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EFFECT OF CANE LENGTH ON BUD BEHAVIOR, BUNCH CHARACTERISTICS WOOD RIPENING AND CHEMICAL CONTENTS OF THOMPSON SEEDLESS GRAPEVINE

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ABSTRCT

This investigation was carried out in a private vineyard located at Senhera, Kalubia Govermerate on twelve years old of Thompson Seedless grapevines. The study was continued for two successive seasons 1997 and 1998. Vines were pruned to different numbers of canes (4,5,6 and 9 canes/vine) and to different number of buds (18,14,12 and 8 buds per cane) (number of buds/vine being fixe to 72-70 buds), in addition to the renual spure buds per each, level of cane length.

The results showed that percentage of buds burst and bunch index increased with increasing cane length to 18 buds, while the fruitful buds percentage, No. of bunches and fertility coefficient were increased at cane length 12 and 8 buds/cane.

Vines with cane length 12 buds gave the greatest bunch weight, length, and berry weight in gms, as well as berry index and number of berries per bunch were more increased at cane length 12 and 8 buds, than the long canes 18 and 14 buds. This increase in number of berries increased compactness coefficient for bunches at the same treatment with cane length 12 buds/cane. T.S.S. was increased at the short cane length, while acidity was decreased. Wood ripening gradually advanced in all treatment till November. Increasing cane length depressing weight of vine pruning, total carbohydrates and total nitrogen.

The short cane length 12 and 8 buds cane showed a significant increase at the different dates of measuring than long canes 18 and 14 buds.

INTRODUCTION

Among the horticultural practices already carried out in vineyards, pruning is considered the most important practice through which grape production can be increased and bunch quality improved. Thompson Seedless is the leading grape cultivar in Egypt. The basal 3-4 buds of this cultivar are less fruitful. So, using long fruit canes is a must for production of a normal crop.

To achieve the best compromise between vine capacity, shoot vigor, yield and fruit quality, vine load should be carefully determined. The total bud-load per vine results from varying number and length of the canes.

Cane length and number of canes per vine are the most important factors affecting in getting permanent high and good quality of bunches in relation with the vine vigor of Vitis cultivar. Many investigations studied the effect of cane length and bud load per vine on fruit quality and yield of Thompson Seedless grape cultivar (Shaulis and May, 1971, Lider *et al*, 1973, Weaver and Kassimatis, 1975, Sourial, 1976, Cawthon and Marries, 1977, Morris and Cawthan, 1980, May *et al*, 1982, Rizk *et al*, 1994, and Rizk, 1996).

In this connection, Fawzi (1984) showed that within a constant buds load of 72 buds/vine the increase of cane length resulted in a paralled increase in number of bunches and yields per vine. Fruit quality was slightly affected (Sarow and Bakshi, 1972, Fawzi *et al*, 1984, and Tomer and Brar, 1985).

The objective of this work is carried out to determine the optimum number of canes left on the vine within constant 70-72 buds per vine on 12 year old-vines of Thompson Seedless grape cultivar. Also, to study the effect of cane length on the quality of bunches, berries, total yield per vine, wood ripening, total carbohydrate and nitrogen contents.

MATERIALS AND METODS

This work was carried out in a private vineyard situated in Senhera, Kaliobia Governorate on 12-year-old Thompson Seedless grapevines. This study extended for two successive years (1997 and 1998). The vines were trellis-trained according to the cane pruning system. All vines were grown 2 x 2.5 meters apart, the soil is well-drained sandy loam, irrigated by flood system. At winter pruning 16 selected vines which were of about similar vigor were adopted to different treatments concerning the length of fruiting canes, but with the same bud-load which was 70-72 buds/vines. In addition to the reneual spure per each treatment. Thus, the following treatments were obtained.

4 canes x 18 buds per each cane.

5 canes x 14 buds per each cane.

6 canes x 12 buds per each cane.

