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EFFECT OF SUPPORTING SYSTEMS ON VINES GROWTH AND ROOT DISTRIBUTION OF FLAME SEEDLESS GRAPEVINES.

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ABSTRACT

Growth and root distribution of 10 years old Flame Seedless grapevines grown in a sandy soil under different supporting systems were studied during 2007 and 2008 seasons. At four vineyards, five feddan/each the objective was studying the effect of the geometrical shape of four supporting systems: Telephone (Double T), Y-shape, Gable and Baron shape on vines growth and roots distribution. Planting distance was 1.75 X 3.0 m between the vines and the rows for all types of supporting systems. Telephone and Y – shape vines were quadrilateral cordon trained, spure pruned and vines load was 56 buds/vine.

While Gable and Baron shape vines load was 64 and 96 buds/vine and trained according to quadrilateral cordon and mixed pruning respectively. Study of the grapevines root system.

The results revealed that Telephone (Double T) and Y shape enhanced budburst date in comparison with Baron and Gable shape, while the later two types of supporting systems improved budburst number and percentage per vine, fruit full shoots number/vine and fertility coefficient. Also these two types had the maximum total leaf area per vine, leaf area index, shoot length, pruning wood (kg/vine) and wood ripening coefficient significantly as compare with Telephone (Double T) and Y shape during seasons of study. Concerning physical and chemical properties of the yield: Data showed that Baron and Gable shape increased these parameters and Gable shape have the highest values in TSS% and the lowest values in total acidity percentage compared with other types of supporting systems. As for total carbohydrates canes content%, leaf area (cm^2)/cluster and anthocyanin (mg) in berries skin/100 gm fresh weight, data showed that Baron shape had the highest significant values in this respect followed by Gable shape.

Regarding leaf petiole N, P and K content (%) high significant values were found in the vines supported with Baron shape and the lowest values resulted from the vines trellised with Telephone (Double T) and Y-shape in the two seasons of the study.

Grape vines roots systems: Data revealed that Baron and Gable shape increased total roots densities in horizontal and vertical direction and its diameters, also distance of 50 cm from vines trunk and depth of 60 cm from soil surface had the maximum values in total roots densities and its percentage, followed by upper soil layer (30 cm depth) and 25 cm distance. While minimized values resulted from deeper layer (90 cm depth) and third distance from the trunk (75 cm). Therefore Baron and Gable supporting systems seems to be better than Telephone (Double T) and Y-shape and preferable to maintain reasonable yield with good quality from Flame Seedless grapevines.

INTRODUCTION

It is generally accepted that above – ground growth is a good indicator for root spread at maximum depth. The root system serves important physiological and biochemical functions, and it has been showed that both grape yield and quality are dependant on the health status of the root, Morlat & Jaquet (1993). Many soil and management factors, such as impenetrable layers, lack of oxygen, aeration, texture, water level and nutrient availability, P^H and availability of carbohydrate are from the leaves. Also play an important role in determining root depth and shape, Smart (2006). Grapevines, as general a group, appear to have proportionally deeper root distributions in vertical and horizontal as compared to many plants in natural ecosystems. This would allow vines to grow in wide areas. Richards (1983) found that the upper soil layers (<50 cm) were more favorable for root growth as a consequence of either the physical or chemical characteristics, which might have been brought about by the soil preparation to this depth. In this study, a higher percentage of roots were found in the soil depth at 60 cm and distance of 50 cm from the vine trunk and roots less than 1mm diameter occupied a higher percentage of total roots densities, this in vertical or horizontal direction. While the number of roots diameters (1-2 mm and more than 2mm) remained relatively low. Also this study showed a positive relationship between high supporting systems, (Baron and Gable shape), high canopy densities and vine total roots densities. This was attributed to certain soil fungi, mycorrhizae, live in a natural, mutually beneficial association with grape roots. Mycorrhizae influence grapevines nutrition and growth has been showed to increase the uptake of phosphorus, Richards (1983). Concerning of supporting systems shape: Baron and Gable types they have higher trunks which store larger amounts of foods that could be used in the process of budburst and other important process in the vines.

Also these two types provided an increase in vine area and sunlight density compared to other types (Telephone and Y-shape), where sunlight is the environment factor that is most frequently not fully utilized by grape growers to maximum crop yields. By manipulating vine width and high through new trellis training systems, row direction and vine and row spacing, a grower can greatly increase the total amount of light intercepted by foliage per unit area of vineyard and there by increase photosynthetic capacity. This increase may be due to the regular distribution of foliage on the wires and therefore photosynthesis improved. Sunlight and temperature are the most influential environmental factors on grapevines flower cluster initiation. According to William *et al* (1994), the development of uncommitted primordial into either flower clusters or tendrils is dependant upon the amount of sunlight striking the bud during development.

High trellis system enhanced bud break and its percentage improved fruit quality and yield, Orth & Chambers (1994).

In conclusion, Baron and Gable shape is more suitable for mechanized canopy management. Also these two types of supporting system improved bud break, fruit full shoots, fruit ripening and wood maturity and providing the consumers with bunches with good quality.

