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EVALUATION OF ARMS SHAPING FOR THOMPSON SEEDLESS GRAPEVINES

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ABSTRACT

Thompson Seedless grapevines grown in EL-Korimat region were subjected to three training systems under gable trellising system for two years (2004 and 2005),1- Divided canopy (DC), 2- Head shape (HS) and 3- Four main arms (FMA). All three training systems were cane pruned to 6 canes x 12 buds. Divided canopy (DC) led to the best growth expressed by weight of cane pruning, trunk and cane thickness and moderate internode length compared to FMA. However, head shape training improved vine growth better than FMA training system.

Also, DC training and HS training system gave significant increase in bud burst, fruitful buds and number of clusters per vine compared to FMA training system. Also, clusters number at early stage (30-40 cm of shoot length) was significantly increased compared to FMA training system. Cluster weight was significantly increased in the first season but not in the second one. Berries number per cluster was not affected. Cluster weight was significantly increased in the first season only compared to FMA. Berry weight and size were slightly increased with DC and HS shapes compared to FMA system.

Moreover, SSC and sugar content of berry juice were increased with DC and HS training system, while acidity was reduced in the first season only compared to FMA shaping system. These data suggest that vigorous vine growth, high crop loads, better quality of clusters and berries occurred with divided canopy training system (DC) compared to the other two training methods under study.

INTRODUCTION

Grapevines training systems display a typical canopy structure. Also, the best training system, which gave good light and pesticide penetration to leaf area of canopy and clusters zone will improve the rate of photosynthesis and assimilation.

The suitable distribution of arms on the trunk is important for desired canopy shape and regular bearing of the vines.

Divided canopies of Riesling vines increased weight of cane pruning (vine size) and main cane weights. Yields were consistently highest for divided canopies , (Reynolds *et al.* 2004). The training system significantly influenced the rate of photosynthetic assimilation of Erbalue grapevines (Bica and Novello, 1995).

The effect of training system on yield and fruit quality was studied in many grapes cvs. The success of T shape training system is attributed to good light penetration (HE Puchao and Cheng, 1994).

However, Zhang *et al.* (1995) noticed that, the U shape and V shape training systems i.e. open centered systems were considered the best for high yields and good berry quality.

Vines of Seyval Blanc trained to the different systems had more grapes, less Botrytis bunch rot, and higher juice soluble solids than bilateral

cordon or upright cordon in some years (Ferree *et al.* 2002). While, Reynolds *et al.* 2004 noted that brix, titratable acidity and pH were not strongly affected by the training system.

The aim of the present study was to evaluate the effect of arms distribution on the trunk and arms shape on vines growth and fruit quality of Thompson Seedless grapevines.

MATERIALS AND METHODS

This trial was carried out in 2004 and 2005 seasons at EL-Korimat region,Egypt to study three shapes of vines arms training systems on three-years-old Thompson Seedless grapevines under gable trellis system. The vines are growing in a sandy soil using drip irrigation. The vines were pruned during the first week of January in the first season and last week of December in the second season of the study by using cane pruning leaving 72 buds,per vine (6 canes x 12 buds).

Three shapes of arms distribution on the head of the vines were performed :

