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STUDIES ON THE EFFECT OF POTASSIUM AND MAGNESIUM FERTILIZATION AS WELL AS VINE LOAD ON FLAME SEEDLESS GRAPE PRODUCTIVITY

El-Kady, M.I.; N. R.E. Samra and A. S. S. EL-Shahat
Pomology Dept., Fac. Agric+., Mansoura Univ.

ABSTRACT

This study was carried out during 2007 and 2008 seasons to study the effect of potassium and magnesium as soil fertilization under bud load of 40 or 60 eye/vine on bud behavior, yield and berry quality of Flame Seedless grapevines. Potassium was applied as potassium sulphate at two rates 150 and 300 g/vine and magnesium was applied as magnesium sulphate at 30 and 60 g/vine.

Obtained data reveal that, both potassium and magnesium fertilization under 40 or 60 eye/vine increased bud burst and fertility percentages than the control. Furthermore, potassium fertilization at 300 g with 30 g magnesium sulphate per vine under leaving 40 eye/vine gave the highest bud burst percentage than those obtained under leaving 60 eye/vine. Also, potassium fertilization at 300 g with magnesium sulphate at 60 g/vine under leaving 60 eye/vine gave higher number of clusters and yield/vine than those obtained under leaving 40 eye/vine. Yet, potassium fertilization at 300 g with 30 g magnesium sulphate per vine under leaving 40 eye/vine gave higher cluster and berry weight, SSC, SSC/acid ratio and anthocyanin content than the other levels of potassium or magnesium fertilization under leaving 60 eye/vine.

INTRODUCTION

Grape (*Vitis vinifera*, L.) is considered the first deciduous fruit crop in the world, and the second in Egypt after citrus. Vineyards have continuously increased especially in the newly reclaimed lands. Since, the total area of grape in Egypt reached about 167048 feddans producing about 1531418 tons according to the last statistics of the Ministry of Agriculture (2009).

Flame Seedless is considered one of the most popular and favorite table grape for consumer, since it ripens early with good clusters, and berries which contain higher percentage of anthocyanin content.

Pruning is an obvious management technique developed to regulate the balance between vegetative growth, berry quality and productivity of grapevines, Possingham (1993) and Howell & Striegler (1998).

Yield and berry quality of the grapevine is related to the number of eyes, which retained after winter pruning in such cultivars, i.e. Flame Seedless, King Ruby and Roumi Red (AL-Saidi & AL-Wan, 1990; Hussain & EL-Dujaili, 1990 and Murisier & Ziegler, 1991). Also, grape quality is affected by vineyard conditions and cultural practices such as fertilization, irrigation, disease and pest management. However, grape growers have inadequate informations about the suitable rate of macro nutrients such as N, P, K in our vineyard.

Nitrogen (N) is usually the most limiting element for grapevine growth and yield. When N requirements are insufficient or applied in excessive amounts it results in negative effects of plant productivity and fruit quality. High rates of N application resulted in increasing shoot growth, pruning weights, leaf area, internal shoot length and trunk growth of some grape cultivars (Martin *et* *al*., 2004). Increasing N concentration has increased phosphorus (P) and iron (Fe) levels in leaf petioles and decreased calcium (Ca) and magnesium (Mg) concentrations of some grape cultivars (Bell & Robson, 1999). Potassium (K) is a mobile element in the plant and is an activator of enzymes that are essential for photosynthesis and respiration as well as enzymes that produce starch and proteins (Bhandal & Malik, 1988). The application of K can result in increasing vine growth, shoots/vine and trunk girth, while K deficiency decreases crop yield and fruit quality (Conradie & Saayman, 1989). Magnesium (Mg) is a component of chlorophyll and essential for the functional ability of ATP in many reactions. It is also responsible for the activation of many enzymes in photosynthesis, respiration and the formation of DNA and RNA (Salisburg & Ross, 1992). Both Ca and Mg concentrations can be decreased as a result of K application. Since, an antagonism was also observed with K and Mg, as the addition of K decreased, the concentration of Mg was increased in the plant (Wolf *et al*., 1983).