MATERIALS AND METHODS

This investigation was carried out during the two consective seasons of 2007 and 2008 on 10 – year's old Flame Seedless grapevines growing on a sandy soil dripped irrigate system at Badr Center Behra Governorate to study the effect of supporting systems on vines growth and roots distribution of Flame Seedless grapevines. The supporting systems were:

1- Telephone shape (Double T)   2- Y – shape
3- Gable shape   4- Baron shape

Diagrammatic of these supporting systems are shown in Figure (1).The following parameters were calculated before the study starting. Physical and chemical properties of the soil at 0.0 – 90 cm depth under different supporting systems prior to the experiment start were determined according to Evenhuis (1978) Table (1). Percentages of carbohydrate were calculated in canes before experiment starting and at the study end table (2). Also pruning wood (kg)/vine and yield (kg)/vine of preceding season were calculated before study to determination vine load from buds left before study for coming season according to this formula (El-Ashram 1993).

$$\mathbf{Y} = \frac{\mathbf{F}}{\mathbf{V}}$$

Y= vine load as No. of buds indicator.
F= preceding yield (kg)/vine.
V= preceding wood pruning weight (kg)/vine

Where:

4 – 6 = proper bud load number / vine during winter pruning.
> 6 = Over bud load number / vine.
< 4 = Lower bud load number / vine.

For carrying out this experiment four vineyards were selected areas of 5 feddans per each. The first and second vineyard supported by Telephone (double T) and Y-shape, the planting distance was 1.75 X 3 m between the vines and the rows (800 vine per feddan), the trunk length was 1.60 m above the surface soil, the vines were quadrilateral cordon trained, spur pruned and vines load was 56 buds per vine (4 cordon X 7 spures and two buds per each).

The third and fourth vineyard supported by Gable and Baron shape and the trunk length was (1.6 and 2.0 m) above the surface soil for these two systems respectively, planting distance was 1.75 X 3.0 m between the vines and rows (800 vines/feddan),the vine load was 64 bud per vine for Gable shape (4 cordon X 8 spurs each have two buds), while Baron shape vine load was 96 bud per vine and mixed pruning was followed. Winter pruning was established at the second and the third week of January in both seasons of study for all the tested vines under the four supporting systems. Drip irrigation system was followed and the vines rows have a double drip lines (drip

emitters at follow rate of 4L/h). 40 cm distance between plant row and drip line on either side of the grapevines. The water table depth was more than 2 m under the soil surface. Horticultural practices including fertilization, weeds control, irrigation as well as pests and fungi control were carried out as usual. The experiment was set in a completely randomized blocks design, 60 vines per treatment was used for the study and were selected to be representative of each treatment on the basis of trunk diameter, vine vigor, preceding weight of one year pruning wood (kg)/vine and cordon diameter for each supporting system in three replicates each contain on 20 vines.
The following parameters were recorded for both seasons:

1- Bud behaviour:

Beginning of budburst was recorded when red leaves emerged from the buds of each vines (5 buds/vine were opened), according to (El-Ashram 1993).

$$\text{- Budburst (\%)} = \frac{\text{No. of opened buds/vine}}{\text{Bud load / vine}} \times 100$$

$$\text{- Fruitful shoots/vine (\%)} = \frac{\text{No. of fruitful shoots / vine}}{\text{Total No. of shoots/vine}} \times 100$$

$$\text{- Fertility coefficient} = \frac{\text{Total No. of clusters / vine}}{\text{Total No. of buds / vine}}$$

According to Bessis, R (1960).

2- Vegetative growth:

Leaf area (cm^2), total leaf area (m^2)/vine and leaf area index: At Veraison twenty mature leaves at the position from vegetative shoot tips (5^{th} and 6^{th} leaves) were collected from each replicate of each supporting systems and leaf area (cm^2) was measured dye using the Laser Area Meter CI – 203 CID inc vanco Uves, USA, total vine area (m^2) calculated by multiplied average leaf area by the number of leaves per shoot by number of shoots per vine. Also leaf area index was determined by dividing total leaf area per vine (m^2) by the total ground area (m^2) allotted to each vine.

Shoot length (cm), wood ripening % and pruning weight (kg)/vine. Random vegetative shoot samples were harvested (20 shoots) for each replicate at the end of growth season (November) and their length were determined (cm) at each supporting system, wood ripening percentage was calculated by dividing the length of the ripened part (brownish part cm) by the total length of the shoot according to Bourd (1966).

Weight of pruning woods (kg)/vine and canes content of total carbohydrate:

At winter pruning all shoots, age 1-year-old per vine were recorded (kg/vine) as a parameter of vegetative growth vigor. Three canes / vine were collected for determining total carbohydrate (g/100g dry weight) using phenol sulphoric acid method as described by Smith *et al* (1956).

3- Leaf petiole N, P and K percentage:

Samples of twenty random leaves opposite the basal cluster were collected per each replicate at full bloom at each supporting systems to determine leaf petioles N, P and K content according to Evenhuis (1978) and Wilde *et al* (1985).

4- Yield (kg)/vine and Yield structure:

At harvest time the following parameters were taken to evaluate: total yield (kg)/vine, and yield structure for the testing supporting systems. Yield (kg)/vine calculated by multiplying number of clusters per vine by weight of cluster (g) Sixteen clusters for each supporting system (20 cluster/each replicate) were picked when total soluble solids in berry juice attained 17 – 18 % Kader *et al* (1985) to determine TSS % in berry juice by using a hand refractometer, total titratable acidity was expressed as tartaric acid (%), according to A.O.A.C. (1985) and anthocyanin content in berry skin were determined according to Yilidz and Dikmen (1990).

Study of the grapevines root system:

Three vines per each supporting system were used for the root study and were selected similar to representative on the basis of trunk diameter, cordon diameter and cordon length. Samples were taken before the beginning and during the development cycle of vines, soil was kept weeds free manually and chemically to avoid interferences with results. Soil samples were taken after end of blooming (may) because grapevine root growth initiates after budburst and growth rates increase rapidly to a maximum at the blooming stage (Van zyl, 1988), soil taken from the field using an auger 7 cm in diameter (auger volume = 1153.8 cm^3). The auger was driven into the soil to a depth of 90 cm in three stages of 30 cm each. Samples were taken at distances of 25, 50 and 75 cm from the trunk of each vine, roots cleaned and separated manually, counted and classified according to its diameters. Roots (less than 1mm, 1-2 mm and more than 2mm) according to Richards (1983) and their percentage of each group were calculated. Root length was calculated using the formula $L=\Pi N/2$ where N = mean of horizontal and vertical counts. Classified into the three groups: root diameter less than 1mm, root diameter 1-2 mm and root diameter more than 2mm and their percentage of each group were calculated.

