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OPTIMAL BUD LOAD FOR THOMPSON SEEDLESS GRAPEVINES

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ABSTRACT

This study was conducted through the seasons of 1995 and 1996 to determine the optimal bud loads per vine for Thompson Seedless grapevines. Ten years-old-uniformed vines were chosen and pruned to five different levels of bud load, namely 48, 60, 72, 90 and 120 buds per vine. Canes number was fixed for all treatments by 6, while bud number was differed from 8, 10, 12, 15 and 20 buds per cane. The results showed that the fruitful cane could be divided into 3 parts according to number of fruitful buds, basal, middle and distal part. Low fruitful buds were found in the basal part, then increased rapidly in the middle part and reached its higher number in the distal part. Increasing of bud load decreased bud burst and increased fruitful buds, number of bunchs and yield per vine. However, it increased dormant buds, while it significantly decreased bunch weight, T.S.S., carbohydrates in new canes, wood ripening while acidity was increased. It was found that the optimal bud load/vine was 72 to 90 buds to produce high yield with good quality and maintaining the vigour of the vine.

INTRODUCTION

Bud load is the most important factor affecting yield and bunch quality as well as vine vigour of Thompson Seedless grapevines (Morris and Cawthon, 1980; Fawzi *et al.,* 1984 and Marwad *et al.,* 1993). Total yield was increased by increasing bud load, but the percentage of marketable bunches was decreased (Miller *et al.,* 1993 and Korpas, 1994). Leaf shading, resulting from low bud load, induced a reduction in leaf dry weight, leaf starch content and soluble carbohydrates, vine yield, and berry quality, linearly with increasing shade intensity (Cartechini and Palliotti, 1995). In low bud loaded vines number of leaves was increased, which shade clusters and resulted in decreasing bunch quality (Gao and Cahoon, 1994). High bud load/vine gave higher yield with less vegetative growth than moderate bud load (Miller *et al.,* 1993). Bud burst decreased as bud load was increased (Christensen *et al.,* 1994). The effect of bud load extended to the vigour of the vines. Fawzi *et al.,* (1984) observed that vines were weakened as a result of increasing bud load to 92 buds/vine. On the contrary, decreasing bud load to 44 buds/vine induced a vigourous growth of grapevines. So, it is logically important to prune Thompson Seedless grapevines to produce high yield with good quality and maintaining simultaneously the vigour of the vines.

Hence, this experiment was designed to determine the suitable bud load per vine for Thompson Seedless grapes and study bud behaviour with different levels of bud load.

MATERIALS AND METHODS

This study was conducted through two seasons (1995 and 1996) in a private vineyard located in Menia El-Qamh, Sharkia governorate. Thompson Seedless grapevines of 10-year-old were grown in clay soil and spaced 1.75 X 2.75 m.. The vines were trellis-trained according to cane pruning system. At winter, eighty vines of almost similar vigour were selected and pruned to different bud load levels with fixed number of 6 canes per vine.

The treatments were as follows :

1st- 6 canes with 8 buds each = 48 buds
2nd- 6 canes with 10 buds each = 60 buds
3rd- 6 canes with 12 buds each = 72 buds
4th- 6 canes with 15 buds each = 90 buds
5th- 6 canes with 20 buds each = 120 buds

Each treatment contained 4 replicates, of 4 vines each. The randomized complete block design was adopted, and the data were subjected to Duncan's method to compare between means as desribed by Snedecor and Cochran (1980).

The following parameters were recorded :

Bud behaviour (percentage of bursted, dormant, fruitful and vegetative buds), number of bunches per vine, bunch weight, yield per vine, wood ripening (W.R. = $\frac{\text{length of ripe wood}}{\text{Shoot length}}$ X 100), juice TSS in the third week of July and the total carbohydrates content in new canes was determined in December following the method of Dubois *et al.,* (1956).

RESULTS AND DISCUSSION

- Bud behaviour

One- The bursted and the dormant buds :

Bud burst was affected by bud position on the cane and bud load per vine.

Fig (1) showed that bud burst was increased from basal to distal part of the cane. The lowest bud burst was observed at the basal part of the cane. In this part, bud burst percentage was inversely proportional to cane length. Dormant buds were in contrast with bursted buds (Fig. 2).

Increasing bud load per vine significantly decreased bud burst percentage (Table 1). The highest bud burst was associated with the lower bud load 48 and 60 buds/vine. Dormant buds showed a reverse trend.

Buds are dependant on parent vines for stored nutrients to burst out. The increase of bud load decreases bud burst as a result of minimizing the amount of nutrients for each bud to burst out. Phillips (1969) pointed out that the translocation of reserved carbohydrates from basal to distal buds promoted the distal buds to burst out.