Most growers of grapes under Dakahlia region used in their fertilization program high level of nitrogen with small amount of potassium and magnesium.

This investigation aimed to study the effect of potassium and magnesium as soil fertilization under two levels of pruning (40 or 60 eye/vine) on bud behavior, yield and fruit quality of Flame seedless grapevines under Dakahlia region.

MATERIALS AND METHODS

This study was carried out during 2006, 2007 and 2008 seasons on 6-years-old Flame Seedless grapevines growing at EL-Dear village near Aga City, Dakahlia Governorate, Egypt. Yet, the obtained results of the later two seasons under the study are presented and discussed. The vines were planted at 2 m between vines and 2.5 m between rows using spur-pruning under bilateral cordon trellis system.

At the beginning of this study, soil samples were taken from (0-30 and 30-60 cm depths) at 4 different sites representing major parts of the root zone before adding any soil fertilization. Samples of each layer were thoroughly mixed and analyzed for measure soil physical and chemical characteristics. The obtained results are presented in Table (1).

Table (1): Soil physical and chemical characteristics :

A- Physical characteristic	**Soil depth**	
	(0-30 cm)	**(30-60 cm)**
Clay %	43.28	43.60
Silt %	40.33	40.76
Sand %	10.67	10.26
Organic matter %	2.46	2.04
$CaCO_3$	3.26	3.34
Texture class	Silty-clay	Silty-clay
B- Chemical characteristic		
Mg^{++} (Meq/L)	6.14	7.11
Available K^+ (Meq/L)	0.42	0.49
pH	7.5	7.3
EC ppm	413	405

For this study, 108 vines almost similar in vigor and productivity were pruned as spur pruning by leaving 40 or 60 eye/vine and subjected to the normal horticultural practices in the vineyard. Each treatment consisted of 4 vines replicated 3 times. Also, one row of vines served as border between each replicate and block receiving the same adjacent fertilization treatment.

Soil fertilization was applied in an area of approximately 40 cm on each side of the trunk through the row and at 10-15 cm depth according to Mannson & Nelson (1963).

Potassium fertilization was applied in the soil as potassium sulphate (namely commercially Solucros) contains (50 % K_2O and 18 % S) at two rates (150 and 300 g/vine) in two equal doses, at 50 % bud burst and after fruit set stage.

Magnesium fertilization was applied in the soil as magnesium sulphate (98.5 % $MgSO_4$) at two rates (30 and 60 g magnesium sulphate/vine) combined with potassium in the same time through the season.

In this respect, the treatments are presented in Table (2) :

Table (2): The applied treatments used :

Treatment	Pruning level	Potassium sulphate g/vine	Magnesium sulphate g/vine
1		Control*	
2	**40 eye/vine**	150	30
3		150	60
4		300	30
5		300	60
6	**60 eye/vine**	150	30
7		150	60
8		300	30
9		300	60

*** Control treatment received the normal fertilization used in the farm (60 units of nitrogen, 200 kg of super phosphate during the seasons). Also, these amounts were added to all vines under study during the season.**

Nitrogen as ammonium nitrate and phosphorus as superphosphate per vine were added according to the farm fertilizer program. Nitrogen fertilization at 60 units was applied in the soil as ammonium nitrate (33.5 %) and added in three equal doses (20 units of nitrogen/fed.) after bud burst, fruit set and after harvesting time. Whereas, superphosphate (15.5 % P_2O_5) was applied at (200 kg/fed.) in one dose before bud burst stage during the two seasons of the study. Most growers under this area add potassium at very low amount but not adding magnesium through their fertilization program.