Soil moisture content:

Soil moisture content (%) was calculated at difference depths and distances from the vine trunk at the end of harvesting date of Flame Seedless grapevines under different supporting systems table (8).

Statistical analysis was done using L.S.D test according to Snedecor and Cochran (1990).

RESULTS AND DISCUSSION

Data presented in table (1) showed that soil under study classified as a sandy soil, P^H ranged from 7.5 to 7.8, EC was 0.85 to 0.88 and organic matter content ranged from 1.25% to 1.6%. This soil consider suitable for vines growth.

Pruning wood (kg)/vine, canes carbohydrate percentage and preceding yield (kg) / vine of Flame Seedless grapevines under different supporting systems prior the experiment start. It is evident from data obtained in table (2) that slight increment of pruning wood (kg)/vine. Baron and Gable shape trellis produced the highest pruning weight (kg)/vine in comparison with Y shape and Telephone (double T) which had insignificant value in this respect. The results may be due to Baron and Gable shape allowed more exposed sunlight as a result to good orientation in this supporting systems and high vine vigor.

These results in agreement with Abdel-Ghany *et al* (2001). Data in table (2) obviously reveal that the maximum yield/vine was detected on vines supported with Baron followed by Gable, Y shape while the vines supported with Telephone had insignificant value in this respect. These results are in accordance with Kliewer (1996).

Also data in table (2) clearly reveal that canes carbohydrate percentage with high supporting systems like as Baron and Gable shape had significantly maximized percentage of canes carbohydrate content comparing with Telephone (Double T and Y shape).

This is due to that high trellis systems increased photosynthetic capacity which improves reservoir food incense Kliewer (1996).

Notice: Data in tables (1 and 2) calculated for clearing vines vigor statues in the preceding season and give information about vineyard status.

Table (1): Analytical data of the soil under experimental vines.

Practical size distribution	Telephone (Double T)	Y-shape	Gable Shape	Baron Shape
Sand %	88.4	87.9	87.6	88.3
Silt %	5.5	5.8	6.2	5.6
Clay %	6.1	6.3	6.2	6.1
Texture	Sandy	Sandy	Sandy	Sandy
pH(1 : 2.5 extract)	7.7	7.8	7.6	7.5
E.C(1 : 2.5 extract) (mmhos / 1 cm)	0.88	0.89	0.86	0.85
O.M %	1.4	1.6	1.25	1.35
N %	0.44	0.43	0.42	0.43
P (ppm, Olsen)	6.0	7.0	7.0	8.0
K (ppm)	140.0	138.0	141.0	136.0

Table (2): Pruning wood (kg)/vine, canes carbohydrate % and preceding yield (kg)/vine of Flame seedless grapevines before the experiment start under different supporting systems.

Supporting systems	Average pruning wood (kg)/vine	Average yield (kg) / vine	Cane carbohydrate %
Telephone (Double T)	1.8	8.5	21.4
Y-Shape	2.2	10.6	22.2
Gable Shape	3.1	12.4	25.8
Baron Shape	3.9	15.9	28.6
New L.S.D at 5%	0.3	1.6	3.2

Effect of supporting systems on:

1- Bud behavior of Flame Seedless grapevines:

Data in table (3) indicate that budburst date occurred during March for all vines under different supporting systems. It started between 2 – 7 March while Baron Trellis system delayed budburst date 4 days in comparison with other supporting systems. This may be due to longer trunk and old wood prolonged shoots and Canopy growth, (Elmore *et al* 1997). These results are in harmony with El-Ashram (1993), who found that vine with high trunk delayed budburst by about 7 days.

As for budburst number and percentage, data in table (3) also showed that high trellis systems and open Canopy (Baron and Gable shape) have significant values in budburst number and its percentage. This result was valid for both seasons of study. While Telephone (Double T) and Y shape have lower values in this respect. It is due to the later supporting systems had shorter trunk, little old wood ,number of buds per vine (56 bud/vine) and crowed canopy, but Baron shape have more old wood per vine as trunk, arms and open canopy followed by Gable shape. This finding is in accordance with Hassan *et al* (1991) who stated that high trellis systems had more old wood per vine acts as a carbohydrate reservoir and therefore budburst number and its percentage was improved. Also these results are in harmony with Rizk *et al* (2006) stated that such results may explain the role of old wood in reserving high amounts of carbohydrates.

As for fruitfull shoot number per vine and fertility coefficient data in table (3) shows that high trellis systems specially Baron shape had maximum significant values followed by Gable shape and finally the lowest values in the vines supported by Telephone (Double T and Y – shape). The merits values may be due to many reasons: Baron and Gable shape were considered as ideal, offered a wide surface of vegetative growth which allow light levels to enter through the center canopies and therefore Baron and Gable shape had a higher degree of light penetration into the vine canopy as compared with Telephone and Y shape. These reasons increased bud fertility and fertility coefficient. As for Telephone and Y shape had more layers from leaves which increase shading and canopy density.

Also if the foliage and shading were increased light interception within canopy will reduce. Low light density during bud induction and differentiation cause a reduction in bud fertility and reduce fertility coefficient and therefore high supporting systems like as Baron shape increase bud fertility.

