J. Agric. Sci. Mansoura Univ., 29 (8): 4711 - 4728, 2004

EFFECT OF POTASSIUM SULPHATE AND VINE LOAD ON THE GROWTH AND YIELD OF THOMPSON SEEDLESS GRAPEVINES WITH A SPECIAL REFERENCE TO THE OCCURRENCE OF CLUSTER TIP DESICCATION PROBLEM

Shoeib, M. M.
Viticulture dept. Hort. Res. Instit. Agric. Res. Centre , Giza, Egypt.

ABSTRACT

This study was conducted during 2000 and 2001 seasons to examine the effect of vine load (72, 96, or 108 buds / vine) and potassium sulphate (0.0, 100, 200 and 300 kg/ fed) on growth, percentages of N, P, K and Mg, total and marketable yield, cluster tip desiccation %, harvest date as well as some physical and chemical characters of the berries and wood ripening of Thompson seedless grapevines.

Results showed that increasing vine load levels from 72 to 108 buds/ vine was followed by a gradual reduction in leaf area, main shoot length, percentages of N, P, K and Mg , berry weight, total soluble solids % and wood ripening, meanwhile it was responsible for increasing total yield slightly, cluster tip desiccation % and total acidity %. Harvesting date was delayed in response to raising vine load levels. Increasing potassium sulphate levels was accompanied by increasing the investigated characters except percentages of P, K and Mg, cluster tip Desiccation % and total acidity % . In most cases meaningless effect was detected in the studied characters between the application of 200 and 300 kg potassium sulphate /fed. The positive action of increasing potassium sulphate and the negative influence of increasing vine load on raising cluster tip desiccation % were ensured.

For checking cluster tip dryness % and improving yield and quality of Thompson seedless grapes, it is recommended to leave 96 buds / vine and fertilize the vines with 200 kg potassium sulphate/ fed.

INTRODUCTION

Thompson seedless cv. is considered as one of the most important and popular grape cvs in Egypt. Cluster tip desiccation represents a serious drawback in utilizing and marketing grapes of these cv. Previous studies emphasized the great benefits of potassium for overcoming this problem and enhancing growth, yield and quality of different grapevine cvs.

Potassium is essential in many plant metabolic processes. While it is not a part of plant compounds, it plays many important regulatory roles in the development of tissues. Functions of potassium in plants can be outlined under the following main topics (According to Tisdale *et al.,* 1985). 1] It enhances translocation of sugars and starch.2] It builds cellulose and reduces lodging; 3] Under high K level, starch is efficiently moved from sites of production to storage organs. In addition, continuous application of potassium to all grapevine cvs. is necessary for avoiding most of the unfavorable phemomena in clusters and berries of such grape cvs., (Conradie and Saayman, 1989) .

The great profits of K especially when applied at the optimum rate on growth, yield and quality parameters in different grapevine cvs were confirmed by the results of; Taha, (1996) and Ibrahim- Alia,(2003).

Recently, the results of Omar (2000) and Shoaieb (2002); supported the favourable influence of K on fruiting of various grapevine cvs.

In vineyards, Winter pruning is considered as the important and vital practice necessary for obtaining an economical yield. Pruning is a limiting factor for yield expressed in weight and quality. The improper application of pruning by leaving a lower or higher number of buds /vine was always accompanied by some negative effects on productivity of all grapevine cvs. Adjusting vine load seems to be very important for achieving a good balance between growth and fruiting of vines, maintaining the vines in the desired shape that will enhance productivity, and facilitate various horticultural operations and distribute the proper amounts of shoots over the vines and between vines according to vine capacity for maintaining higher crops of high fruit quality. Dvornin and Ipatii , (1986).

Few researches have dealt with overcropping vines, and its relation to number of buds left at time of pruning. Winkler(1962) found that with too many buds left at pruning, the number of clusters that set was so larger that the vine could not mature them normally as a result of which overcropping took place and delayed maturity. Further increase in over cropping resulted in week vines.

There are two conditions of interrupted berry development called water berry. In one condition the affected berries are largely confined to the tip of the rachis; in the other they may be scattered throughout the cluster.
This study throws some light on the effects of vine load and potassium application on cluster tip desiccation phenomenon, yield and quality of Thompson seedless grapevine.

MATERIALS AND METHODS

This study was carried out during 2000 and 2001 seasons on seventy two-12-year old Thompson seedless grapevines, of uniform vigour and supported to Telephone system in a private vineyard located at Samannoud, El-Gharbia Governorate. The chosen vines were planted at 2.0x2.5 meters apart and grown in a clay soil. Physical and chemical properties of the tested soil at 0.0–90 cm depth according to Wilde *et al.*,(1985)are shown in Table (1).

Table (1): Physical and chemical properties of the tested soil.

Sand %	11.51
Silt %	26.27
Clay %	62.22
Texture	Clay
pH(1: 2.5 extract)	7.88
E.C. (1 : 2.5 extract) (mmhos(cm)	0.24
O.M. %	1.92
Total N%	0.1
Available P (ppm, Oslen)	6.1**
Available K (ppm , ammonium acetate)	148

According to Ulrich and Ohki, (1965), This soil is deficient in K.