9 canes x 8 buds per each cane, this treatment is the common farmer application in this vineyard.

From the statistical point of view, the completely randomized design was carried out. Data were statistically analyzed according to the methods described by Sendecor, 1967.

The following parameters were considered to evaluate the effect of different treatments.

1- Bud behavior :

During spring of each season, number of bursted buds, and fruitful buds were counted. Then, percentages of these values were calculated. Number of clusters originating from the bud at different positions of the cane were also recorded for each experiental vines. Then the percentage of fruitful buds and budberst were calculated as follows.

$$\text{Percentage of budburst} = \frac{\text{No. of bursted buds}}{\text{Bud-load/vine}} \times 100$$

$$\text{Percentage of fruitful buds} = \frac{\text{No. of fruitful buds}}{\text{No. of bursted buds}} \times 100$$

Fertility coefficient was calculated by dividing number of bunches per vine by total number of buds per vine as mentioned by Huglin (1958) and Bessis, R., (1960).

2- Number of bunches and yield/vine:

At harvest time (end of July) bunches were picked in each season. Total number of bunches and their total weights per vine were recorded.

3- Bunch quality and berry characteristics:

At harvest, time samples of 24 bunches per each treatment were taken to the laboratory to carrying out the following data:

- Average bunch weight in gms.
- Average bunch length in cms.
- Average number of berries per bunch.
- Compactness coefficient (dividing No. of berries per bunch by bunch length (Winkler 1962).
- Average weight of rachis per bunch.
- Bunch index (average bunch weight divided by average weight of rachis per bunch).
- Berry index (average number of berries presented in 100 gms of bunches).

Two samples of 50 berries per replicate were randomly taken to measure the average berry weight, total soluble solids (TSS) using a hand refractometer and acidity determined by titration of the juice with N/10 NaOH, and expressed as grams tartaric acid per 100 cm^3 of the juice.

4- Dynamics of wood ripening :

On each experimental treatment, 16 shoots of the current season were tagged for each treatment to follow up the rate of wood ripening on their basal section. Starting from September and at monthly intervals till mid of November. Coefficient of wood repining was calculated as follows:

$$\text{Dynamics of wood ripening} = \frac{\text{Length of ripened part}}{\text{Total length of the shoot}}$$

At each measuring date, the part of the shoot that ripened is changing in color from greenish to brownish (Bouard 1966).

5- Chemical contents of 1-year old wood:

Samples of one-year-old canes which bore bunches in summer were collected at winter pruning (one cane per each vine). In the laboratory, canes were mixed, dried and ground as one sample for the following assays:

1st- Total carbohydrates:

Total carbohydrates were determined according to the method described by Plummer (1971).

2nd- Nitrogen contents :

Nitrogen content was estimated in the obtained digests using micro-kjeldahl distillation method (A.O.A.C., 1975).

A complete randomized design was followed. Date were subjected to analysis of variance and L.S.D test was used for comparison between means (Snedecor 1967).

RESULTS AND DISCUSSION

Bud behavior:

Data concerning the effect of cane length on bud behavior are presented in Table (1). It is clear that bud burst was markably affected by increasing cane length. It was increased significantly as cane length increase in the two seasons of the study (1997 and 1998). This increase may be attributed to the elimination of polarity phenomenon. i.e by increasing cane length from 10-14 buds/cane. Thus, Fouad 1990, showed that the least percentage of bud burst observed in oblique orientation of the cane of Thompson Seedless grapevines, could be ascribed to the slight influence of this treatment on polarity phenomenon, since the position of canes approaches the vertical position at which is polarity is accentuated.