The following parameters were undertaken :

1-Percentage of bud burst : The percentage of bud burst was estimated by counting the number of bursted buds and expressed as a percentage from the total number of buds left on the vine according to the following equation:

$$\text{Bursted buds \%} = \frac{\text{No. of bursted buds/vine}}{\text{Total No. of buds}} \times 100$$

2- Percentage of bud fertility : It was calculated by recording the number of clusters then expressed as a percentage from the total number of buds/vine according to the following equation:

$$\text{Bud fertility \%} = \frac{\text{No. of clusters / vine}}{\text{Total No. of buds}} \times 100$$

3- Yield per vine (kg).
4- Soluble solids/vine (SS/vine) was estimated according to Shaulis & Steel (1969) as the following equation :

SS/vine (kg) = soluble solids % x yield per vine (kg) x 0.01.

5- Number of clusters per vine.
6- Cluster weight (g).
7- Berry weight (g).
8-Soluble solids content (SSC %) was determined by using Carlzeiss hand refractometer.
9- Titratable acidity % was expressed as g tartaric acid/100 ml juice according to (AOAC, 1980).
10- SSC/acid ratio.
11- Total anthocyanin in berry skin was measured at 520 μm using spectro photometer according to Hsia *et al.* (1965).

Statistical analysis :

The obtained data were subjected to analysis of variance for the experiment in complete randomized block design according to Snedecor & Cochran (1990) and means were compared using LSD at 5 % level.

RESULTS AND DISCUSSION

I- Effect of potassium and magnesium fertilization on bud behavior :
Bud burst % :

Data presented in Table (3) showed that both potassium and magnesium fertilization under leaving 40 or 60 eye/vine increased bud burst percentage than the control during the two seasons of the study. Furthermore, potassium fertilization at 300 g with 30 g magnesium sulphate per vine under leaving 40 eye/vine gave the highest bud burst percentage than those obtained under leaving 60 eye/vine. Whereas, potassium application at 150 g with 30 g magnesium sulphate under leaving 60 eye/vine gave lower bud burst percentage than the other treatments used but also higher than the control.

In this respect, Rizk & Rizk (1994) presented that Mg application at 5-30 g/vine increased the percent of bud burst and fruitfull buds of Thompson seedless grape than the control. Moreover, Ibrahim (2002) mentioned that potassium application at 213 g/vine as potassium sulphate was very effective in increasing the percentage of bursted, fruiting buds and fertility coefficient of Flame seedless grapevine.

Table (3) : Effect of potassium and magnesium fertilization on bud burst and fertility of Flame seedless grape.

Treatment			Bud burst %			Bud fertility %		
			2007	2008	Mean	2007	2008	Mean
Control			67.6	69.2	68.4	48.6	52.2	50.4
40 eye/vine	K_2O 150 g	Mg(30)	78.1	79.5	78.8	58.9	63.3	61.1
		Mg(60)	80.2	81.2	80.7	65.4	66.7	66.1
	K_2O 300 g	Mg(30)	82.9	84.2	83.6	62.9	61.4	62.2
		Mg(60)	81.2	82.4	81.8	67.6	71.3	69.5
60 eye/vine	K_2O 150 g	Mg(30)	73.2	74.6	73.9	54.0	57.1	55.6
		Mg(60)	75.7	76.0	75.9	52.5	54.4	53.5
	K_2O 300 g	Mg(30)	76.3	77.5	76.9	54.6	55.0	54.8
		Mg(60)	78.2	80.6	79.4	57.4	59.3	58.4
L.S.D at 5 %			2.63	2.03	---	3.69	4.42	---

Whereas, Awad (2003) found that the percentages of bud burst and bud fertility were decreased by increasing the number of buds per cane. Similarly, Soliman (2004) mentioned that bud burst percentage was reduced by increasing the number of eyes per each cane. Since, leaving 8 canes with 14 eyes per each cane gave a lower value than leaving 10 or 12 eye/cane under the same number of canes.