Surface irrigation system was followed:

The experiment included two factors. The first factor (A) consisted of three levels of vine load :

(a_1) 72 buds / vine (6 fruiting canes X 10 buds plus 6 renewal spurs X two buds per spur).

(a_2)96 buds / vine (8 fruiting canes X 10 buds plus 8 renewal spurs X two buds).

(a_3) 108 buds / vine (9 fruiting canes X 10 buds plus 9 renewal spurs X two buds).

While, the second factor (B) included four levels of potassium sulphate (48 % K_2O) i.e.:-

(b_1) 0.0 kg/ fed.

(b_2) 100 kg/ fed.

(b_3) 200 kg/ fed.

(b_4) 300 kg/ fed.

Thus, the experiment consisted of 12 treatments; each treatment was replicated three times with two vines per each. Winter pruning in the three vine load levels was conducted at the second week of January in both seasons. Potassium sulphate fertilizer at the above-mentioned levels was added at three unequal batches as 25% of the total amount at bud burst start + 25 % after berry set and 50% immediately at veraison stage.

The experiment was set in a completely randomized blocks design in split plot arrangement in which the three vine load levels occupied the main plots and the four levels of potassium sulphate represented the sub plots.

The vines received the same recommended cultural practices followed in this condition except K fertilization i-e (250 kg mono calcium super phosphate (15.5 % P2O5) and 400 Kg ammonium sulphate per fed. as 37.5 % during 30- 40 % of bud burst, 37.5 % after berry set and 12.5% at three weeks later and 12.5% after crop harvesting.

The following parameters were recorded for both seasons.

1-Growth Aspects:

Average leaf area (cm2) was determined in the twenty leaves opposite to the first basal clusters on the current shoots (just after veraison) according to Ahmed and Morsy (1999). Average shoot length (cm) was measured just after veraison stage.

2-Leaf chemical composition:

Percentage of N in leaf blade and percentages of P, K and Mg in the leaf petioles(from the leaf directly opposite to the cluster) were determined at full bloom on dry weight basis according to the standard methods outlined by Wilde *et al.* (1985).

3-Cluster tip desiccation:

Clusters characterized by tip desiccation were discarded and weighed (in kg) and percentages were measured by dividing weight of tip dried clusters by total yield/ vine and multiplying the product by 100.

4-Dynamics of fruit ripening:

Dynamics of fruit ripening expressed as total soluble solids and total acidity was measured periodically each five days starting from 10th June till 10th July in both seasons.

5-Yield as well as physical and chemical properties of the berries

Harvesting date was recorded when T.S.S. reached 16-17 % for each treatment. The total yield / vine (kg) in terms of weight was recorded, then the marketable yield/ vine was estimated by subtracting the weight of clusters characterized with tip desiccation from total yield. Five clusters were taken at random from the marketable yield of each vine for determining average weight of 100 berry (g), total soluble solids %and total acidity % (According to A.O.A.C.1985).

6-Wood ripening:

Wood ripening % (coefficient of wood ripening) was monthly calculated from 25th June to 25th October by dividing length of the ripened part of shoot (brownish colour) by the total length of the shoot.

The obtained data were tabulated and statistically analyzed according to Snedecor and Cochran (1972) using the new L.S.D. test for comparing the differences between various treatment Means.

RESULTS AND DISCUSSION

1-Leaf area and shoot length:

It is clear from the data in Table (2) that increasing vine load levels from 72 to 108 buds vine caused a significant reduction in leaf area and shoot length of Thompson seedless buds / vine, grapevines .The maximum and minimum values were recorded for vines pruned to 72 and 108 respectively. These results were true in both seasons. Similar results were obtained by El- Azzouni *et al.*, (1967) and Abramov(1971).

It is obvious from the data in Table (2) that soil addition of potassium sulphate at 100 to 300 kg / fed significantly improved leaf area and shoot length compared to unfertilization with K . The promotion was associated with increasing K levels. No significant differences in both growth characters were observed between 200 or 300 kg potassium sulphate / fed treatments. Similar results were obtained in both seasons.

The maximum values were observed on vines pruned to 72 buds / vine and fertilized with 300 kg potassium sulphate/ fed in both seasons. The minimum values were recorded on vines having a load of 108 buds/ vine and unfertilized with K. These results were true in both seasons of the study.

The stimulating effect of K on growth characters was supported by the results of Abdel- All (1991); Ahmed (1991); Taha (1996) and Omar (2000).

2-Leaf chemical composition:

It is evident from the data in Tables (2 & 3) that varying vine load levels had a pronouncing and significant influence on percentages of N, P, K and Mg in the leaves of Thompson seedless grapevines.

Table (2): Effect of vine load and potassium sulphate levels on leaf area, shoot length as well as percentages of N. and Pin the leaves of Thompson seedless grapevines.