The upper most budburst percentage were 75.0, 77.2 for the treatment with (4 canes x 18 buds) in the two seasons respectively and followed by the next cane length baring (5 canes x 14 buds), (6 canes x 12 buds) and (9 canes x 8 buds). The results in this respect agree with those obtained by Fawzi *et al*., (1984b), Fouad, (1990) and Rizk *et al*., (1994). On the other hand, data of both seasons clarify indicated significant differences between the tested treatments concerning the percentage of fruitful buds, the highest value were (66.2 and 64.2) and (64.6 and 60.2) for the two treatments (6 canes x 12 buds and 5 canes x 14 buds percane), at the two seasons 1997 and 1988 respectively. The same was found for the fertility coefficient it recorded (0.54 and 0.59) for the treatment comprised (6 canes x 12 buds/vine).

Table (1): Effect of cane length on bud behavior of Thompson Seedless Grapevines at 1997 and 1998 seasons.

Treatments	First Season (1997)			Second Season (1998)		
No.Canes XNo. Buds/Cane	Budburst (%)	Fruitfull Buds(%)	Fertility Coefficient	Budburst (%)	Fruitfull Buds(%)	Fertility Coefficient
4 x 18	75.0	58.5	0.46	77.2	55.3	0.43
5 x 14	74.4	64.6	0.58	73.6	60.2	0.56
6 x 12	67.8	66.2	0.54	69.3	64.6	0.59
9 x 8	61.4	60.4	0.49	60.2	58.0	0.46
L.S.D. at 5%	4.7	2.7	.040	3.4	4.7	0.11

Number of bunches and yield per vine:

From Table (2), it is clear that treatments of (6 cans x 12 buds) gave the highest number of benches and yield per vine was increased significantly in the two treatments. It recorded (27.3 and 28.3) for the No. of bunches/vine respectively in the two seasons, while the yield/vine was (18.2 and 17.2, kg/vine) for the two seasons of 1997 and 1998. The least values were for the

long and very short cane length (4 x 18 and 9 x 8) and no significant differences were noticed between them. These results are in agreement with those obtained by Sourial 1976, Fawzi *et al*., 1984b, Lagarda, 1986, Marwad *et al*., 1993, Rizk e*t al*., 1994 and Rizk, 1996.

Table (2): Effect of cane length on number of bunches per vine and yield of Thompson Seedless grapevines 1997 and 1998 seasons.

Treatments	First season (1997)		Second season (1998)	
No.CanesXNo.Buds /Cane	No. Bunches/vine	Yield/kg/vine	No. Bunches/vine	Yield/kg/vine
4 x 18	21.4	11.6	20.0	10.20
5 x14	24.0	16.3	26.0	15.6
6 x 12	27.3	18.2	28.3	17.2
9 x 8	20.0	12.3	22.0	11.3
L.S.D. at 5 %	3.0	4.0	4.6	3.3

Bunch and berry characteristics:

Data in Table (3) indicates that treatment of 6 canes x 12 buds gave the highest significant values concerning bunch weight. This treatment recorded 420.6 and 390 gm/bunch during 1997 and 1998 seasons, respectively. The treatment 5-cane/14 bud cane to the second rank. Treatments of 9 cane/8 buds and 4 cane /18 buds gave the lowest values in that respect, which recorded 290.3 and 330.5 for the first season and 275 and 290.0 for the second season respectively.

Table (3): Effect of cane length on some bunch characteristics of Thompson Seedless grapevines.

Treatments No. of Canes x No. of buds /canes	First Season (1997)				
	Bunch weight (gm)	Rashis weight (gm)	Bunch index %	Bunch length (cm)	Compactness coefficient %
4 x 18	330.5	9.5	35.0	23.0	10.0
5 x 14	380.4	11.3	33.6	28.2	9.1
6 x 12	420.6	12.8	32.0	29.6	10.4
9 x 8	290.3	10.6	28.2	23.0	8.3
L.S.D at 5%	34.1	0.75	1.8	4.2	1.2
Treatments No. of Canes x No. of Buds/canes	**Second Season (1997)**				
	Bunch weight (gm)	**Rashis weight (gm)**	**Bunch Index %**	**Bunch Length (cm)**	**Compactness coefficient %**
4 x 18	290.0	8.9	34.8	25.0	8.2
5 x 14	355	10.0	33.8	27.6	8.9
6 x 12	390	11.6	32.8	30.0	9.6
9 x 8	27.5	8.2	33.0	24.2	7.5
L.S.D at 5%	28.4	0.90	1.0	2.3	1.7

Regarding coefficient of bunch compactness this parameter as shown in Table (3) the same trend for the above-mentioned treatments (2 and 3) contains 14 and 12 buds/cane.