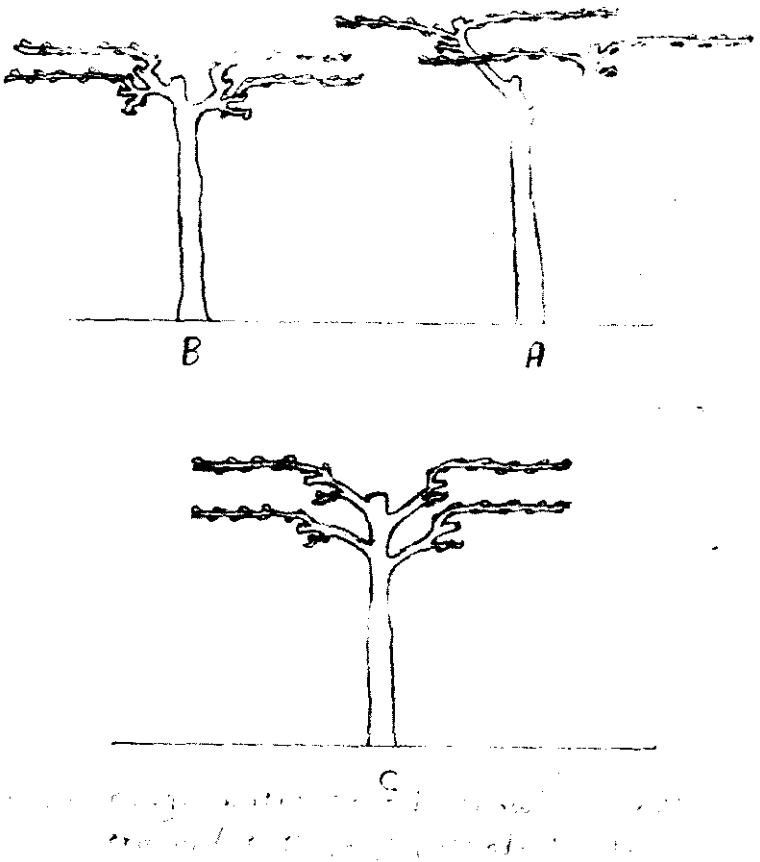
A- Divided canopy (DC), two arms from the head were tied towards the two parallel fruiting wires and cane pruned as shown in Fig. (1-A).
B- Head trained and cane pruned (H) (Fig. 1-B).
C- Four main arms (FMA) from the apical four nodes of the trunk (Fig. 1-C).

The three training systems were investigated for the following characteristics :

1- Pruning wood weight by weighing pruning wood in the first week of January in the first season and in the last week of December in the second one as kg/vine. Trunk thickness, cane thickness as diameter (cm), internode length, by dividing shoot length by internode number as (cm) were carried out in the time of winter pruning of the two seasons.
2- Bud burst and fertility status, after bud burst when shoot length reached about 30-40 cm, the number of vegetative shoots, shoots bearing one cluster and shoots bearing two clusters were counted, bud burst was calculated as shoots number/vine, total number of clusters per vine was calculated at this time, while, number of clusters was counted at harvest per/vine.
3- Fruit quality : at harvesting time, three clusters were taken at random from each replicate for the determination of average cluster weight (g), number of berries per cluster, berry weight (g) and size (cm^3) as an average of 50 berries were worked out.

Soluble solids content (SSC %) was determined using a hand refractometer, total titratable acidity as a titratable acidity% according to A.O.A.C. (1975), also total and reducing sugar content were estimated.

The experiment was a randomized complete block design with four replicates. All obtained data were tabulated and statistically analyzed according to Gomez and Gomez (1984).



(Fig. 1)

RESULTS AND DISCUSSION

Vine growth expressed as weight of cane prunings as affected by arms shape and distribution on the trunk are presented in Table (1). Divided canopy training system significantly increased prunings weight per vine compared to the traditional head and cane pruned system or the four main arms. It is also noticed that the increment was not significant in first season. The results may be due increased shading in case of training four main arms system. These results are in agreement with Reynolds *et al.* 2004 who noted that divided canopies of Riesling vines led to an increase in weight of cane pruning.

Trunk thickness of Thompson seedless vines was significantly increased with divided canopy training system in the two seasons. Head trained system was significantly increased in the first season only compared to four main arm training system. As for internode length, data in Table (1) showed moderate length of internodes of divided canopy training system, while internode length showed significant increase with head training system.

On the other hand, cane thickness was significantly increased with divided canopy training system and head trained system compared to four main arms training system. These results may be due to more light penetration to the leaf area, where divided canopy had more gapes.

Table (1): Effect of training shape of Thompson Seedless grapevines on vine growth.

Treatment	Weight of cane pruning (kg/vine)		Trunk thickness (cm)		Internode length (cm)		Cane thickness (mm)	
	2004	2005	2004	2005	2004	2005	2004	2005
Divided canopy training and cane pruned	0.548 A	0.620 A	2.6 A	4.05 A	6.2 A	6.2 A	10.0 A	11.0 A
Head trained and cane pruned	0.507 AB	0.597 B	2.4 B	3.4 AB	6.7 B	6.6 B	10.0 A	10.0 A
Four main arms and cane pruned	0.453 B	0.470 C	2.3 C	3.0 B	7.2 A	7.1 A	0.90 B	0.82 B
L.S.D at 5 %	0.054	0.017	0.094	0.756	0.189	0.077	0.122	0.77

Data presented in Table (2) revealed that there was significant increases of bud burst as shoots number per vine with divided canopy training system compared to the four main arms training system. Also, head training system improved bud burst compared to four main arms system. On the other hand, shoot length in Table (2) was slightly increased with four main arms training system compared to the other training system. These results may be due to improved rate of assimilation in the vine as a result of better sunlight penetration to the canopy. (HE Puchao and Chang, 1994) attributed the success T shape training system of White Riesling grapevines to good light penetration.