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine Load (A)								Levels (Buds/ vine)							
	72	96	108	Mean(B)	72	96	108	Mean(B)	72	96	108	Mean(B)	72	96	108	Mean (B)
Characters	Leaf area (cm)2								Shoot length (cm)							
0.0 kg	132.0	128.0	125.3	128.4	130.0	127.0	124.1	127.0	235.0	225.0	215.0	225.0	232.0	222.0	211.0	221.7
100 kg	141.0	138.0	135.0	138.0	145.0	142.0	139.0	142.0	250.0	239.0	228.0	239.0	248.0	240.0	230.0	239.3
200 kg	146.0	143.0	140.0	143.0	151.0	148.0	145.0	148.0	269.0	257.0	247.3	257.8	258.0	250.0	240.0	249.3
300 kg	148.0	144.0	141.0	144.0	152.0	149.0	146.0	149.0	277.0	266.0	2 55.0	266.0	260.3	251.0	241.0	250.8
Mean (A)	141.8	138.3	135.3		144.5	141.5	138.6		257.8	246.8	236.3		249.6	240.8	231.0	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	1.9	2.9	5.0		2.1	2.3	4.0		8.9	8.9	15.4		7.1	7.3	12.6	
Characters	Leaf N %								Leaf P %							
0.0 kg	1.84	1.80	1.60	1.75	1.88	1.80	1.70	1.79	0.36	0.33	0.30	0.33	0.37	0.33	0.29	0.33
100 kg	1.78	1.71	1.61	1.70	1.80	1.72	1.60	1.17	0.32	0.29	0.24	0.28	0.33	0.30	0.26	0.30
200 kg	1.74	1.69	1.60	1.68	1.70	1.60	1.50	1.60	0.29	0.25	0.20	0.25	0.30	0.26	0.23	0.26
300 kg	1.51	1.46	1.36	1.36	1.61	1.51	1.41	1.51	0.27	0.22	0.19	0.23	0.27	0.23	0.20	0.23
Mean (A)	1.72	1.67	1.54		1.75	1.66	1.55		0.31	0.27	0.23		0.32	0.28	0.25	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.04	0.02	0.03		0.04	0.02	0.03		0.03	0.02	0.03		0.03	0.02	0.03	

Table (3): Effect of load and potassium sulphate levels on percentages of K and Mg in the leaves, total yield/ vine and marketable yield/ vine (kg.) of Thompson seedless grapevines.

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine Load (A)								Levels (Buds/ vine)							
	72	96	108	Mean(B)	72	96	108	Mean(B)	72	96	108	Mean(B)	72	96	108	Mean (B)
Characters	Leaf K %								Leaf Mg %							
0.0 kg	1.02	0.98	0.81	0.94	1.05	1.00	0.97	1.01	0.79	0.75	0.70	0.75	0.80	0.76	0.74	0.77
100 kg	1.20	1.17	1.10	1.16	1.24	1.20	1.10	1.18	0.75	0.73	0.70	0.73	0.78	0.74	0.72	0.75
200 kg	1.51	1.47	1.42	1.47	1.53	1.50	1.41	1.48	0.70	0.68	0.64	0.67	0.72	0.69	0.66	0.69
300 kg	1.70	1.60	1.55	1.62	1.75	1.70	1.60	1.68	0.68	0.66	0.61	0.65	0.70	0.66	0.64	0.66
Mean (A)	1.36	1.31	1.22		1.39	1.35	1.27		0.73	0.71	0.66		0.75	0.71	0.69	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	1.36	1.31	1.22		1.39	1.35	1.27		0.73	0.71	0.66		0.75	0.71	0.69	
Characters	Total yield / vine (kg.)								Marketable yield/ vine (kg.)							
0.0 kg	5.6	7.1	7.8	6.8	5.4	6.9	7.8	6.7	4.8	5.8	4.6	5.0	4.5	5.7	4.4	4.9
100 kg	6.0	7.6	8.3	7.3	6.1	7.4	8.5	7.3	5.2	6.6	5.8	5.9	5.3	6.3	5.9	5.8
200 kg	7.9	8.5	9.4	8.6	7.8	8.3	9.3	8.5	7.3	7.6	7.2	7.4	7.2	7.6	6.9	7.2
300 kg	8.2	8.8	4.8	9.0	8.1	8.6	9.7	8.8	7.6	7.9	7.7	7.7	7.5	7.8	7.6	7.6
Mean (A)	6.9	8.0	8.8		6.9	7.8	8.8		6.2	7.0	6.3		6.1	6.9	6.2	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	N. S.	0.5	0.9		N. S.	0.6	1.0		N. S.	0.5	0.9		N. S.	0.5	0.9	

There was a gradual and significant reduction in the investigated macronutrients with increasing vine load levels from 72 to 108 buds / vine. Leaving 72 and 108 buds / vine was accompanied by producing the maximum and minimum values of these nutrients, respectively, These results were true in both seasons.

The results were supported by the results of Dvornin and Ipatii (1986).

Data with regard to the effect of potassium sulphate on leaf mineral content (Tables 2 & 3) clearly show that all nutrients except K in the leaves tended significantly to reduce with increasing potassium sulphate levels and the effect expressed either in increase or in decrease was associated with increasing the applied rate. Similar results were obtained in both seasons .