Compactness coefficient was more increased by the cane length (12 buds/cane) than the very long and very short cane length/vine, (18 buds and 9 buds/cane). The highest bunch compactness were recorded (10.4 and 9.6%) for the two seasons receptively. The same treatment gave longest bunch in cms. as showed in Table (3), which recorded (29.6 and 30.0 cm) in the two seasons, respectively. While the highest bunch index value was found at treatment (4 cans x 18 buds per/vine). Than the other treatments (2, 3 and 4) in the two seasons 1997 and 1998. This increase could be attributed to the increases in fruit setting at this treatment. (Marwad *et al*., 1993; Rizk *et al* 1994; and Rizk, 1996).

Berry characteristics and juice quality:

Table (4) showed that No. of berries per bunch were increased at treatment (3) having (6 canes x 12 buds and followed by treatment (2) having (5 canes x 14 buds/vine). The largest number of berries were significantly recorded (305 and 285 berries/bunch) against the least number of berries were (190 and 180) for the farmer treatment having (9 canes x 8 buds/vine) in the two seasons 1997 and 1998 respectively. As for berry index it is clear from Table (4) that the highest value was found for treatment comprised (6 canes x 12 buds/vine).

This results could be expected due to insufficient supply from roots to the relatively greater and longer number of shoots which might depress fruit setting on flower clusters on such long and great number of canes. The same results were obtained by (Bhyjbal 1979, Fawzi *et al*., 1984; Rbd-El Fattah *et al*., 1993; Marwad *et al*., 1993 and Rizk *et al*., 1994).

Table (4): Effect of cane length on berry characteristics of Thompson Seedless grapevines.

Treatments No. of Canes x No. of buds /canes	First Season (1997)				
	Berry weight (cm)	No .of berries/bunch	Berry Index %	TSS %	Acidity %
4 x 18	1.30	230	68.6	16.4	0.63
5 x 14	1.44	255	66.1	17.0	0.60
6 x 12	1.48	305	73.0	18.6	0.52
9 x 8	1.31	190	64.0	18.2	0.56
L.S.D at 5%	0.12	164	3.7	2.0	0.06
Treatments No. of Canes x No. of buds /canes	**Second Season (1998)**				
	Berry weight (cm)	**No. berries /Bunch**	**Berry Index %**	**TSS %**	**Acidity %**
4 x 18	1.22	205	71.0	16.0	0.66
5 x 14	1.30	246	68.3	16.8	0.63
6 x 12	1.40	285	72.7	17.4	0.58
9 x 8	1.26	180	64.4	17.8	0.53
L.S.D at 5%	0.11	223	2.7	1.2	0.04

Berry weight in gms, as shown in Table (4) it is evident that the average berry weight in gms increased significantly at treatments comprised (6, 5 canes x 16, 14 buds/vine) (treatments 2, 3). Data recorded (1.48, 1.44 and,

1.40, 1.30 gms) for the above two mentioned treatments at the two seasons 1997 and 1998 respectively, in comparison by the two other treatments (1, 4 having (4, 9 canes x 18 , 8 buds/vine).

This increase in berry weight was due to the increase of the bunch weight to the same treatment, (Howell *et al*.,1991, Abdel Fattah *et al*.,1993 and Rizk, 1996).

