruitfullness %		
Shape	**Thick**	**2005**	**2006**	**Mean**	**2005**	**2006**	**Mean**
Normal	**10.3 mm**	48.4	54.5	51.5 b	59.9	68.4	64.2b
Thick	**13.5 mm**	52.1	57.5	54.9 a	65.5	72.5	69.0a
Flat	**15.0 mm**	38.4	42.5	40.5 c	50.7	56.3	53.5c
Diverted	**9.2 mm**	46.1	50.7	48.4 b	60.1	64.7	62.4b
L.S.D at 5 %		3.42	3.07	3.22	3.73	3.52	3.61

II. Yield per cane :

Yield/cane (kg) was estimated as number of cluster/cane and average cluster weight (gm).

1- Number of cluster per cane :

Data from Table (4) show the effect of leaving different cane thickness on number of cluster/cane. In this respect, almost similar trend was found to those obtained from bud fertility and fruitfulness. Since, leaving thick cane produced a higher significant number of clusters than those obtained from the other canes left on the vine .Also, leaving normal or flat diverted cane gave a higher significant number of cluster/cane than flat cane. Yet, flat cane gave a lower number of clusters during both season of the study. Likewise, El-Agamy *et al.* (2003) presented that middle portion of fruiting cane 5^{th} -8^{th} produced higher number of clusters compared with the basal 1^{st} to 4^{th} and terminal 9^{th}-10^{th} eye. Bud fertility of different bud positions was confirmed by number of flowers produced at each eye. They also found that thick cane› 2 cm and medium 1-1.5 cm gave a higher bud burst and fertility percentage.

2- Cluster weight (gm) :

Data from Table (4), reveal that leaving flat or diverted canes on the vine at winter pruning significantly increased average cluster weight than leaving normal or thick canes. Yet, no significant difference in cluster weight was obtained from leaving normal or thick canes on Superior grapevine. Whereas retained flat or diverted cane gave a higher significant weight of cluster as mean of two seasons. These increments may be due to these canes produced a higher number of clusters than those obtained from normal or thick cane. The present data go in line with those obtained by Awad (2003) who mentioned that average cluster weight was reduced by increasing the number of eyes and bud fertility.

Table (4): Effect of cane shape and thickness on No. of cluster/cane and cluster weight of Superior seedless grape.

Cane characterizes		No. of clusters/cane			No. Cluster weight (g)		
Shape	**Thick**	**2005**	**2006**	**Mean**	**2005**	**2006**	**Mean**
Normal	**10.3 mm**	4.2	4.8	4.50b	596.4	600.3	598.4b
Thick	**13.5 mm**	5.0	5.4	5.20a	594.7	598.2	596.5b
Flat	**15.0 mm**	3.7	4.0	3.85c	608.2	612.4	610.3a
Diverted	**9.2 mm**	4.0	4.5	4.25b	604.2	610.3	607.4a
L.S.D at 5 %		0.39	0.36	0.37	2.64	2.82	2.78

3- Yield/cane (kg) :

It is obvious from Table (5) that thick canes retained at winter pruning produced a higher significant yield/cane than those obtained from normal, flat and diverted canes. Furthermore, leaving thick cane with about 13.5 mm gave a higher significant yield than obtained from normal cane (10.3 mm). The increment in yield which obtained from this treatment was mainly due to their effect on increasing number of cluster's/cane than the other treatment. Whereas, leaving flat or diverted flat to thin cane (9.2mm) produced a lower yield than normal or thick cane. Yet, leaving flat cane on the vine gave a lower significant yield than the other cane thickness.

Table (5): Effect on cane shape and thickness on yield per cane and berry weight of Superior seedless grape.