The minimum values of N, P and Mg were recorded on vines having a load of 108 buds / vine and fertilized with 300 kg potassium sulphate / fed.However, leaving 72 buds / vine and fertilizing with the same previous rate of K achieved the maximum values of K in both seasons.

These results are in agreement with those obtained by Roy *et al.* (1990) and Shoeib (2002).

3-Total and marketable Yield:

Total and marketable yield as shown in Table (3) were slightly increased with increasing vine load levels from 72 to 108 buds / vine. However, increasing vine load from 96 to 108 buds / vine caused an insignificant reduction in the marketable yield in both seasons. The maximum marketable yield was recorded due to retaining 96-buds/ vine in both seasons.

Similar results were announced by El- Azzouni *et al*, (1967) and Dvornin and Ipatii (1986).

Increasing potassium sulphate levels from 0.0 to 300 kg / fed resulted in a gradual increase in total and marketable yield. Significant difference were observed in total and marketable yield among all levels except between the two higher levels (200 and 300 kg / fed.)

Retaining 96 buds / vine and fertilizing the vines with 200 kg / fed gave the best results with regard to marketable yield. In this treatment the marketable yield reached 7.6 kg / vine in both seasons.

The positive action of K on the yield was confirmed by the results of Papric (1991); El- Shahat (1992); Taha (1996) and Omar (2000).

4-Cluster tip desiccation:

As shown in Table (4) the phenomenon of cluster tip desiccation was negatively affected with occurrence of such increasing vine load from 72 to 108 buds / vine. Insignificant increase in the undesirable phenomenon was observed due to raising vine load from 72 to 96 buds / vine. However, a significant increase was detected in this character due to raising vine load from 96 to 108 buds / vine. The maximum and minimum values were observed on vines pruned to 108 and 72 buds / vine, respectively. As for values of marketable yield are concerned, it is advised to leave 96 buds/ vine for overcoming cluster tip desiccation and obtaining an economical yield of Thompson seedless grapevines. These results were true in both seasons .

The results are in accordance with those obtained by Barsegyan *et al*,. (1984) and Dvornin and Ipatii (1986).

Increasing potassium sulphate levels from 0.0 to 300 kg / fed was accompanied by reducing the percentage of clusters showing tip desiccation. A significant reduction was observed in such undesirable phenomenon among all levels of K except between using the two higher levels. Therefore, for controlling tip desiccation of clusters, it is advised to use 200 kg potassium sulphate / fed instead of using 300 kg for reducing costs and increasing the net profit as will be discussed later. These results were true in both seasons of the study.

Putting in to consideration the value of marketable yield, the promising treatment in this respect was retaining 96 buds / vine and fertilizing with 200 kg potassium sulphate / fed in both seasons

The effect of K on improving bunch quality and controlling cluster tip desiccation was confirmed by the results of Ahlawat and Yamadgni (1988).

5-Harvest date:

Increasing vine load from 72 to 108 buds/ vine was followed by delaying harvest date of Thompson seedless grapevines in 2000 and 2001 seasons (Table 4).

The results of El-Azzouni *et al.,* (1967) and Chadha *et al.,* (1969) supported these results.

There was a great advancement in the harvest date of Thompson seedless grapes with increasing the amount of potassium sulphate added from 100 to 300 kg / fed compared to unfertilization . Raising the amount of fertilizer from 200 to 300 kg / fed gave the same date of harvesting . These results were true in both seasons (Table 4).

Retaining 72 bus / vine and supplying the vines with 200 kg. potassium sulphate / fed proved to be effective in enhancing harvest date of Thompson seedless grapes in both seasons.

These results are in agreement with those obtained by Shikhamany *et al.,* (1990) , Ahmed (1991) and Taha *et al.,* (1996).

6-Berry weight:

Data inTable (4) clearly show that increasing vine load levels from 72 to108 buds/ vine was significantly accompanied by reducing berry weight. The minimum and maximum values were detected due to leaving 108 and 72 buds / vine, respectively. These results were true in both seasons.

The results of El-Azzouni *et al.,* (1967) emphasized the present finding

Application of potassium sulphate at 100 to 300 kg/fed caused a positive action on berry weight compared to unfertilization. The promotion was associated with increasing the applied rate. Statistical analysis showed that varying levels of potassium sulphate caused a significant promotion on berry weight and the maximum values were detected on vines receiving 300 kg potassium sulphate / fed . The minimum values were noticed on unfertilized vines. Similar results were obtained in both seasons.

Table (4): Effect of vine load and potassium sulphate levels on percentage of cluster tip desiccation, 100 berry weight, harvest date as well as desiccation of bunch ripening of Thompson seedless grape .

