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EFFECT OF FOLIAR APPLICATION OF MINERAL OR CHELATED CALCIUM AND MAGNESIUM ON THOMPSON SEEDLESS GRAPEVINES GROWN IN A SANDY SOIL:

A- Vegetative growth, nutritional status and yield

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ABSTRACT

This study was carried out throughout two successive seasons (2003 & 2004) at El – Sadat region, Menoufeya Governorate on 10 – year – old Thompson Seedless grapevines Quadrilateral cordon shaped using the spanish Parron trellising system. The trees were grown in a sandy soil and the drip system was used for irrigation. This investigation aimed to study the effect of the foliar application of mineral or chelated Ca and Mg on the vegetative growth, chemical composition of leaves and cane and yield components of Thompson Seedless grapevines. The vines received three foliar sprays in each season, i.e. at the beginning of vegetative growth (2nd week of March), immediately after fruit set (1st week of May) and 4 weeks later (1st week of June). The vines were subjected to thirteen treatments: control (water), Ca Cl_2 at 0.5%, 1% and 2%, Ca – EDTA at 0.1%, 0.2% and 0.3%, Mg SO_4 at.0.5%, 1% and 2%, Mg – EDTA at 0.1%, 0.2% and 0.3%. The results indicated that, all treatments significantly increased the shoot length compared to the control. Mg – EDTA at 0.3% significantly gave the highest length of the new shoot, number of leaves / shoot, leaf area, cane thickness, number of clusters / vine, bud fertility coefficient and yield / vine followed by Ca – EDTA at 0.3%. However, Mg – EDTA at 0.3% significantly increased N, K and Mg levels in the leaf petiole, leaf pigments and total content of carbohydrates in the cane. Calcium treatments either in the mineral or the chelated form significantly increased applied petiole Ca content. Significant increases were also obtained in leaf petioles in chelated calcium at 0.3%. Mg – EDTA and Ca – EDTA at 0.3% treatments enhanced the weight of pruning wood. According to the obtained results, it can be recommended to spray calcium and magnesium in the chelated form at 0.3% on Thompson Seedless grapevines three times in each season. i.e. at the beginning of vegetative growth (2nd week of March), immediately after fruit set (1st week of May) and 4 weeks later (1st week of June), to improve the vegetative growth, and nutritional status and to raise the yield per vine.

INTRODUCTION

The importance of grape as an agricultural crop in general or as a fruit crop in particular, is doubtless when its cultivated area and its production are concerned. It is considered as the first major fruit crop all over the world. Thompson Seedless is still one of the leading table grape cultivars in the world and Egypt as well. Foliar fertilization is an important method for improving vegetative growth and production through a better understanding of the physiological behavior of the vine and its response to various horticultural practices. Essential elements, either macro or micro play a great role in this respect. Thus, nutrition seems to be the main factor influencing growth and development of the plant (Bergman *et al.*, 1960). Many elements such as calcium (Ca^{++}) and magnesium (Mg^{++}) play an important role for improving vegetative growth, yield and nutritional status of grapevines (Wolf *et al.*, 1983; Hansen & Munns, 1988; Kilany, 1992; Rizk and Rizk, 1994 a, b and Spiers & Braswell, 1994; Mg^{++} activates many plant enzymes required in growth process and it is a component part of the chlorophyll molecule and thus essential for photosynthesis (Bidwell, 1979).

Consequently, the present investigation was designed to study the effect of foliar sprays of mineral or chelated calcium (Ca^{++}) and magnesium (Mg^{++}) on growth vigor and production of Thompson Seedless grapevines grown in a sandy soil.

MATERIALS AND METHODS

This experiment was carried out during 2003 and 2004 seasons in a private vineyard at Sadat city, Menoufeya Governorate on Thompson Seedless grapevines. Vines of ten years old, grown in a sandy soil under drip irrigation system, spaced at (3 x 3) meters. The vines were Quadrilateral cordon shaped and trellised by the Spanish Parron system. Vines were pruned at the 3rd week of Jan. in 2003 and at last week of December in 2004 season, at the length of 12 buds / cane and a load of 72 buds / vine. Physical and chemical properties of the experimental soil (according to Wild *et al.*, 1985) are shown in Table (1):

Table (1): Physical and chemical analysis of the experimental soil.