These results were valid for both seasons of study and are in harmony with those obtained by Smart *et al* (2006), who found that wide supporting systems improve bud fertility and fertility coefficient.

Telephone (Double T and Y – shape) failed to show significant differences on the data in table (3) compared with Baron and Gable shape it's due to these two shapes of supporting systems it is increased shading and reduced light interception within the foliage. According to Williames *et al* (1994), the development of uncommitted into either flower clusters or tendrils is dependent upon the amount of sunlight striking the bud during development, the number and size of cluster primordial increase with sunlight levels.

Table (3): Effect of supporting system on bud behavior of Flame Seedless grapevines

Supporting systems	Bud burst						Fruit full No. shoots / vine		Fertility coefficient	
	Date		No. / vine		%					
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Telephone (Double T)	4/3	2/3	42.0	44.0	75.0	79.0	24.0	26.0	0.42	0.46
Y-Shape	4/3	3/3	43.0	45.0	77.0	80.0	25.0	26.0	0.45	0.46
Gable Shape	6/3	4/3	54.0	56.0	84.0	88.0	30.0	31.0	0.47	0.48
Baron Shape	7/3	6/3	78.0	79.0	81.3	82.0	46.0	47.0	0.48	0.49
New L.S.D at 5%			12.2	11.8	2.8	3.6	6.0	6.0	0.04	0.02

2- Vegetative growth of Flame Seedless grapevines:

As showed in table (4) leaf area, total leaf area per vine and leaf area index were positively affected by the supporting systems. The maximum and significant values were recorded on vines supporting with Baron follow by Gable shape. These two types provide an increase in light density as compared to other trellis system. The increasing in these parameters may be due to the regular distribution of foliage on a wide surface and improvement of photosynthesis activity followed by increasing vegetative growth expressed positively by leaf area of the vine, Kliewer (1996).

Concerning leaf area index determined by dividing total area per vine (m^2) by total ground area (m^2) allotted to each vine. Data in table (4) revealed that Baron and Gable shape gave the highest values as compared to Telephone (Double T) and Y – shape in both seasons of study. This increment in leaf area index may be due to improvement in photosynthesis activity. Also the vines supported by Baron and Gable shape had increased in roots density tables (8 and 9) which increased vegetative growth specially leaf area of the vine, Kliewer (1996). With regard to effect of supporting systems on shoot length (cm), pruning wood (kg) per vine and wood ripening coefficient. Data presented in table (4) indicate that there were significant differences concerning the above parameters. Baron shape had the highest significant values followed by Gable shape as compare with Telephone (Double T) and Y – shape in both seasons of study. This attributed to these two types of trellis, it is had the highest amount of old wood (Trunk and arms) and the widest trellis, also they had the good fidder roots table (8 and 9), they which increase the possibility of absorption of water and nutrients. Likewise roots may increase their effectiveness as a source of hormones, specially cytokines and gibberellins that regulate processes of growth of the aerial part of the vine. Pire & Diez (2006). Also these methods of trellis provided a high degree of shoot distribution and therefore reducing shade and good wood ripening and shoot length were observed. For these reasons significantly increased the above parameters when compared with Telephone (Double T) and Y – shape trellis. These results are in harmony with those obtained by Shoaieb *et al* (2004) on Thompson Seedless grapevines.

It can be notice from data in table (4) that positive effect of supporting systems on total cane carbohydrate content percentage. The best significant results were obtained on the vine canes were supported the by Baron and Gable shape. This may due to that these two types of trellis had higher ventilation.

4

Also these types provided an increase in vine leaf area and light density as compared to other trellis. This increase may be due to the regular distribution of foliage on the wires and therefore the immigration of assimilates from leaves to canes increase and improve of photosynthesis. Also these trellis provided a high degree of shoot distribution, reducing shade, hence to have good canes carbohydrate content.

On the contrary the lowest carbohydrates accumulation was found on the vines canes supported by Telephone (Double T) and Y shape it's attributed to these two types had short trunk, leaves and shoots crowded on the wires. This factors lead to high canopy density and reducing in photosynthesis capacity, because in fact that light must pass through two layers of leaves the intensity of light reaching the third layer of leaves would theoretically be at about the light compensation point (100 to 125 ft-c) or the light intensity where the rate of photosynthesis just equals the rate of respiration and a vine would neither gain nor lose weight. Kliewer (1996), and therefore photosynthesis capacity reduce and canes carbohydrates percentage severely reduced.

This result was valid for both seasons of study and are in harmony with those obtained by El-Mogy (2006) and Shoaieb *et al* (2011). Also data in table (8 and 9) revealed that Baron and Gable shape had a high total roots density specially roots less than (< 1mm diameter) resulting in an appreciable increase in nutrient absorption and translocation of more carbohydrates from leaves to canes, hence so Baron, Gable and Y – shape increased canes carbohydrates percentage.

3- Physical and chemical properties of the yield:

Data in table (5) show the different supporting systems resulted in a positive effect on number of clusters per vine, average cluster weight and yield per vine. The best results with regard to the above parameters were obtained on vines supported by Baron and Gable shape compared with Telephone and Y- shape. There are a significant increase in number of cluster per vine, average cluster weight and yield per vine in Baron and Gable trellis systems as compared with the other two trellis systems Telephone double T and Y shape in both seasons.

Table (5): Effect of supporting systems on physical and chemical properties of the yield at the two seasons 2007 and 2008.