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine Load (A)								Levels (Buds/ vine)							
	72	96	108	Mean (B)	72	96	108	Mean (B)	72	96	108	Mean(B)	72	96	108	Mean (B)
Characters	Cluster tip desiccation %								100 berry weight (g.)							
0.0 kg	14.3	18.3	41.0	24.5	16.7	17.4	43.6	25.9	209.0	203.0	198.0	203.3	211.1	204.0	197.1	204.0
100 kg	13.3	13.2	30.1	18.9	13.1	14.9	30.6	19.5	225.0	220.0	215.0	220.0	220.0	214.0	208.0	214.0
200 kg	7.6	10.6	23.4	13.9	7.7	8.4	25.8	13.8	249.0	241.0	235.0	241.7	228.0	222.0	216.0	222.0
300 kg	7.3	10.2	21.4	13.0	7.4	9.3	21.6	12.8	251.0	246.0	240.0	245.7	236.0	230.0	223.0	229.7
Mean (A)	10.6	13.1	29.0		11.2	12.5	30.4		233.5	227.5	222.0		223.8	217.5	211.0	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	3.0	2.0	3.5		1.9	2.2	3.8		4.1	4.0	6.9		5.0	5.3	9.2	
Characters	Harvest date								T.S.S.% (10 / 6)							
0.0 kg	20./7	22./7	25./7	22.3	20/7	22/7	25/7	22.3	9.6	8.8	7.9	8.8	9.5	8.5	7.6	8.5
100 kg	15/7	17/7	19/7	17.0	15/7	16/7	18/7	16.3	10.0	9.7	9.1	9.6	10.3	9.4	8.9	9.5
200 kg	10/7	12/7	14/7	12.0	10/7	12/7	14/7	12	11.3	11.0	10.3	10.9	10.8	10.8	10.1	10.6
300 kg	10/7	12/7	14/7	12.0	10/7	12/7	14/7	12	11.5	11.2	10.8	11.2	11.2	11.0	11.0	11.1
Mean (A)	13.8	15.8	18.9		13.8	15.5	17.8		10.6	10.2	9.5		10.5	9.9	9.4	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
									0.2	0.3	0.5		0.3	0.3	0.5	

The maximum berry weight was obtained at the load of 72 buds vine and the application of 300 kg potassium sulphate / fed. Leaving 108 buds/ vine and unfertilization with K gave the minimum values. These results are in agreement with those obtained by Abdel- All (1991); Taha (1996) and Shoaieb (2002).

7-Chemical quality of the berries:

Data in Tables (4 & 5 & 6 & 7& 8 and 9) clearly show that with advancing maturity stage there was a progressive promotion in total soluble solids % and a gradual reduction in total acidity % till 10 July in both seasons. In each date of measurement, total soluble solids % tended to reduce and total acidity % tended to increase with raising vine load from 72 to 108 buds / vine. The undesirable effects on quality were associated with increasing number of buds left per vine. These results were true in both seasons.

These results are in agreement with those obtained by Chadaha *et al.*, (1969) and Abramov (1991).

It is clear from the data in Tables (4 & 5 & 6 & 7& 8 and 9) that there was a gradual promotion on the total soluble solids % and a reduction on total acidity % with increasing potassium sulphate levels. The great advancement in fruit ripening occurred on vines fertilized with 300 kg potassium sulphate / fed. The untreated vines with K gave unsatisfactory enhancement on fruit quality. Similar results were obtained in both seasons.

Leaving 72 buds / vine and fertilizing with 300 kg potassium sulphate / vine gave the best results with regard to chemical quality of the berries in both seasons.

These results are in harmony with those obtained by Omar (2000) and Shoaieb (2002).

8-Wood ripening:

As shown in table (8) in both wood ripening was found to increase progressively through the period extending from 25th June up to 25th October. Wood ripening coeffient gradually decreased with increasing vine load from 72 to 108 buds / vine in each date of measurement. In all dates of measurement, the maximum and minimum values were detected on vines having 72 and 108 buds / vine, respectively.

Increasing potassium sulphate levels from 0.0 to 300 kg / fed was accompanied by increasing wood ripening coefficient and the promotion was associated with increasing K levels. Fertilizing the vines with 300 kg and 0.0 kg potassium sulphate / fed gave the maximum and minimum values, respectively in both seasons.

Retaining 72 buds /vine and fertilizing the vines with 300 kg potassium sulphate/ fed resulted in the maximum values. The minimum values were detected on vines having 108 buds/ vine and without K fertilization. These results were true in both seasons.

The results are in agreement with those obtained by Ahmed (1991) and Ibrahim – Alia (2002).