Bud fertility % :

Concerning the effect of potassium and magnesium fertilization under leaving 40 or 60 eye/vine on bud fertility percentage, data in Table (3) revealed that all potassium fertilization levels with magnesium significantly increased bud fertility percentage than the control. In this respect, potassium fertilization at 300 g per vine with 60 g magnesium sulphate under leaving 40 eye/vine gave higher bud fertility than the other treatments. Yet, vines treated with potassium sulphate at 150 g with magnesium sulphate at 30g/vine under leaving 60 eye/vine gave lower bud fertility than those obtained from the other treatments but also higher than the control.

In this respect, Samra (2001) found that bud fertility was affected by number of buds that retained on the canes. Since, leaving 8 or 10 canes with 12 buds gave a higher bud fertility than leaving 14 or 16 buds on the cane of Crimson seedless grape. Also, Awad (2003) presented that Leaving 6, 8 or 10 canes with 14 eyes gave lower bud fertility than leaving 6, 8 or 10 canes with 12 eyes per cane.

Furthermore, Matter (2003) mentioned that both bud fertility and fruitfulness of Thompson seedless grape significantly increased by increasing the level of potassium fertilization. So, potassium fertilization at 150 g/vine gave higher bud fertility and fruitfulness than 50 or 100 g/vine. Moreover, Omar & Abdelall (2005) presented that N+K fertilization at 40 kg N/fed. + 100 or 150 kg K_2O/fed. significantly increased bud fertility of Crimson seedless grapevine.

II. Effect of potassium and magnesium fertilization on yield and SS/vine:
Yield per vine (kg) :

Data from Table (4) cleared that yield per vine was higher under leaving 60 eye/vine than those obtained under leaving 40 eye/vine. In this respect, Soliman (2004) mentioned that both yield per vine and per feddan was increased by increasing bud load per vine. Since, leaving 8 canes with 14 eye resulted in higher yield per vine and per feddan than leaving 10 or 12 eye/cane. Also, Keller *et al*. (2004) found that yield generally correlated positively with the number of eyes retained at pruning and number of clusters per shoot. So, leaving 130 eye/vine yielded considerably less than 260 eye/vine.

Table (4) : Effect of potassium and magnesium fertilization on yield and SS/vine of Flame seedless grape.

Treatment			Yield per vine (kg)			SS/vine (kg)		
			2007	2008	Mean	2007	2008	Mean
Control			11.81	12.44	12.13	1.82	1.99	1.91
40 eye/vine	K_2O 150 g	Mg(30)	13.02	14.59	13.81	2.24	2.63	2.44
		Mg(60)	14.71	14.83	14.77	2.47	2.57	2.52
	K_2O 300 g	Mg(30)	13.81	15.08	14.45	2.43	2.77	2.60
		Mg(60)	14.24	15.56	14.90	2.42	2.71	2.57
60 eye/vine	K_2O 150 g	Mg(30)	16.69	18.45	17.57	2.67	3.14	2.91
		Mg(60)	16.11	17.02	16.59	2.55	2.84	2.70
	K_2O 300 g	Mg(30)	16.49	17.51	17.00	2.75	3.03	2.89
		Mg(60)	18.12	18.31	18.22	2.94	3.13	3.04
L.S.D at 5 %			1.09	1.44	---	0.17	0.10	---

Furthermore, potassium fertilization at 300 g with magnesium sulphate at 60 g/vine under leaving 60 eye/vine gave higher yield/vine than those obtained under leaving 40 eye/vine. Whereas, potassium fertilization at 150 g with magnesium sulphate at 30 g per vine under leaving 40 eye/vine presented a lower yield per vine than the other treatments used and higher than the control.

Similar results were reported by Rizk-Alla *et al*. (2006) mentioned that Mg-EDTA at 0.3 % resulted in the highest values of number of clusters per vine and bud fertility coefficient, also, gave the highest yield/vine in two seasons of study. Also, Samra *et al*. (2007) found that yield per vine (kg) and per feddan (ton) was significantly increased by increasing the amount of potassium fertilization. Since, potassium fertilization at 150 g/vine gave significantly higher yield of Thompson seedless grape per vine and per feddan than using 50 or 100 g per vine.