Supporting systems	Number of cluster/vine		Cluster weight (g)		Yield/vine (kg)		Anthocyanin in berry skin (mg/100 g fresh weight)		T.S.S %		Acidity %	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Telephone (Double T)	26.0	27.0	451.0	460.0	11.7	12.4	22.1	21.9	16.2	16.1	0.58	0.58
Y-Shape	27.0	29.0	455.0	458.0	12.3	13.3	24.8	23.9	16.4	16.2	0.57	0.58
Gable Shape	34.0	36.0	516.0	510.0	17.5	18.4	32.0	31.6	16.8	16.6	0.51	0.55
Baron Shape	52.0	54.0	450.0	455.0	23.4	24.6	33.1	32.9	16.4	16.3	0.57	0.57
New L.S.D at 5%	3.8	4.2	52.4	48.2	1.6	1.8	3.0	3.2	0.3	0.2	0.05	N.S

The remarkable increase may be due to that Baron and Gable shape offered a wide surface of vegetative growth which allowed light levels to enter through the center of the canopies and have low canopy density, Williams (1996) who found that the number and size of cluster increase with increasing sunlight levels, Mullins *et al* (1992) concluded that it is probable that a combination of exposure light temperature and high light intensity is necessary for maximum fruitfulness of dormant buds. Also these two types of trellis increase total leaf area per vine and therefore photosynthesetic activity, shoot fertility and shoot physiological status improved.

In addition, data in table (8 and 9) show that the highest trellis systems (Baron and Gable shape) had higher total roots compared with the two other trellis and fine roots (< 1mm diameter) were the most abundant and represented to (57.2, 56.6 % and 60.1, 58.1 %respectively) of the total grapevine root counted in vertical and horizontal. Also lateral roots growth provides an important means to increase the possibility of absorption of water and nutrient. Like wise, root may increment their effectiveness as a source of hormone. Specially cytokinin (increase bud fertility and cell division) and gibberellins that regulate processes of growth of the aerial parts of the plant, Pire & Diez (2006). This explain the role of highest trellis systems are causes increasing in number of clusters per vine, average cluster weight and yield per vine. These results are valid for both seasons of study and are in harmony with those obtained by Hassan *et al* (1991) and Abd-Ghany *et al* (2001) who stated that more complex trellis systems typically have more old wood per vine as trunks and cordons, and this also could enhance yield. Also Data in figure (1) indicated the differences between types of supporting systems in surface area which exposure the foliage to sunlight. Telephone (Double T) have double T, their lengths in between 60 – 80 cm, Y-shape have two arms that length 140 cm and the distance between lateral about 175 cm, Gable shape have two arms that length at 180 cm and the distance between them 3 m while Baron shape a wide surface area. From this described, Baron and Gable shape provided an increase in vine area and light density as compare to Y and Double T shape. This increase may be due to the regular distribution of foliage on the wires and improvement of photosynthesis. Also resulted in high fruit quality of clusters and berries, this method provided a high degree of shoot distribution, reducing shade and having good wood ripening for canes.

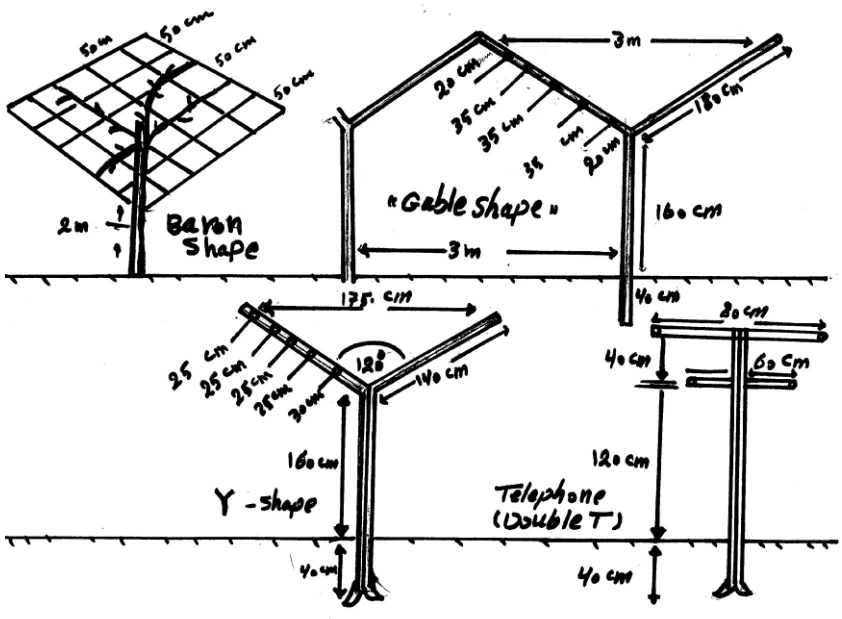

Figure 1: Diagrammatic illustration of the four supporting systems

Chemical characteristics of berries:

Data in table (5) revealed that Gable, Baron and Y shape had the highest significant TSS percentage values and the least total acidity as compared with Telephone (Double T). This may be due to that Gable trellis design and Y shape where have horizontal and vertical canopies and reduce shoots crowded. Also these two trellis systems have few layers of leaves and therefore the leaves are directly exposed to full sun light during the entire day compared with Telephone (Double T). In these case clusters grow beneath the first outer layer of the vines canopy. These types of trellis having low canopy density and followed by moderate density canopy.

Also Gable and Y – shape reduce shading and increase the total amount of light interfere by foliage per unit area of vineyard and thereby increase photosynthetic capacity hence TSS increase and total acidity reduce. On the other hand in Baron and Telephone shape the clusters were shaded by layer of leaves, shoots and overhanging foliage which over shadow on clusters and therefore photosynthesetic capacity reduce TSS and total acidity increase. This was true during both seasons of study. This findings agreement with Pire & Diez (2006) how found that shading canopy density reduce fruit sugar and increased malice acid. Also the improving effect of Gable and Y shape trellis on chemical fruit quality is supported by the results of Shoaieb *et al* (2004) who found that higher canopy density in the close trellis system causes a shading effect on bunches and berries resulting decrease in bunch quality.