Table (5): continued

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine load (A)								Levels (buds / vine)							
	72	96	108	Mean (B)	72	96	108	Mean (B)	72	96	109	Mean(B)	72	96	108	Mean (B)
Characters	T.S.S.%(15/6)								T.S.S.% (20/6)							
0.0 kg	10.3	10.3	8.6	9.7	10.4	9.4	8.4	9.4	11.6	10.6	9.6	10.6	11.8	10.6	9.5	10.6
100 kg	11.1	11.0	9.8	10.6	11.3	11.1	9.7	10.7	12.0	12.9	10.7	11.9	12.3	11.5	10.8	11.5
200 kg	12.6	12.4	10.7	11.9	12.5	12.0	10.5	11.7	13.3	13.7	11.6	12.9	13.1	12.7	11.7	12.5
300 kg	12.89	12.5	11.6	12.3	12.8	12.3	12.1	12.4	14.0	14.2	12.1	13.4	13.8	13.4	12.9	13.4
Mean (A)	11.7	11.6	10.2		11.8	11.2	10.2		12.7	12.9	11.0		12.8	12.1	11.2	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.2	0.4	0.7		0.3	0.7	0.7		0.2	0.7	0.7		0.3	0.4	0.7	
Characters	T.S.S.% (25/ 6)								T.S.S.% (30/ 6)							
0.0 kg	12.8	12.5	10.8	12.0	12.6	12.3	11.2	12.0	13.9	13.6	12.4	13.3	13.5	13.5	12.1	13.0
100 kg	13.3	12.8	11.9	12.7	13.1	13.1	12.2	12.8	14.6	14.3	12.9	13.9	14.4	14.2	12.7	13.8
200 kg	14.2	14.0	12.7	13.6	14.0	13.9	13.4	13.8	15.1	14.8	14.1	14.7	14.8	14.5	14.2	14.5
300 kg	14.6	14.6	13.6	14.3	14.3	14.0	14.0	14.1	15.8	15.4	15.2	15.5	15.5	15.2	15.1	15.3
Mean (A)	13.7	13.5	12.3		13.5	13.3	12.7		14.9	14.5	13.7		14.6	14.4	13.5	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.2	0.4	0.7		0.2	0.4	0.7		0.3	0.4	0.7		0.2	0.3	0.5	

Table (6) continued

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine load (A)								Levels (buds / vine)							
	72	96	108	Mean (B)	72	96	108	Mean (B)	72	96	108	Mean(B)	72	69	108	Mean (B)
Characters	T.S.S.% (5/ 7)								T.S.S.% (10.7)							
0.0 kg	14.8	14.4	13.8	14.3	14.6	14.3	13.6	14.2	15.6	15.1	14.6	15.1	15.4	154	14.8	15.2
100 kg	15.3	15.1	14.4	14.9	15.0	15.0	14.2	14.7	16.1	16.0	15.3	15.8	16.3	16.1	15.3	15.9
200 kg	16.2	15.8	14.9	15.6	16.1	15.7	15.1	15.6	16.9	16.4	16.0	16.4	16.7	16.2	16.4	16.4
300 kg	16.6	16.2	15.6	16.1	16.3	16.1	15.8	16.1	17.4	16.9	16.4	16.9	17.8	17.0	16.6	17.1
Mean (A)	15.7	15.4	14.7		15.5	15.3	14.7		16.5	16.1	15.6		16.6	16.2	15.8	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.2	0.2	0.03		0.2	0.3	0.05		0.3	0.2	0.03		0.3	0.3	0.05	
Characters	T.S.S. % at harvest date								Total acidety % (10/6)							
0.0 kg	16.4	16.2	15.4	16.0	16.5	16.3	15.6	16.1	1.52	1.83	1.79	1.71	1.54	1.71	1.88	1.71
100 kg	16.8	16.6	16.5	16.6	16.7	16.7	16.5	16.6	1.42	1.54	1.64	1.53	1.50	1.55	1.81	1.62
200 kg	17.7	17.5	17.0	17.4	17.8	17.3	16.9	17.3	1.40	1.42	1.50	1.44	1.45	1.45	1.59	1.98
300 kg	18.8	18.4	17.6	18.2	18.3	18.2	17.4	18.0	1.30	1.40	1.45	1.38	1.37	1.42	1.42	1.40
Mean (A)	17.4	17.2	16.6		17.3	17.1	16.6		1.41	1.55	1.60		1.47	1.53	1.68	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.2	0.3	0.05		0.2	0.3	0.04		0.05	0.04	0.07		0.04	0.09	0.16	

Table (7) : continued

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine load (A)								Levels (buds / vine)							
	72	96	108	Mean (B)	72	96	108	Mean (B)	72	96	108	Mean(B)	72	96	108	Mean (B)
Characters	Total acidity % (15/ 6)								Total acidity% (20 / 6)							
0.0 kg	1.50	1.55	1.68	1.58	1.51	1.56	1.74	1.60	1.40	1.42	1.52	1.45	1.41	1.44	1.54	1.46
100 kg	1.40	1.42	1.50	1.44	1.40	1.41	1.54	1.45	1.10	1.12	1.44	1.22	1.06	1.32	1.45	1.28
200 kg	1.20	1.22	1.44	1.29	1.18	1.20	1.46	1.28	0.99	1.03	1.31	1.11	1.00	1.20	1.28	1.16
300 kg	1.00	1.18	1.31	1.16	1.16	1.18	1.25	1.20	0.98	0.99	1.08	1.02	0.97	1.02	1.04	1.01
Mean (A)	1.28	1.34	1.98		1.31	1.34	1.50		1.12	1.14	1.34		1.11	1.25	1.33	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.05	0.09	0.16		0.03	0.09	0.16		0.02	0.09	0.16		0.05	0.07	0.12	
Characters	Total acidity % (25/ 6)								Total acidity % (30/ 6)							
0.0 kg	0.99	1.11	1.22	1.11	1.20	1.22	1.29	1.24	0.96	0.98	0.99	0.98	0.99	0.99	1.02	1.00
100 kg	0.96	1.01	1.11	1.03	1.00	1.03	1.13	1.05	0.91	0.95	0.96	0.94	0.91	0.97	0.99	0.96
200 kg	0.95	0.98	1.03	0.99	0.98	1.00	1.10	1.03	0.88	0.89	0.92	0.90	0.89	0.94	0.97	0.93
300 kg	0.92	0.97	1.00	0.96	0.95	0.98	1.05	0.99	0.81	0.87	0.90	0.86	0.88	0.89	0.92	0.90
Mean (A)	0.96	1.02	1.09		1.03	1.06	1.14		0.89	0.92	0.94		0.92	0.95	0.98	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.03	0.03	0.05		0.03	0.03	0.05		0.02	0.03	0.05		0.03	0.02	0.03	