Concerning total should solids (TSS) and acidity in Table (4) generally revealed significant increase at the tested treatments (12 buds/cane and 8 buds/cane) treatments No. (3 and 4) in comparison by the two other treatments having 18 and 14 buds/cane. The increases in TSS at the above two mentioned treatments for came length (12 and 8 buds/cane) has been directly related to cluster exposure to sunlight and accelerate berry ripening as a reason for the short cane length where no more shoots causing shading, these results are in agreement with shaulis and May, 1971; Clingeleffer, 1989; Howell *et al*, 1991 and Abbd-El Fattah *et al*., 1993; Marawad *et al*., 1993 and Rizk, 1996. They found that, a significant increment in TSS could be noticed with pruning to short canes in comparison by long canes pruning.

Table (5): Percentage of Total carbohydrates, nitrogen contents and weight of pruning in 1-year-old wood as influenced by cane length of Thompson Seedless grapevines at (1997 and 1998) seasons.

Treatments No. of Canes x No. of buds /canes	First Season (1997)		
	Weight of pruning wood (gm)	Total carbohydrate %	Total Nitrogen %
4 x 18	1.45	19.63	0.89
5 x 14	1.70	21.34	0.85
6 x 12	1.80	24.46	0.94
9 x 8	1.41	20.82	0.81
L.S.D at 5%	0.17	0.13	N. S.
Treatments No. of Canes x No. of buds /canes	**Second Season (1998)**		
	Weight of pruning wood (gm)	**Total carbohydrate %**	**Total Nitrogen**
4 x 18	1.36	17.56	0.92
5 x 14	1.52	24.20	0.96
6 x 12	1.65	26.31	1.04
9 x 8	1.30	18.65	0.87
L.S.D at 5%	2.31	4.22	N. S.

Data in this aspect recorded the highest TSS values they were (18.6, and 17.4%) for the two season respectively. As for total acidity the same treatments (3, 4 with cane length 12, 8 buds per cane) showed a significant decrease for the above shorter canes as compared by the other long cane treatments with (18 and 14 buds/cane).

Weight of 1-year-old pruning:

The obtained results, reveal the depressing effect of increasing cane length per vine on the weight of vine pruning and cane constituents of total carbohydrates and nitrogen, contents of 1-year-old wood.

From Table (5) cane length effect obviously on the weight of pruning significantly in the two seasons 1997 and 1998. The longest cane length caused significant reduction in the weight of pruning. Such result might have relation to the cane length. Similar results were obtained by Abd-El Fattah *et al*., (1993).

Total carbohydrates:

Cane length is one of the factors effecting chemical composition of grape shoots. Results concerning total carbohydrates as influence by cane length/vine in Table (5). Data indicate gradual significant decrease as cane length increased to 18 and 14 buds and cane length decreased for 8 buds in the two seasons 1997 and 1998. The highest value was (24.46 and 26.31%) for treatment comprised at the two seasons (12 buds per can) respectively. Similar observations were reported by Kliwer (1973), Melkonyan (1985), Miktenk (1985), Bowen and Kliewer (1990) and Abd-EL Fattah *et al*., (1993). They reported that the increment in total yield needs more vegetative growth resulting low storage of total carbohydrates in the canes.

Nitrogen percentage:

Table (5) clarified that nitrogen percentage of the 1-year-old wood was not significantly affected by cane length in both seasons. This result may by due to insufficient synthesis of protein nitrogen from soluble nitrogenous compounds to supply the fast growing of shoots in the previous growing season. This result in agreement with Abd-EL- Fattah *et al*., (1993).

Dynamics of wood ripening:

As shown in Table (6), wood ripening gradually advanced in the successive dates of measurements. Coefficient of wood ripening was always higher in November than in September. As for the effect of cane length on this parameter, it is obvious that in all measuring dates, coefficient of wood ripening was negatively influenced by the increase in cane length (18 and 14 buds/cane). The increase in wood ripening was significant only in treatment (9 and 12 buds/cane) at all measuring dates. Data recorded in this aspect (86,78 and 89, 83%) for the two mentioned treatments for the two seasons respectively. These results are in line with those obtained by Fawzi *et al*., 1984; Morwad *et al*., (1993); Rizk *et al*., 1993 and Rizk, 1996.