Also the results of Kliewer (1996) who found that the decrease in TSS percentage and increase total acidity percentage induced by the high canopy density was due to fruits at interior shoots which had lower sugar and higher acidity, and supported the beneficial effect of low canopy density in improving fruit chemical quality.

As for anthocyanin in berry skin (mg/100g fresh weight) it is evident in table (5) that, Baron and Gable shape obviously increased berry skin anthocyanin content without significant differences in between. Also Telephone and Y shape had a moderate values without significant in between. The first two types of supporting system had highest significant values in berry skin anthocyanin as compare with Telephone and Y shape although these two types had a lowest bud load per vine. The improving effect of Baron and Gable shape on increasing anthocyanin in berry skin attributed to these two types of supporting system had higher level area per cluster higher trunk, and higher total canes carbohydrates %. Also these two types provided an increase in vine area, light density compared to other types, a good regular distribution of foliage and shoots on the wires and improvement of photosynthesis, in additional the cluster grow under ventilation area and far away direct sun light which prevent anthocyanin degradation. This result was valid for both seasons of study and are in harmony with those obtained by Tognela (2002) and Gonzalez – Neves *et al* (2004) they showed that grape berries anthocyanin was significantly affected by trellis system. On the contrary Kliewer *et al* (2000) and Mattii (2005) indicated that trellis systems did not affect berry color.

Hence the favorite Flame grape clusters for edible use which pick from the leaves center.

Table (6): Effect of supporting systems on leaf petiole N, P and K content (%) of Flame Seedless grapevines at the two seasons 2007 and 2008.

Supporting systems	N %		P %		K %	
	2007	2008	2007	2008	2007	2008
Telephone (Double T)	1.67	1.61	0.37	0.38	1.60	1.55
Y – shape	1.70	1.68	0.33	0.35	1.54	1.51
Gable shape	1.88	1.84	0.30	0.32	1.45	1.48
Baron shape	2.10	2.04	0.23	0.20	1.30	1.33
New L.S.D at 5%	0.16	0.14	0.06	0.07	0.18	0.17

Leaf petiole N content was affected by different supporting systems of Flame Seedless grapevines, Data in table (6) showed that the highest values observed in leaf petiole of the vines supported by Baron and Gable shape, although these two types of supporting produced significant yield per vine compared with Telephone and Y shape. This result was valid for both seasons of the study. This may be due to that the first two types of trellis had more old wood acts as a carbohydrate reservoir, Hassan *et al* (1991), in additional Baron and Gable shape trellis had higher root density tables (8 and 9) especially feeder roots (less than 1mm diameter). These results are in harmony with Pire & Diez (2006) who stated that lateral roots provides an important means to increase the possibility of absorption of water and nutrients increase leaf petiole N of vines supported by Baron and Gable trellis shape. As for leaf petiole P and K percentage data in the same table (6) revealed that the differences of percentage values attributed to depleting these two elements in fruit growth, wood ripening, berries coloration and roots growth. The high yield per vine was associated in vines supported by Baron and Gable shape table (3) and therefore happened reducing in these two elements. This was true in both seasons of study. These results are in harmony with those obtained by Ragab (1999) who found that the reduction in P and K attributed to their depletion in developing new tissues.

Table (7): Soil moisture content (%) at difference depths and distances from the vine trunk of Flame Seedless grapevines under different supporting systems.

Distances (cm)	Depths (cm)	Soil moisture content (%)			
		Telephone (Double T)	Y shape	Gable shape	Baron shape
25	30	27.1	27.4	30.6	32.4
	60	39.8	40.5	43.4	44.6
	90	14.1	15.6	15.7	15.8
50	30	26.8	26.9	27.3	29.1
	60	37.6	37.8	38.1	40.6
	90	11.1	11.3	11.5	11.8
75	30	25.9	26.1	27.0	27.8
	60	36.4	37.2	37.6	38.9
	90	6.2	6.3	7.2	7.4

Soil moisture contents and distribution at different distances from the vine trunk and at three depths from the land surface at the end of harvesting season are calculated in table (7). The obtained results revealed that soil moisture tended to decrease by increasing distance from the vine trunk, Pire & Diez (2006). Concerning soil moisture in different depths, data from this table (7) show that first depth (30 cm depth) contains little values in soil moisture than the second depth (60 cm depth). This values was true in all soil tested under different supporting systems. This may be due to rapid drought and extreme temperatures reduce moisture in upper soil. Second depth (60 cm depth) contain higher drought moisture content it is due to manure application in this depth which holding water. On the other hand deeper soil contains less values of moisture in all soil samples. This result is supported by the result of Van zyl (1988).

As a conclusion: Baron and Gable shape had higher leaf area index table (4) which shaded the soil surface and reduce evaporation for this reason the soil contained higher moisture.

Effect of supporting systems on Flame Seedless vine roots density:

Data collected from vine roots in tables (8 and 9) show a considerable variation on total roots density percentage and diameters. Also it can be noticed that roots density tended to decrease by going away from the vine trunk and depth from the soil surface especially in the distance of 75 cm and depth at 90 cm. this was true in all types of supporting system.

This could be attributed to that under drip irrigation system, the soluble salts moved horizontally from the dripper and increased towards where the wet front.