Cane characterizes		Yield / cane (kg)			Av. Berry weight (g)		
Shape	**Thick**	**2005**	**2006**	**Mean**	**2005**	**2006**	**Mean**
Normal	**10.3 mm**	2.50	2.88	2.69b	5.91	5.90	5.91b
Thick	**13.5 mm**	2.97	3.23	3.10a	5.83	5.80	5.82b
Flat	**15.0 mm**	2.25	2.45	2.35c	6.17	6.12	6.15a
Diverted	**9.2 mm**	2.42	2.75	2.58bc	6.23	6.13	6.18a
L.S.D at 5 %		0.229	0.252	0.221	0.229	0.206	0.184

Since, this cane presented about 2.35 kg/cane as mean of two seasons under the study. In this respect, Boichev (1972) found that bud productivity was greatest with 6 to 8 buds/cane. Furthermore, buds on thick canes had more productive than thin canes. Moreover, Bowed and Kliewer (1990) mentioned that yield/vine was limited by the number of canes retained and number of cluster per vine .They also revealed that thicker canes were more productive than thinner one due to better bud burst. Furthermore, El-Mogy (2006) found that the yield which obtained from vine pruned to 84 buds/vine with 1.5-2.0 cm spur thickness was higher than those obtained from thinner spur ‹ 1.0cm thickness.

III. Physical and chemical characteristics of berries :

The effect of cane thickness which retained on the cane on berry weight, SSC, total acidity and SSC/acid ratio in berry juice of Superior seedless grapes are presented in Tables (5 and 6).

1- Berry weight :

Data from Table (5) showed that berry weight taken from clusters on diverted flat to thinner (9.2 mm) and flat canes were significantly higher than those obtained from normal or thick cane (13.5 mm). Whereas, no significant differences of fruit weight obtained from normal or thick canes during the both seasons.

On the other hand, leaving flat or diverted cane at pruning showed a higher significant berry weight than the other cane thickness. Yet, the differences between these canes on berry weight were unpronounced. These results are in agreement with those obtained by Terry and Rick (2003) mentioned that increasing vine load decreased berry weight of Concord and Niagara grapevines. Yet, El-Mogy (2006) revealed that spur thickness from ‹ 1.0 to 10.5: 2.0 cm was effective for increasing berry weight of Flame seedless grape

2- SSC, total acidity and SSc/acid ratio :

It is clear from Table (6) that no significant effect on SSC in berry juice was obtained from leaving different cane thickness on the vine at winter pruning. Since, these treatments produced SSC with about (14.4 – 14.7%) as mean of the two seasons.

Table (6): Effect of cane shape and thickness on SSC% and total acidity of Superior seedless grape.

Cane character		SSC %			Acidity %		
Shape	**Thick**	**2005**	**2006**	**Mean**	**2005**	**2006**	**Mean**
Normal	**10.3 mm**	14.3	14.4	14.4	0.539	0.537	0.538ab
Thick	**13.5 mm**	14.6	14.4	14.5	0.542	0.541	0.542ab
Flat	**15.0 mm**	14.4	14.4	14.4	0.554	0.553	0.554a
Diverted	**9.2 mm**	14.7	14.7	14.7	0.528	0.526	0.527b
L.S.D at 5 %		N.S	N.S	N.S	N.S	0.017	0.022

Regarding to the effect on total acidity in berry juice, data from the same table reveal that leaving canes of different thickness on the vine presented unpronounced effect during the first season but gave a somewhat effect in the second one. Since, leaving flat canes on the vine gave a higher total acidity than those obtained from the other cane thickness.

Concerning the effect on SSC/acid ratio, data from Table (7) showed that no significant variation in SSC/acid ratio in berry juice from leaving various cane thickness on Superior grapevine. This result may be due to the effect on SSC and total acidity in berry juice were unpronounced.

From this data it is obvious that soluble solids content in berry juice did not affected by cane thickness. Yet, flat canes gave a higher total acidity than diverted cane which gave a lower acidity in berry juice. Thus, the effect on SSC acid ratio was unpronounced as mean of the two seasons. In this respect, Glen and Patrick (1993) mentioned that clusters from shoots arising from thick canes had a higher concentration of NH_4^+ than from thinn canes. It is possible that a more vigorous shoot growth associated with large, diameter canes increased the shade around the shoots.