Data in Table (2) show that shoots bearing one cluster per vine. Divided canopy training system and head training system was significantly increased in the two seasons of the study compared to the four main arms training system. The increment was not significant in the second season with head training system compared to the four main arms training.

As a general trend it is clear that, both divided canopy training system and head training system significantly increased shoots bearing two clusters per vine compared to four main arms system.

Total clusters per vine which was recorded at 30-40 cm of shoot development was paralleled to number of shoots bearing one cluster per vine. The best increment of total cluster per vine was obtained with divided canopy training system. However, number of clusters per vine at harvest as shown in Table (2) show parallel results to total clusters per vine at 30-40 cm. of shoot development but there are reductions in the number of cluster per vine of harvest compared to the total numbers of clusters per vine at 30-40 cm. of shoot development.

The reduction in the number of clusters at harvest may be due to that some clusters dried and fall at early stage of cluster development as a results to unbalanced nutrition status in the vine. The increase in cluster number per

vine with divided canopy training systems may be due to good light penetration to the leaf area of the canopy and cluster zone. Reynolds *et al.* (2004) noted that with divided canopies of Riesling vines, yield was consistently higher compared to five training treatments (alternate double cross arm ADC, lenz moser L.M, low cordon L.C and pendel bogen PB). However, Baeza *et al.* 1999 reported about the effect of training systems (single curtain, vertical trellis, spur pruned high head trained and low head). As whole, vertical trellis showed the best performance, since it produced the highest yield.

Moreover, Bica and Novello (1995) noted that, the divided canopy training system significantly influenced the rate of photosynthetic assimilation of Erbaluce grapevines to central curtains than alternate curtain and pergola.

Table (2): Effect of training shape on bud behaviour of Thompson seedless grapevines.

Treatment	Burst buds (no)/vine		Vegetative shoots (no)/vine		Shoots bear one cluster (no)/vine		Shoots bear two cluster (no)/vine		Total cluster/vine		Cluster (no) at harvest /vine	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Divided canopy training and cane pruned	57 A	61.2 A	11	12	40 A	42.3 A	8 A	7.0 A	56 A	56 A	45 A	45 A
Head trained and cane pruned	53 A	55.0 B	11	13	35 B	36.0 B	6 B	6.0 A	47 B	48 B	40 B	35 B
Four main arms and cane pruned	48 B	50.0 C	13	14	34 B	33.3 C	2 C	2.2 B	37 C	38 C	26 C	26 C
L.S.D at 5%	4.169	4.131	N.S	N.S	1.847	2.234	0.957	1.257	1.29	1.29	2.06	0.815

Concerning cluster weight, data presented in Table (3) show that, divided canopy training system and head trained training system significantly increased cluster weight in the first season of the study, but the increment was not significant in the second season compared to four main training system.

Table (3): Effect of training shape on cluster characteristics of Thompson seedless grapevines.

Treatment	Cluster weight (g)		Berries (no)/cluster		Berry weight (g)		Berry size cm^3	
	2004	2005	2004	2005	2004	2005	2004	2005
Divided canopy training and cane pruned	503 A	507	265	258	2.0	2.10	1.9 A	2.0 A
Head trained and cane pruned	503 A	483	266	241	2.0	2.2	1.8 AB	2.1 A
Four main arms and cane pruned	485 B	432	266	244	1.9	1.9	1.75 B	1.8 B
L.S.D at 5 %	6.733	N.S	N.S	N.S	N.S	N.S	0.054	0.211

The effect of training system in parallel trend to berry weight and size. These results are in harmony with Zhang *et al.* (1995) that, the U shaped and V shaped training system i.e. open central systems, were considered the best for high yields and good berry quality.