8-9

The reduction in total roots in deeper layer soil (90 cm) may be due to it appears possible that water and nutrient did not reach to the 90 cm depth in any case. Also upper layer (30 cm depth and first distance 25 cm) from the vine trunk occupied the second values of roots density compared with other distances and depth. These reductions in roots density were attributed to loss of water from the surface soil immediately surrounding the basal region of the main roots. This result coincide with Van Zyl (1988) they reported that roots densities were low in the top 20 cm in the sandy soils as due to rapid drying and extreme temperature may be shortening root life in this type of soils.

On the other hand higher values of total roots densities and diameters were found in the second layer (60 cm depth and 50 cm distance from the vine trunk) in all supporting systems due to that these layer and distance were more favorable for root growth, as a consequence of the physical characteristics, which might have been brought about by the soil preparation to this depth.

These findings is in agreement with Van Zyl (1988) who found that higher grapevine root presence in a sandy soil horizontal and vertical was observed and related to higher organic matter, moisture, nutrient element and low soil P^H ranged from 4.4 – 6.0 (layer 60 cm depth and distance between 50 – 75 cm from the vine trunk.

Concerning roots diameters in horizontal and vertical direction under different supporting types: Data in tables (8 and 9)indicated that fine roots (< 1mm diameter)were the most abundant and represented (44.4, 45.5, 58.1, 60.1% and 52.1, 52.8, 56.6 and 57.2%) of total grapevine roots content in horizontal and vertical direction respectively and the majority of roots were confined to distance 50 cm for the vine trunk and depth of approximately 60 cm. this was true under all supporting systems. This result can conclude that soil layer (60 cm depth) were more favorable for root growth, as a consequence of either the physical or chemical characteristics, which might have been brought out by soil preparation on this depth and distances. This result corresponds with Van zyl (1988) who stated that the shallower soil layers, i.e. to a depth of 30-60 cm were predominantly colonized by fine roots (<1mm diameter) while the number of thick roots (>2mm diameter) remained relatively low. With permanent roots (1-2 mm and root >2mm diameter). Data in the same tables (8 and 9) show that differences were observed in roots density according to its diameters in horizontal and vertical and the diameter of 1-2 mm occupied the highest root density in distances or depths direction. Also data indicated that increasing fine roots densities (< 1mm diameter) reduce thick roots density.

Concerning the exchangeable effect between roots densities and supporting systems. It is generally accepted that above-ground growth is a good indicator of root spread and maximum depth Smart *et al* (2006). This was true during this study. Data from table (4) indicated that great differences in percentage pruning wood (kg)/vine, average yield (kg)/vine and cane carbohydrate percentage were the maximum values in this respect resulted from the vines supported by Baron shape followed by Gable, Y shape and finally Telephone (Double T shape). Our data in tables (8 and 9) detected a great variation in total roots and its diameters. Baron shape had maximum values in this respect in horizontal or vertical direction as compare with other types of supporting and Telephone (Double T) seems to have relatively low root densities. This may be attributed to Baron shape have great values in total leaf area/vine table (4) compared with Gable, Y shape and Telephone trellis systems. Also Baron shape provided and increase vine area and light density compared to other types of trellis. This increase may be due to the regular distribution of foliage on the wires resulted in improvement of photosynthesis, as leaves are the source of photosynthate. Thus the majority of food materials are first sent to actively growing areas such as shoot tips and root tips. Later, when growth rate has showed full canopy is producing more photosynthates than are demanded by growing points increasing of food are directed goes to the roots, Pire and Diez (2006).

Conclusions: Modern supporting systems are consider the first factor of component for maximize grape yield and good quality. Baron and Gable trellis systems in vineyards results in high fruit quality of bunches and berries, also these systems provided a high degree of shoot distribution, reducing shade and good wood ripening, Kliewer (1996).

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تأثير نظم التدعيم علي نمو الجذور لكروم العنب الفليم سيدليس .

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قسم بحوث العنب-معهد بحوث البساتين-مركز البحوث الزراعيه-الجيزه-مصر.

أجريت هذه الدراسه خلال عاميين متتاليين ٢٠٠٧ , ٢٠٠٨ بمركز بدر محافظه البحيره علي كرمات عنب فليم سيدليس عمرها ١٠ سنوات ناميه في تربه رمليه في: أربعه مزارع متجاوره مساحه كل منها ٥ أفدنه لدراسه تأثير نظم التدعيم التاليه علي نمو الجذور و المحصول.

(١) التدعيم بنظام التليفون ذات العرضتين. (٢) التدعيم بنظام الواي.

(٣) التدعيم بنظام الجيبل. (٤) التدعيم بنظام البارون.

مسافه الزراعه كانت ١,٧٥ X ٣م لكل نظم التدعيم و تم تقليم الكرمات المدعمة بنظام التليفون و الواي بنظام الكردون الرباعي و كان حمل الكرمات ٥٦ عين لكل كرمه. كذلك الكرمات المدعمه بنظام الجيبل قلمت بطريقه الكردون الرباعي و حموله الكرمه كانت ٦٤ عين لكل كرمه أما الكرمات المدعمه بنظام البارون قلمت تقليما مختلطا وكانت حمولتها ٩٦ عين للكرمه.