Fig 1+2

Stanescu (1993) and Christensen *et al.,* (1994) observed that increasing bud load gave a lower percentage of bud burst. On the contrary, decreasing bud load increased bud burst with a great capacity for latent buds to burst out and vigoursly grow (Fawzi *et al.,* 1984). The hormonal control of bud burst is an interesting point to be discussed. Kilewer (1977), Farag *et al.,* (1981) and Badawi *et al.,* (1984) explained that the increasing of bud burst of the distal part is due to its higher content of IAA and GA_3 and lower contents of ABA in both swelling and bud burst stages. Moreover, Phillips (1975) pointed out that the apical buds are acting as a rich source for IAA and GA_3 that increased bud burst of the distal part. Badawi *et al.,* (1984) found that the increase in dormant buds in the basal part is due to the accumulation of ABA translocated from the distal part. So, increasing number of buds of the cane, lead to an increase in dormant buds of the basal part.

Two- Fruitful and vegetative buds :

Fruitful buds were also affected by bud position on the cane and bud load per vine. According to the shape of the curve representing percentage of fruitful buds lengthwise the cane (Fig. 3) which showed three clear parts regardless of the length of each cane, it was found more convenient to classify the cane into the three following parts :

- Buds from 1-3 represent the basal part which was characterized by having the lowest values of fruitful buds%. It is obvious that the shorter the cane the higher this percent in the basal part (Table 2).
- Buds from 4-7 represent the middle part which showed a tendency towards an increase of fruitful buds%. This percent was inbetween when compared to that of basal and distal parts (Table 2).
- Buds from 8-20 represent the distal part which contained the highest fruitful buds%. The number of buds varied according to the length of the cane.

For example, in 1995 the distal part of the short canes (8 buds) contained one bud only which had 71% fruitful buds (Table 2). Canes with 10 buds had three buds (8, 9 and 10) in the distal part and their fruitful buds% was 66. The distal part of twelve buds/cane had 5 buds (8-12) with an average of 65% for fruitful buds. The longer cane with 15 buds had 8 buds (8-15) in the distal part. The fruitful buds% for the first six buds (8-13) was 64 then decreased to 47 for the last two buds (14-15). The fruitful buds% average of this distal part was 60. Similarly, the longest cane of 20 buds contained 13 buds in its distal part. The fruitful buds% for the first ten buds (8-17) was 63, then decreased to 43 for the last three buds (18-20). The average of the fruitful buds% for this part was 58. The same trend was observed in 1996.

The overall picture showed that the percentage of fruitful buds was the lowest in the basal part of the cane, then increased in the middle part, and reached its maximum value in the distal part. However, fruitful percentage decreased at the end of the distal part of long canes (15 buds and over).

Maximous *et al.,* (1971) reported that the distal buds of the cane were found to have the highest percentage of bursted and fruitful buds.

Fig 3

Table 1

Table (2): The relationship between parts of the cane and its fruitful buds percentage of Thompson Seedless grapevines.

Number of	1995						1996					
	Basal Part		Medium part		Distal part		Basal part		Medium part		Distal part	
buds/cane	N.B.	F.B.%	N.B.	F.B.%	N.B.	F.B.%	N.B.	F.B.%	N.B.	F.B.%	N.B.	F.B.%
8	3	12	4	51	1	71	3	8	4	39	1	57
10	3	10	4	49	3	66	3	6	4	38	3	53
12	3	6	4	44	5	65	3	4	4	35	5	51
15	3	0	4	43	8	60	3	2	4	36	8	49
20	3	0	4	44	13	58	3	0	4	40	13	46

N.B. = Number of buds
F.B% = Fruitful buds

Fruitful buds% were also affected by bud load per vine. Table (1) clearly showed a significant increase in fruitful buds as bud load increased. Vegetative buds took a reverse trend compared to fruitful buds. The results are in agreement with those of Fawzi *et al.,* (1984); Hegazi *et al.,* (1984); Marwad *et al.,* (1993); Miller *et al.,* (1993) and Cartechini and Palliotti (1995).

- Bunch characteristics, yield and wood ripening :

Number of bunches per vine were increased significantly as bud load was increased (Table 1). It is obvious that the high bud load of 120 buds per vine increased number of bunches over two times more than bunches resulting from 48 buds per vine. Bunch weight took a reverse trend, i.e, increasing bud load significantly decreased bunch weight especially with 90 and 120 buds/vine. The yield per vine was significantly increased by increasing bud load. Moreover, the yield was nearly doubled when bud load reached 72, 90 or 120 buds per vine compared to 48 buds/vine. Despite of increasing yield, this was accompanied by a significant decrease of bunch weight. It is worthwhile to mention that a thinning of bunches should be applied in such high bud loads (90 and 120 buds) to improve quality of bunches.

Wood ripening decreased significantly as bud load was increased. TSS was significantly affected by bud load per vine. Increasing bud load up to 72 buds per vine significantly increased berry T.S.S.. No significant difference in T.S.S. was observed between bud load of 60 and 72 buds per vine. Leaving 48 or 120 buds per vine recorded lower T.S.S. with no significant difference. The same observations were recorded for carbohydrates in the new canes.