Soluble solids/vine (kg) :

These parameters were estimated to be an index to vine productivity. In this respect, data from Table (4) indicated that all potassium and magnesium fertilization under both 40 or 60 eye/vine significantly increased the SS/vine than the control during both seasons. Since, potassium and magnesium fertilization increased both yield/vine (kg) and SSC values in berry juice. With regard to the effect of various treatments used, the data also reveal that potassium fertilization at 300 g with magnesium sulphate at 60 g/vine under leaving 60 eye/vine gave higher pronounced effect in this respect.

Whereas, potassium fertilization at 150 g with magnesium sulphate at 30 g/vine under leaving 40 eye/vine gave a lower SS/vine than the other treatments. The data go in line with Samra (2001) who found that SS/vine (kg) increased by increasing the yield per vine (kg) and soluble solids in berry juice. Since, there is a good relation between these parameters (SS/vine and vine productivity). Also, Mahfouz (2007) mentioned that SS/vine (kg) of Red Roumi grape was affected by the number of eyes/vine. Since, leaving 80 eye/vine gave a somewhat increment of SS/vine than those obtained from leaving 60 eye/vine.

Effect of potassium and magnesium fertilization on cluster and berry quality:

Number of clusters per vine :

Data presented in Table (5) showed that potassium fertilization at 300 g potassium sulphate with 60 g magnesium sulphate under leaving 40 or 60 eye/vine gave higher number of clusters/vine during both seasons of study. Furthermore, potassium fertilization at 300 g with 60 g magnesium sulphate per vine under leaving 60 eye/vine gave the highest number of clusters than those obtained under leaving 60 eye/vine. In this respect, Soliman (2004) mentioned that number of clusters per vine was increased significantly by increasing both number of canes and number of eyes per each cane. Moreover, Shoeib (2004) presented that increasing potassium sulphate levels from 0.0 to 300 kg/fed. resulted in a gradual increase in total and marketable yield.

Table (5): Effect of potassium and magnesium fertilization on No. of clusters, cluster and berry weight of Flame seedless grape.

Treatment			No. of clusters per vine			Cluster weight (g)			Berry weight (g)		
			2007	2008	Mean	2007	2008	Mean	2007	2008	Mean
Control			25.5	26.0	25.8	463.3	478.6	471.0	2.73	3.12	2.93
40 eye/vine	K_2O 150g	Mg(30)	23.5	25.3	24.4	553.1	577.0	565.1	3.46	3.52	3.49
		Mg(60)	26.2	26.7	26.5	561.6	555.5	558.6	3.56	3.60	3.58
	K_2O 300g	Mg(30)	25.2	24.6	24.9	548.6	613.2	580.9	3.38	3.57	3.48
		Mg(60)	27.0	28.5	27.8	527.4	546.1	536.8	3.48	3.59	3.54
60 eye/vine	K_2O 150g	Mg(30)	32.4	34.3	33.4	515.3	538.6	527.0	3.05	3.54	3.30
		Mg(60)	31.5	32.6	32.1	511.4	522.0	516.7	3.36	3.49	3.43
	K_2O 300 g	Mg(30)	32.7	33.0	32.9	504.0	530.5	517.3	3.20	3.35	3.28
		Mg(60)	34.4	35.6	35.0	526.8	514.2	520.5	3.44	3.50	3.47
L.S.D at 5 %			1.33	2.15	---	13.46	15.74	---	0.14	0.09	---

Cluster weight :

Data from Table (5) show clearly that cluster weight was affected by the number of eyes leaving on the vine. Since, leaving 40 eye/vine presented a higher cluster weight than leaving 60 eye/vine under the different levels of potassium and magnesium fertilization. The data also reveal that potassium fertilization at 300 g with 30 g magnesium sulphate per vine under leaving 40 eye/vine gave higher cluster weight than the other levels of potassium or magnesium fertilization under leaving 60 eye/vine. In this respect, Awad (2003) mentioned that average cluster weight was reduced by increasing the number of eyes of Thompson seedless grapes. Also, Mahfouz (2007) mentioned that average cluster weight was almost higher from vines which leaving 60 eye than those obtained from leaving 80 eye/vine in Red Roumi grape.