Regarding soluble solids content (SSC), data presented in Table (4) show that SSC of berry juice were significantly increased with divided canopy training system, while head trained system in the second season compared to the four main arms training system. However, total sugar percentage and reducing sugar percentage of berries juice were in parallel trend to SSC of berries juice as affected by training system.

As for total titratable acidity, data presented in Table (4) show that, both divided canopy training and head trained training system significant reduced juice acidity percentage in the first season, but did not in the second season compared to four main arms training system. These results are in agreement with Ferree *et al.* 2002 who mentioned that vines trained to sylovs system had more gapes and higher juice soluble solids than bilateral cordon. While, Reynolds *et al.* (2004) recorded that brix, titratable acidity and pH were not strongly affected by the training system.

From this study we can conclude that the best training system which gave high light penetration and good distribution of bearing unit on the fruiting vines was divided canopy and cane pruning system, which gave vigour vine growth, good bud fertility and the best fruit quality.

Table (4): Effect of training shape on juice quality of the berries of Thompson seedless grapevines.

Treatment	SSC %		Acidity %		Total sugars %		Reduced sugars %	
	2004	2005	2004	2005	2004	2005	2004	2005
Divided canopy training and cane pruned	18.9 A	20.2 A	0.62 B	0.43	17.57 A	18.8 A	17.0 A	18.3 A
Head trained and cane pruned	18.7 A	19.0 AB	0.62 B	0.45	17.40 A	17.8 AB	16.8 A	17.2 AB
Four main arms and cane pruned	16.9 B	18.2 B	0.71 A	0.49	15.60 B	16.9 B	15.0 B	16.3 B
L.S.D at 5 %	0.527	1.544	0.017	N.S	0.632	1.396	0.591	1.354

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" تقييم بعض أشكال تربية الأذرع فى العنب الطومسون اللابذرى "

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أجريت هذه التجربة على عنب طومسون لابذرى منزرعة بمنطقة الكريمات أرض رملية رى بالتنقيط تحت نظام تدعيم جيبل خلال موسمى ٢٠٠٤ و ٢٠٠٥.
حيث تم تربية كرمات العنب بتوزيع بثلاثة نظم على الجذع هى :
١- تقسيم المجموع الخضرى لإتجاهين رئيسيين كل قسم فى إتجاه أحد أسلاك الإثمار (DC) ٢- تكوين رأس للكرمة فى وسط سلكى الإثمار يخرج منها ذراعين فى إتجاهين موازيين لسلكى الإثمار يخرج من كل ذراع ذراعين (H).
٣- إختيار أربع أذرع رئيسية تخرج من السلاميات العليا للجذع وتوجيه كل منها فى الإتجاه القريب من سلك الإثمار (FMA) وقد إستخدم فيها التقليم القصبى (٦ قصبات X ١٢ عين) لكل طرق التربية السابقة.
وكانت أهم النتائج :
- قوة نمو الكروم متمثلة فى وزن خشب التقليم عمر سنة – سمك الجذع – سمك القصبة الثمرية كان أفضل مع نظام تربية (DC) ، (H) بالمقارنة (FMA) بينما طول السلامية كان متوسطا مع (DC) و (H) بينما كانت السلاميات أطول مع FMA.
- حققت التربية (DC) و (H) أفضل تفتح كعدد البراعم/كرمة وأفضل عدد عناقيد على الكرمة فى المراحل الأولى (٣٠-٤٠ سم من طول الفرع) وكذلك عند الجمع بالمقارنة بالتربية (FMA).
- أظهرت التربية (DC) و (H) صفات جيدة فى العنقود متمثلة فى وزن العنقود ووزن الحبة وحجمها بينما لم يتأثر عدد الحبات/عنقود بطريقة التربية.
- أظهرت التربية (DC) و (H) تحسن فى جودة الحبات متمثلة فى SSC ، السكريات الكلية الذائبة ونقص طفيف فى الحموضة بالمقارنة بالتربية (FMA).

أفضل طريقة تحت ظروف التجربة بين الثلاث طرق السابقة هى تقسيم الكرمة لجزأين فى إتجاه سلكى الإثمار (DC) حيث يحقق هذا نموه فى منتصف الكرمة تحسن فى نفاذ الضوء إلى الأوراق والثمار.