Table (6): Effect of cane length on dynamics of ripening of Thompson Seedless grapevines at season 1997 and 1998.

Treatments No. Canes X No. of Buds/Cane	First Season (1997)				Second Season (1998)			
	Date				Date			
	20/8	14/9	12/0	20/11	20/8	18/9	15/10	16/11
4 Canes x 18 buds	0.29	0.36	0.42	0.61	0.26	0.33	0.46	0.59
5 canes x 14 buds	0.34	0.43	0.51	0.66	0.31	0.37	0.52	0.66
6 canes x 12 buds	0.46	0.54	0.63	0.78	0.38	0.51	0.64	0.83
9 x 8 buds	0.48	0.55	0.69	0.86	0.44	0.59	0.69	0.89
L. S. D. At 5%	0.08	0.12	0.14	0.11	0.66	0.12	0.16	0.14

Length of basal section of the shoot with mature wood

The values represent = ——————————————————————
Shoot length.

On account of the four mentioned results it can be concluded that, the short cane length 12 buds/cane and 14 buds/cane are recommended in our study for the lest results were given in most parameters under this system of training, while the shorter cane length 8buds/cane is not suitable and productive for this grape cultivar for the cane training system.

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تأثير طول القصبة علي سلوك العيون وصفات العناقيد ونضج الخشب والمحتوى الكيماوي لصنف العنب طومسون سيدلس

ميرفت عبد الكريم علي ، محفوظ محمد الموجي وإيزيس عبد الشهيد رزق

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أجري هذا البحث في مزرعة خاصة سنهرة بمحافظة القليوبية علي كرمات عمرها 12 عام من العنب البناتي-الدراسة استمرت لمدة عامين 1997-1998 ، قلمت الكرمات إلى عدد مختلف من القصبات و القصبات إلي عدد مختلف من العيون بحيث ثبت عدد العيون في النهاية من (70 – 72 عين للكرمة) وكانت المعاملات (4، 5، 6، 9 قصبات في عدد العيون 18 ، 14 ، 12 ، 8 عين للقصبة) هذا بالإضافة إلى الدوابر التجديدية المتروكة علي الكرمة حيث يمثل طول القصبات 8 × 9 عين معاملة المزرعة عامة التي يقوم بها المزارع وأحياناً يترك 8 عيون على القصبة.

أوضحت النتائج أنه زادت النسبة المئوية لتفتح العيون ومعامل العنقود زيادة معنوية بزيادة طول القصبة إلي 18 عين للقصبة بينما زادت النسبة المئوية للعيون الثمرية والخصوبة في القصبات المقلمة إلى 12 ، 8 عيون للقصبة.

وكان أعلي وزن للعنقود وطوله ووزن الحبة لمعاملة التقليم 12 عين للقصبة كما زاد معامل الحبة وعدد الحبات زيادة معنوية في القصبات المقلمة إلى 12 ، 8 عين عن القصبات المقلمة إلي طول 18 ، 14 عين للقصبة، هذه الزيادة في عدد الحبات زادت من معامل امتلاء العنقود لنفس المعاملة 12 عين للقصبة كما زادت المواد الصلبة الذائبة الكلية بقصر طول القصبات وقل معدل الحموضة بالنسبة لطول الخشب كان متقدما تدرجيا في جميع المعاملات حتى شهر نوفمبر، وكانت الزيادة في نضج الخشب معنوية في طول تقليم 12 ، 8 عين للقصبة كما أثر زيادة طول التقليم حيث قلل وزن قصاصة التقليم والكربوهيدرات الكلية ونسبة النتروجين لخشب التقليم.