On the other hand, potassium fertilization at 150 g potassium sulphate with magnesium sulphate at 60 g per vine under leaving 60 eye/vine gave lower cluster weight than the other treatments used. Similarly, Omar and Abdelall (2005) found that potassium fertilization at 100 kg/feddan increased both cluster and berry weight than those fertilized with 50 or 150 kg/feddan.

Berry weight (g) :

It is obvious from Table (5) that berry weight significantly increased with potassium and magnesium fertilization under leaving 40 or 60 eye/vine. Also, potassium fertilization at 150 g potassium sulphate with 60 g magnesium sulphate under leaving 40 eye/vine presented higher berry weight than the other treatments used. Whereas, potassium fertilization at 300 g/vine with magnesium sulphate at 30 g/vine gave a lower berry weight than the other levels of fertilization under both levels of pruning.

Likewise, EL-Baz *et al*. (2003) found that, using potassium sulphate at 50-350 g/vine gave a significant increase in both cluster and berry weight. Since, potassium application at 350 g K_2SO_4/vine gave the highest berry weight. In this respect, potassium application increased cluster weight by 46.9 and 40.5 %, whereas, berry weight increased by 34.2 and 25.6 % over the control.

Soluble solids content (SSC) % :

It is clear from Table (6) that potassium and magnesium fertilization increased the percentage of soluble solids content in berry juice under leaving 40 or 60 eye/vine. Moreover, the percent of SSC in berry juice was higher with both potassium and magnesium fertilization by leaving 40 eye/vine than leaving 60 eye/vine under the same levels of fertilization. Also, Shen & Lee (1993) reported that potassium fertilization significantly increased the percent of SSC by increasing the amount of K_2SO_4 application.

The data also presented that potassium fertilization at 150 g or 300 g with magnesium sulphate at 30 g per vine presented higher values than the same levels of potassium with 60 g/vine magnesium sulphate. Furthermore, Matter (2003) presented that soluble solids content (SSC %) in berry juice of Thompson Seedless grape was gradually increased by increasing the amount of potassium fertilization. So, potassium fertilization at 100 or 150 g/vine significantly increased the SSC % than potassium fertilization at 50 g/vine. Also, EL-Baz *et al*. (2003) mentioned that SSC in berry juice showed a significant increase than the control. So, the highest rate of potassium (350 g K_2SO_4/vine) gave the most significant increase in SSC % in berry juice. This increase reached to 19.6 % and 18.34 % over the control during both seasons of the study, respectively.

Table (6): Effect of potassium and magnesium fertilization on SSC, total acidity and SS/acid ratio of Flame Seedless grape.

Treatment			SSC %			Total acidity %		
			2007	2008	Mean	2007	2008	Mean
Control			15.4	16.0	15.7	0.610	0.598	0.604
40 eye/vine	K_2O 150g	Mg(30)	17.2	18.0	17.6	0.578	0.586	0.582
		Mg(60)	16.8	17.3	17.1	0.570	0.561	0.566
	K_2O 300g	Mg(30)	17.6	18.4	18.0	0.562	0.555	0.559
		Mg(60)	17.0	17.4	17.2	0.541	0.516	0.529
60 eye/vine	K_2O 150g	Mg(30)	16.0	17.0	16.5	0.580	0.567	0.574
		Mg(60)	15.8	16.7	16.3	0.602	0.593	0.598
	K_2O 300g	Mg(30)	16.7	17.3	17.0	0.552	0.573	0.563
		Mg(60)	16.2	17.1	16.7	0.558	0.552	0.555
L.S.D at 5 %			0.44	0.13	---	0.02	0.03	---

Total acidity :

Data from Table (6) reveal that total acidity in berry juice was reduced with potassium and magnesium fertilization under leaving 40 or 60 eye/vine. Since, the values of total acidity for all treatments were almost lower than the control during the two seasons.