Table (8) : Effect of vine load and potassium sulphate levels on dynamics of fruit ripening as well as wood ripening coefficient during different dates of measurements ofThompson seedless grape .

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine load (A)								Levels (buds / vine)							
	80	100	120	Mean (B)	72	96	108	Mean (B)	72	96	108	Mean(B)	72	96	108	Mean (B)
Characters	Total acidity % (5/ 7)								Total acidity% (10/7)							
0.0 kg	0.89	0.91	0.97	0.92	0.91	0.95	0.98	0.95	0.84	0.88	0.98	0.87	0.87	0.88	0.89	0.88
100 kg	0.86	0.88	0.91	0.88	0.88	0.89	0.97	0.91	0.75	0.76	0.84	0.78	0.73	0.75	0.86	0.78
200 kg	0.78	0.81	0.88	0.82	0.78	0.84	0.88	0.83	0.66	0.72	0.79	0.72	0.72	0.73	0.75	0.73
300 kg	0.74	0.76	0.80	0.77	0.73	0.74	0.81	0.76	0.65	0.71	0.74	0.70	0.71	0.72	0.74	0.72
Mean (A)	0.82	0.84	0.89		0.83	0.86	0.91		0.73	0.74	0.82		0.76	0.77	0.81	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.02	0.04	0.07		0.03	0.04	0.07		0.02	0.02	0.03		0.02	0.02	0.03	
Characters	Total acidity at harvest date								Wood ripening % (25/6)							
0.0 kg	0.74	0.75	0.76	0.75	0.75	0.76	0.78	0.76	7.2	7.0	5.2	6.5	6.8	6.4	5.0	6.0
100 kg	0.72	0.73	0.74	0.73	0.74	0.75	0.76	0.75	9.5	8.8	7.1	8.1	9.1	8.4	6.7	8.1
200 kg	0.62	0.63	0.63	0.63	0.72	0.73	0.76	0.74	13.1	12.4	10.6	12.0	1.6	11.8	10.0	11.8
300 kg	0.60	0.60	0.62	0.61	0.59	0.61	0.62	0.61	15.2	14.5	13.1	14.3	15.2	13.6	12.3	13.7
Mean (A)	0.67	0.68	0.69		0.70	0.69	0.70		11.3	10.7	9.0		11.2	10.1	8.5	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.02	0.02	0.03		0.02	0.02	0.03		0.5	1.0	1.7		0.6	0.9	1.6	

Table (9) : continued

Potassium sulphate levels (B)	2000				2001				2000				2001			
	Vine load (A)								Levels (buds / vine)							
	72	96	108	Mean (B)	72	96	108	Mean (B)	72	96	108	Mean(B)	72	96	108	Mean (B)
Characters	Wood ripening (25/ 7)								Wood ripening (25/8)							
0.0 kg	19.2	18.9	16.1	18.0	18.4	17.8	14.8	17.0	32.3	30.9	25.9	29.7	33.1	29.1	23.8	28.7
100 kg	27.1	26.2	24.1	25.8	24.5	26.0	23.6	24.7	38.1	36.5	34.9	36.5	37.3	35.1	33.6	35.3
200 kg	34.2	33.0	31.6	33.0	33.8	32.2	30.5	32.2	50.6	50.1	48.3	49.7	50.8	51.0	47.4	49.7
300 kg	36.5	35.1	34.2	35.3	35.6	34.6	35.0	35.0	56.1	55.0	53.8	55.0	55.6	54.3	53.3	54.4
Mean (A)	29.3	28.3	26.5		28.1	27.7	26.0		44.3	43.1	40.7		44.2	42.4	39.6	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.7	0.9	1.6		0.8	1.0	1.7		0.8	1.0	1.7		1.0	0.9	1.6	
Characters	Wood ripening (25/ 9)								Wood ripening % (25/10)							
0.0 kg	52.1	51.8	45.6	49.9	51.6	50.6	44.5	48.9	70.2	68.0	62.1	66.8	70.1	68.1	61.6	66.6
100 kg	63.1	61.9	58.2	61.0	62.9	60.4	56.4	60.0	78.4	77.1	75.0	76.8	79.1	76.4	74.1	76.6
200 kg	72.3	70.6	67.4	70.1	72.4	68.4	66.1	69.0	83.5	81.6	78.0	81.0	82.8	80.7	78.2	80.6
300 kg	74.8	72.3	70.8	72.6	74.0	73.0	71.0	72.7	89.2	87.2	82.0	86.1	88.8	85.2	82.1	85.4
Mean (A)	65.6	64.2	60.5		65.2	63.1	60.0		80.3	78.3	74.3		80.2	77.6	74.0	
New L.S.D at 5%	A	B	AB		A	B	AB		A	B	AB		A	B	AB	
	0.7	0.8	1.2		1.0	0.9	1.6		1.0	0.9	1.6		0.9	1.0	1.7	