وقد أظهرت النتائج أن:

- تفتح البراعم كان اكثر تبكيرا في الكرمات المدعمه بالتليفون و الواي تلاهما الكرمات المدعمه بالجيبل و اخرها المدعمه بنظام البارون.بالنسبه لعدد البراعم المتفتحه و النسبه المئويه لهما كانت أفضل النتائج المتحصل عليها في الكرمات المدعمه بالبارون و الجيبل ثم الواي و التليفون. كذلك بالنسبه لعدد الأفرخ الثمريه و معامل الخصوبه. أظهرت نظم التدعيم بالبارون و الواي أفضل النتائج و انطبق علي ذلك ايضا النمو الخضري و وزن خشب التقليم لكل كرمه و نضج الخشب.
- أظهرت الكرمات المدعمه بنظام البارون و الجيبل أفضل النتائج بالنسبه للخصائص الطبيعيه و الكيماويه للمحصول. كذلك حسنت هذه النظم من محتوي القصبات من الكربوهيدرات الكليه و المساحه من الاوراق المخصصه لكل عنقود و زادت محتوي قشر الثمار الطازجه من الأنثوثيانين.
- زاد محتوي عنق الأوراق من النيتروجين , الفوسفور و البوتاسيوم في الكرمات التي دعمت بنظام البارون تلاها نظام الجيبل , التليفون و الواي.
- بالنسبه لتأثير نظم التدعيم علي الكثافه الكليه للجذور أظهرت النتائج أن الكرمات التي دعمت بالبارون احتوت كرماتها علي أعلي كثافه جذور سواء في الاتجاه الأفقي من جذع الكرمه أو الرأسي بعمق التربه. و من هذه الدراسه يستبين لنا أن تدعيم الكرمات بنظام البارون و الجيبل يوفر أفضل الظروف لنمو المسطح الخضري و أعلي جوده في الإنتاج و خصائص المحصول الطبيعيه و الكيماويه للمزارع و أن التكلفه الإنشائيه العاليه لهما تسترد بزياده المحصول العاليه.

قام بتحكيم البحث

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Table (8): The effect of supporting systems on root density in auger samples taken at three distances from the vine trunk of Flame Seedless grapevines.

Distance from the trunk (cm)	Telephone (Double T)					Y - shape					Gable shape					Baron shape				
	Roots groups					Roots groups					Roots groups					Roots groups				
	< 1mm	1-2mm	>2mm	Total	%	< 1mm	1-2mm	>2mm	Total	%	< 1mm	1-2mm	>2mm	Total	%	< 1mm	1-2mm	>2mm	Total	%
25	137.0	127.0	39.0	303.0	33.5	149.0	135.0	68.0	352.0	34.0	267.0	89.0	73.0	429.0	35.5	279.0	86.0	56.0	421.0	31.8
50	170.0	151.0	96.0	417.0	46.1	210.0	154.0	82.0	446.0	43.1	290.0	126.0	77.0	493.0	40.8	346.0	147.0	85.0	578.0	43.7
75	94.0	49.0	41.0	184.0	20.4	112.0	83.0	43.0	238.0	23.0	146.0	77.0	64.0	287.0	23.7	169.0	82.0	72.0	323.0	24.4
Total	401.0	327.0	176.0	904.0		471.0	372.0	193.0	1036.0		703.0	292.0	214.0	1209.0		794.0	313.0	213.0	1322.0	
%	44.4	36.2	19.5			45.5	35.9	18.6			58.1	24.2	17.7			60.1	23.7	16.1		

Table (9): Effect of supporting systems on root density in auger samples taken at different depths of soil surface of Flame Seedless grapevines.

Depth from the surface (cm)	Telephone (Double T)					Y - shape					Gable shape					Baron shape				
	Roots groups					Roots groups					Roots groups					Roots groups				
	< 1mm	1-2mm	>2mm	Total	%	< 1mm	1-2mm	>2mm	Total	%	< 1mm	1-2mm	>2mm	Total	%	< 1mm	1-2mm	>2mm	Total	%
30	199.0	128.0	59.0	386.0	44.5	203.0	125.0	65.0	393.0	44.2	238.0	130.0	88.0	456.0	39.1	285.0	140.0	90.0	515.0	41.8
60	242.0	140.0	78.0	460.0	53.0	253.0	145.0	68.0	466.0	52.4	399.0	156.0	120.0	675.0	57.8	407.0	167.0	117.0	691.0	56.0
90	11.0	6.0	5.0	22.0	2.5	14.0	10.0	7.0	31.0	3.5	23.0	7.0	6.0	36.0	3.1	13.0	8.0	6.0	27.00	2.2
Total	452.0	274.0	142.0	868.0		470.0	280.0	140.0	890.0		660.0	293.0	214.0	1167.0		705.0	315.0	213.0	1233.0	
%	52.1	31.6	16.3			52.8	31.5	15.7			56.6	25.1	18.3			57.2	25.5	17.3		

Table (4): Effect of supporting systems on vegetative growth of Flame Seedless grapevines at the two seasons 2007 and 2008.

Supporting systems	Leaf area (cm^2)		Leaf area / vine (m^2)		Leaf area index		Shoot length (cm)		Pruning weight (kg) / vine		Wood ripening coefficient		Total carbohydrates %		Leaf area (m^2) /cluster	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Telephone (Double T)	185.0	187.0	14.8	15.4	3.5	3.6	190.0	196.0	2.1	2.4	0.78	0.79	15.8	17.6	0.57	0.57
Y-Shape	198.0	202.0	16.6	16.9	3.9	4.0	203.0	209.0	2.8	3.2	0.84	0.87	18.2	20.1	0.61	0.58
Gable Shape	238.0	248.0	22.4	23.5	4.3	4.5	245.0	254.0	3.9	4.3	0.89	0.91	22.6	25.6	0.66	0.65
Baron Shape	246.0	257.0	38.6	40.4	5.8	6.2	294.0	301.0	5.8	6.1	0.92	0.93	26.4	28.3	0.74	0.75
New L.S.D at 5%	7.8	8.1	6.4	6.8	1.0	1.2	46.4	52.2	1.4	1.5	0.04	0.03	3.9	3.8	0.03	0.03