Furthermore, potassium fertilization at 300 g with magnesium sulphate at 60 g/vine gave lower percentage of total acidity in berry juice than the other treatments or the control. Thus, these values of various treatments were almost lower than the control. In this respect, EL-Sese *et al*. (1988) noticed that total titrable acidity in berry juice of Thompson seedless grape decreased with increasing the level of potassium fertilization. These findings could be due to the reduction in tartaric acid which might be changed to potassium tartarate. Furthermore, Matter (2003) presented that total acidity in berry juice of Thompson Seedless grape was reduced by increasing the level of potassium fertilization. In this respect, potassium fertilization at 150 g/vine produced lower total acidity than potassium fertilization at 100 or 50 g/vine.

Soluble solids/acid ratio :

Data from Table (7) reveal that SSC/acid ratio in berry juice significantly increased by potassium and magnesium fertilization. In this respect, potassium fertilization at 300 g/vine with 30 or 60 g/vine of magnesium sulphate gave a higher value of SS/acid ratio in berry juice than using 150 g/vine of potassium sulphate under leaving 40 or 60 eye/vine. That is may be due to that these treatments increased content of soluble solids with reducing the values of total acidity in berry juice. Whereas, potassium fertilization at 150 g/vine with 30 or 60 g/vine magnesium sulphate gave a lower values of SSC/acid ratio. Furthermore, potassium sulphate at 150 g/vine with 60 g/vine magnesium sulphate gave lower values of SSC/acid ratio than the other levels of potassium and magnesium fertilization, but almost higher than those obtained from the control. Similarly, Dhillon *et al*.

(1999) found that SSC/acid ratio was increased with increasing K rate, however, higher doses of K showed better SSC/acid ratio. Furthermore, Shoeib (2004) found that there was a gradual promotion of total soluble solids percentage and a reduction in total acidity with increasing potassium sulphate occurred on vines fertilized with 300 kg potassium sulphate/fed. Moreover, Hassan *et al*. (2007) mentioned that the higher level of potassium fertilization (150 or 225 g/vine) with magnesium sulphate at 60 g per vine increased both SSC and SSC/acid ratio in berry juice.

Berry colour :

It is clear from Table (7) that potassium and magnesium fertilization under leaving 40 or 60 eye/vine significantly increased anthocyanin content than the control. Yet, these treatments under leaving 40 eye/vine were almost higher than those obtained under leaving 60 eye/vine. So, potassium fertilization at 300 g with magnesium sulphate at 30 g per vine under leaving 40 eye/vine gave higher value of anthocyanin during both seasons. Whereas, potassium fertilization at 150 g/vine with magnesium sulphate at 30 or 60 g/vine gave lower anthocyanin content in this respect.

In this respect, Abdel-Mohsen (2003) found that Potassium application positively influenced the development and accumulation of anthocyanin pigment in berry skin. The increase in anthocyanin was proportional to the increase in K-percentage in each NPK ratio which reflects the position effect of K^+ on increasing the accumulation of anthocyanin which indeed due to the role of K^+ in improving sugar content.

Table (7): Effect of potassium and magnesium fertilization on SS/acid ratio and anthocyanin content of Flame Seedless grape.

Treatment			SS/acid ratio			Anthocyanin content O.D. *		
			2007	2008	Mean	2007	2008	Mean
Control			25.2	26.8	26.0	0.512	0.554	0.533
40 eye/vine	K_2O 150g	Mg(30)	29.8	30.7	30.2	0.710	0.803	0.757
		Mg(60)	29.5	30.8	30.2	0.744	0.783	0.764
	K_2O 300g	Mg(30)	31.3	33.2	32.2	0.800	0.895	0.848
		Mg(60)	31.4	33.7	32.6	0.753	0.826	0.790
60 eye/vine	K_2O 150g	Mg(30)	27.6	30.0	28.8	0.640	0.669	0.655
		Mg(60)	26.2	28.2	27.2	0.659	0.704	0.682
	K_2O 300g	Mg(30)	30.3	30.2	30.2	0.725	0.667	0.696
		Mg(60)	29.0	31.0	30.0	0.685	0.765	0.725
L.S.D at 5 %			2.88	1.55	---	0.01	0.01	---