IV. Total carbohydrates in canes :

Table (7) showed total carbohydrates content in the cane of Superior vine at dormant season was affected by various cane thickness which left on the vine. In this respect, the data reveal that thick cane (13.5 mm) gave a higher significant value of total carbohydrate than those obtained from normal, flat and diverted canes. Also, normal cane which of about (10.3mm) thickness gave a higher significant value, than obtained from flat or diverted cane. Since, the lateral ones produced a lower significant values of total carbohydrates in the canes. Similar results were reported by El- Mogy (2006) who mentioned that increasing vine load and spur thickness increased total carbohydrates. Since, spur thickness of about 1.5-2.0 cm produced a higher content of total carbohydrate of canes at dormant seasons than those obtained of spurs with ‹ 1.0 cm. similar effect was obtained with El-Agamy (2003) and Dawn *et al.* (2004).

Table (7): Effect of cane shape and thickness on SSC/acid ratio and total carbohydrate of Superior seedless grape.

Cane characterizes		SSC / acid ratio			Total carbohydrates		
Shape	**Thick**	**2005**	**2006**	**Mean**	**2005**	**2006**	**Mean**
Normal	**10.3 mm**	26.5	26.8	26.7	16.24	16.88	16.56b
Thick	**13.5 mm**	27.0	26.6	26.8	16.82	17.64	17.23a
Flat	**15.0 mm**	26.0	26.0	26.0	15.18	14.87	15.03c
Diverted	**9.2 mm**	27.8	27.9	27.9	15.22	15.95	15.89c
L.S.D at 5 %		N.S	1.22	N.S	0.554	0.564	0.486

From this study it is clear that retained thick canes with about 13.5m.m and normal cane with size 10.3 mm at winter pruning of Superior grapevine presented a higher bud burst, fertility and yield than leaving flat or diverted canes. Furthermore, when we need to complete the load of cane on vine especially under Gabel or Baron trellis systems we recommend to use diverted flat cane to thin round canes (9.0mm diameter), since, these cane produced a higher yield than retained flat canes on the vine which gave a lower yield/cane.

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سمك القصبات المناسب التى تترك على كرمات العنب السوبريور أثناء التقليم الشتوى

باسم نبيل سمره

قسم الفاكهة – كلية الزراعة – جامعة المنصورة

تم تقليم كرمات العنب السوبريور خلال موسم السكون خلال عامى ٢٠٠٥ ، ٢٠٠٦ وذلك بترك قصبات متباينة فى السمك وذلك لمعرفة أنسب سمك للقصبات التى تترك على الكرمات خلال التقليم الشتوى للحصول على محصول عالى ذو صفات جودة ممتازة.

ولقد أوضحت الدراسة أن ترك القصبات المستديرة السميكة بقطر حوالى ١٣,٥ مم أعطت زيادة واضحة فى نسبة تفتح وخصوبة البراعم وكذا محصول الكرمة مقارنة بترك القصبات العادية ذات سمك حوالى ١٠,٣ مم.

بالإضافة لما سبق فإن تحويل القصبات المبططة إلى قصبات مستديرة ناضجة ذات سمك حوالى ٩,٢ مم أثناء التقليم الشتوى أفضل من ترك القصبات المبططة ذات عرض حوالى ١٥ مم وسمك ١٢ مم على الكرمات. إذ أعطت القصبات المحولة إرتفاع ملحوظ فى نسبة تفتح وخصوبة البراعم على الكرمات بينما ترك قصبات متباينة على الكرمات لم تعطى أثر واضح على محتوى عصير الحبات من المواد الصلبة الذائبة والحموضة الكلية وكذا نسبة المواد الصلبة الذائبة إلى الحموضة فى عصير الثمار.