Vigour growth and increase of vegetative buds in low bud load of 48 buds/vine induced a situation of increasing leaves which led to heavy canopy, and shaded conditions (Cartechini and Palliotti, 1995), consequantly, photosynthesis was reduced (Kliewer, 1981). This led to a decrease in T.S.S.; reserved carbohydrates in new canes; wood ripening and increase in the acidity of the berries (Gao and Cahoon, 1994). Bud load of 90 or 120 buds per vine gave higher yield but less vegetative buds than the lower (48 buds) or moderate bud loads (60-72 buds) per vine. It seems that the vegetative growth at higher bud load was not enough to ensure the needs of carbohydrates for higher number of bunches/vine which resulted in a similar case like those of lower bud load. Again, it is worthy to mention that thinning of bunches should be applied with such high bud load to improve bunch quality. Similar results were observed by Antcliff *et al.,* (1956); Fawzi *et al.,* (1984); Marwad *et al.,* (1993) and Korpas, (1994).

From the foregoing results and discussion, it could be concluded that the suitable bud load per vine for Thompson Seedless ranged from 72 to 90 buds to produce high yield with good quality and simultaneously maintaining vine vigour.

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العدد المناسب من البراعم لكروم العنب الطومسون سيدلس "البناتي"

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أجريت هذه الدراسة خلال موسمي 1995 ، 1996 لتحديد العدد المناسب من البراعم لكرمة العنب طومسون سيدلس. قلمت كروم العنب عمر 10 سنوات – في شهر يناير- إلي خمسة مستويات هي 48 ، 60 ، 72 ، 90 و 120 عين/كرمة مع تثبيت عدد القصبات (6 قصبات) و تغيير طول القصبة (8 ، 10 ، 12 ، 15 و 20 عين/قصبة).

أظهرت النتائج أنه يمكن تقسيم القصبة الثمرية الطويلة إلي 3 أجزاء رئيسية وهي القاعدي ويتميز بإنخفاض النسبة المئوية للبراعم الثمرية وزيادة النسبة المئوية للبراعم الساكنة ، ثم الجزء الأوسط وهو جزء يزداد فيه نسبة البراعم الثمرية زيادة مطردة ثم الجزء الطرفي وهو الأعلي في النسبة المئوية للبراعم الثمرية.

كما أوضحت النتائج أن زيادة تحميل الكرمة قد أدت إلي زيادة النسبة المئوية للبراعم الثمرية ، زيادة عدد العناقيد ، والمحصول إلا أن ذلك كان مصحوباً بإنخفاض في نسبة البراعم الخضرية ، نضج الخشب ، وزن العنقود ، .T.S.S ، الكربوهيدرات المخزنة. في القصبات الطويلة تلاحظ أن زيادة عدد العناقيد أنقص من متوسط وزن العنقود ، ولذا فإنه من الضروري للحصول علي عناقيد جيدة ذات وزن مناسب أن يجري خف لعدد العناقيد. وقد وجد أن أنسب عدد من العيون التي يجب أن تترك علي كرمة العنب الطومسون سيدلس يتراوح بين 72-90 عين.

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Table (1): Effect of bud load on bud behaviour, bunch characteristics and wood ripening of Thompson Seedless grapevines

Bud load per vine	Bud Burst %		Dor. buds %		Fr. buds %		Veg. buds %		Wood ripening %		Number of bunches/vine		Bunch weight (g)		Yield/vine (Kg)		Juice T.S.S. %		Carbohydrates (g/100 g dry wt.)	
	1995	**1996**	**1995**	**1996**	**1995**	**1995**	**1996**	**1995**	**1996**	**1995**	**1996**	**1995**	**1996**	**1995**	**1996**	**1996**	**1995**	**1996**	**1995**	**1996**
48	69 a	74 a	31 c	26 d	39 d	30 d	61a	70 a	63 b	66 b	17 d	13 e	355 d	380 c	6.0 c	4.6 c	14.5 c	15.0bc	23 b	25 b
60	67 a	69 a	33 c	31 c	43 c	33 c	57 b	67 b	75 a	79 a	23 c	15 d	380 b	410 b	8.7 b	6.2 b	16.7 a	17.2 a	26 a	27 a
72	63 b	60 b	37 b	40 b	44bc	35bc	56 b	65 c	74 a	77 a	25 c	20 c	395 a	425 a	9.9 a	8.5 a	17.2 a	17.0 a	27 a	28 a
90	58 c	54 c	42 a	46 a	45 b	36 b	55bc	64 c	61bc	70 b	33 b	28 b	302 c	330 d	10.0 a	9.2 a	15.4 b	15.7 b	25 a	27 a
120	58 c	52 c	42 a	48 a	47 a	38 a	53 c	62 d	57 c	61 c	40 a	36 a	254 e	270 e	10.0 a	9.7 a	14.7 c	14.9 c	21 c	23 c

Dor. = Dormant Fr. = Fruitful Veg. = Vegetative
Values with the same letter (s) are not significantly different at 5% level.