*** Optical density.**

Thus, Omar & Abdelall (2005) found that anthocyanin responded positively to N+K application. So, higher anthocyanin content in berry skin was observed as a result of adding 40 kg N/feddan + 50, 100 or 150 kg K_2O/feddan. This presented the importance of potassium fertilization to increase anthocyanin content. It seems that K activates some enzymes associated with the biosynthesis of anthocyanin.

Similarly, Keller *et al*. (2004) reported that fruit of 130 nodes/vine accumulated sugar and color more rapidly than fruit on 260 nodes/vine treatment. Also, Mahfouz (2007) mentioned that anthocyanin content in berry skin gave the highest values from vines which leaving 60 eye than those obtained from leaving 80 eye/vine in Red Roumi grape.

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دراسات على تأثير التسميد بالبوتاسيوم والماغنسيوم وحمولة البراعم على إنتاجية العنب الفليم سيدلس

محمود إبراهيم القاضي ، نبيل رشاد السيد سمره و أحمد سيف الدين سليمان الشحات
قسم الفاكهة – كلية الزراعة – جامعة المنصورة

أجريت هذه التجربة خلال موسمي ٢٠٠٧ - ٢٠٠٨ لدراسة تأثير التسميد الأرضي بالبوتاسيوم والماغنسيوم تحت مستويين من التقليم ٤٠ عين أو ٦٠ عين/كرمة على سلوك البراعم والمحصول وجودة الحبات في عنب الفليم سيدلس. تم إضافة البوتاسيوم في صورة سلفات بوتاسيوم في مستويين (١٥٠ ، ٣٠٠ جرام/كرمة) ، وإضافة الماغنسيوم في صورة سلفات ماغنسيوم بمعدل (٣٠ ، ٦٠ جرام/كرمة).

أظهرت النتائج أن التسميد بالبوتاسيوم والماغنسيوم تحت مستوى تقليم ٤٠ أو ٦٠ عين للكرمة أدى لزيادة نسبة تفتح وخصوبة البراعم مقارنة بالكنترول. بالإضافة لذلك فإن التسميد بالبوتاسيوم عند ٣٠٠ جرام/كرمة مع سلفات الماغنسيوم عند ٣٠ جرام/كرمة تحت مستوى تقليم ٤٠ عين للكرمة أعطى أعلى نسبة تفتح للبراعم مقارنة بالكرمات تحت مستوى تقليم ٦٠ عين للكرمة. أيضاً أظهرت النتائج أن التسميد بالبوتاسيوم عند ٣٠٠ جرام مع سلفات الماغسيوم عند ٦٠ جرام/كرمة تحت مستوى تقليم ٦٠ عين للكرمة أعطى أعلى عدد للعناقيد ومحصول للكرمة مقارنة بالكرمات تحت مستوى تقليم ٤٠ عين للكرمة. إضافة لذلك فإن التسميد بالبوتاسيوم عند ٣٠٠ جرام مع ٣٠ جرام سلفات ماغنسيوم عند مستوى تقليم ٤٠ عين للكرمة أعطى أعلى وزن للحبات والعناقيد والمواد الصلبة الذائبة والمواد الصلبة الذائبة ونسبتها إلى الحموضة ومحتوى الأنثوسيانين مقارنة بمستويات البوتاسيوم والماغنسيوم الأخرى تحت مستوى تقليم ٦٠ عين للكرمة.

قام بتحكيم البحث

أ.د / محمد صلاح سيف البرعى	**كلية الزراعة – جامعة المنصورة**
أ.د / فيصل فاضل أحمد حسن	**كلية الزراعة – جامعة المنيا**