9- An economical study on applying potassium fertilizers and pruning as to leave 96 buds / vine:

It can be stated form the obtained data in Table (10) that application of potassium sulphate at 200 kg/ fed and leaving 96 buds/ vine resulted in the maximum net profit compared with using the higher levels. According to the obtained data, the increase in yield/ fed due to the application of 200 kg potassium sulphate reached 1512 and 1596 kg/ fed. giving a net profit of about 1492 and 1597 Egyptian pounds in the two seasons , respectively.

Table (10) : Some economical data on costs and net profit of the recommended treatment (200 kg potassium sulphate fed. + 96 buds / vine) per fed. compared to control treatment in both seasons(840 vines / fed.)

Items	2000	2001
Price of K fertilizers	298	298
Labor cost (L.E.)	60	60
costs of transport (L.E.)	40	40
Marketable yield of R.T.	6384	6384
Marketable yield of the control	4872	4788
Total costs (L.E.)	398	398
Increase in yield over control (ton)	1512	1596
Increase in yield over control (L.E.)	1890	1995
Net profit (L.E.)	1492	1597

The average price of ton fruits is 1250 L.E.
R.T. = Recommended treatment.

The negative action of increasing vine load as previously mentioned on growth and fruiting of vines might be attributed to the depletion and exhaustion of mineral and organic foods for developing of vegetative portions at the expense of fruiting organs. However, the beneficial effects of K on the above- mentioned characters can be mainly attributed to its positive action on increasing the biosynthesis and translocation of carbohydrates and improving the tolerance of plants to the unfavourable conditions.

As a conclusion, it can be recommended to leave 96 buds / vine and use 200 kg potassium, sulphate / fed for alleviating clusters tip desiccation, increesing yield and improving bunch quality of Thompson seedless cultivar.

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" تأثير سلفات البوتاسيوم و مستوي التحميل علي النمو و المحصول لكرمات العنب الطومسون سيدليس مع الإشارة إلي مدي حدوث مشكلة جفاف طرف العنقود "

مسعد محمد شعيب
قسم العنب – معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة – القاهرة

أجريت هذه الدراسة خلال موسمى ٢٠٠٠ / ٢٠٠١ لاختبار تأثير حمولة الكرمة (٧٢ و ٩٦ أو ١٠٨ عين للكرمة) وكبريتات البوتاسيوم (صفر – ١٠٠ – ٢٠٠ – ٣٠٠ كجم / فدان) على النمو والنسبة المئوية للنيتروجين والفوسفور والماغنسيوم والبوتاسيوم والمحصول الكلى والقابل للتسويق والنسبة المئوية لجفاف طرف العنقود – موعد الحصاد وكذلك بعض الخصائص الطبيعية والكيميائية للحبات وديناميكية نضج الخشب للعنب الطومسون.

أشارت نتائج الدراسة إلي أن زيادة حمولة الكرمة من ٧٢ إلى ١٠٨ عين للكرمة كان مصحوبا بنقص تدريجى فى مساحة الورقة – طول النمو للفرع الرئيسي – محتوي الأوراق من النيتروجين والفوسفور والبوتاسيوم والماغنسيوم – ووزن ١٠٠ حبة والنسبة المئوية للمواد الصلبة الذائبة الكلية بعصير الحبات و نضج الخشب بينما أدت إلى زيادة فى كل من المحصول الكلى والنسبة المئوية لجفاف طرف العنقود والنسبة المئوية للحموضة الكلية وقد تأخر موعدالجمع عند زيادة حمولة الكرمة.وعند زيادة الجرعة المستخدمة من سماد كبريتات البوتاسيوم كان هناك زيادة فى كل الصفات تحت الدراسة ما عدا النسبة المئوية للفوسفور والبوتاسيوم والماغنسيوم بالأوراق والنسبة المئوية لجفاف طرف العنقود والنسبة المئوية للحموضة الكلية وفى كل الأحوال كان هناك تأثير طفيف على هذه الصفات ما بين الجرعتين الأعلى من كبريتات البوتاسيوم وهما ٢٠٠ و ٣٠٠ كجم / فدان.

وقد تأكد من نتائج هذه الدراسة الأثر الايجابي لزيادة كبريتات البوتاسيوم والأثر السلبى لزيادة حمولة الكرمة فى زيادة النسبة المئوية لجفاف طرف العنقود.

و قد اتضح من الدراسة أنه للحد من ظهور جفاف طرف العنقود وتحسين المحصول وجودة حبات العنب الطومسون سيدليس فانه ينصح بترك ٩٦ عين على الكرمة مع تسميد الكرمات بـ ٢٠٠ كجم سلفات البوتاسيوم للفدان.