Physical characters	%	Chemical characters	%
Field capacity	11.8	Ca Co_3	12.9
Available water	1.78	Organic matter	0.25
Wilting point	4.32	Water pti (1:25)	8.9
Coarse sand	35	Ec (mmhos / cm)	0.12
Fine sand	51	ESP	6.95
Silt	8	Ca	0.15
Clay	6	Mg	0.13
		Na	0.33
		K	0.28
		HCo_3	0.39
		Cl	0.48

This study aimed to throw some light on the effect of foliar application of mineral or chelated calcium (ca^{++}) and magnesium (Mg^{++}) sprayed three times in each season, i.e. at the beginning of vegetative growth (2nd week of March, immediately after fruit set (1st week of May) and 4 weeks later (1st week of June). The completely randomized block design was used in this experiment with three replicates in each treatment, and three vines / replicate. The following treatments were applied:

1- Control (vines sprayed with water).
2- $CaCl_2$ at conc. 0.5 %.
3- $CaCl_2$ at conc. 0.1 %.
4- $CaCl_2$ at conc. 0.2 %.
5- Ca – EDTA at conc. 0.1 %.

6- Ca – EDTA at conc. 0.2 %.
7- Ca – EDTA at conc. 0.3 %.
8- Mg SO_4 at conc. 0.5 %.
9- Mg SO_4 at conc. 1 %.
10- Mg SO_4 at conc. 2 %.
11- Mg – EDTA at conc. 0.1 %.
12- Mg – EDTA at conc. 0.2 %.
13- Mg – EDTA at conc. 0.3 %.

Magnesium sulphate (Mg SO_4 .7 H_2O , 9.8 % Mg), calcium chloride , (Ca Cl_2 , 8 % ca), ca – EDTA (10 % ca in the form of calcium ethylene diamine tetra acetate), Mg – EDTA (12 % Mg in the form of magnesium ethylene diamine tetra acetate). All vines received the regular horticultural practices applied in the vineyard except those included in the experimental work. The following determinations were carried out:

1.Vegetative growth:

At the first week of September, the following measurements were taken:

- Length of the new shoots (cm) was recorded by measuring the length of ten of the current growing shoots.
- Number of leaves per current season's shoot was counted.
- Cane thickness was recorded by measuring thickness of the basal internode of ten shoots per vine using a vernier caliper.
- The average leaf area was estimated by picking twenty mature leaves from the middle part of the shoots during the first week of July. Leaf area was measured using the leaf area meter.
- Weight of one year-old pruning wood was recorded at the pruning time in the 3^{rd} week of Jan. in 2003 and in the last week of December in 2004 season.

2 .Yield components:

- Bud fertility coefficient was calculated according to the following equation outlined by (Kamel *et al.*, 1965) :

$$\frac{\textbf{Number of clusters / vine}}{\textbf{Bud load / vine}}$$

Average number of clusters / vine and weight of yield / vine were determined at harvest time (last week of June) for both seasons.

3- Leaf mineral content:

- Leaf mineral content of (N , P , K , Ca and Mg) were determined in the leaf petioles opposite to the flowering clusters two weeks after the last spraying date. Nitrogen content was determined using the modified microkjeldahl method (Pregl, 1945). Phosphorus and magnesium contents were colorimetrically estimated according to the method of Jackson (1958). Potassium and calcium were determined photometrically according to Brown and Lilliland (1946).

4- Chlorophyll A and B were determined in the fresh leaf samples using Carl – zeis spectro photometer according to Wettstein (1957).

5- Total carbohydrates were determined in the Canes collected through the first week of December in both seasons according to the method which described by Smith *et al.*, (1956). Samples were taken from the basal part of the cane.

The obtained data were statistically analyzed according to Snedecor and Cochran (1972) using Duncanś test.

RESULTS AND DISCUSSION

1. Vegetative growth:

1.1 New shoot length:

It is clear from data of Table (2) that all treatments significantly increased the shoot length compared to the control. Mg – EDTA at 0.3% gave the highest new shoot length, followed by Mg – EDTA at 0.2%. The mineral form of Ca gave the lowest values of shoot length. However, control vines were found to have the shortest shoots. The other treatments recorded in between values in this respect. These results were confirmed for both seasons of the study. Fig (1) showed a strong positive correlation (R = 1.0 & 0.996) between concentrations of Mg – EDTA and shoot length. .The positive effect of Mg – EDTA application was previously mentioned by (Wolf *et al.*, 1983; Kilany, 1992; Rizk and Rizk, 1994 a and Ahmed, 2000) who found that, magnesium treatments as foliar application promoted the linear shoot growth.

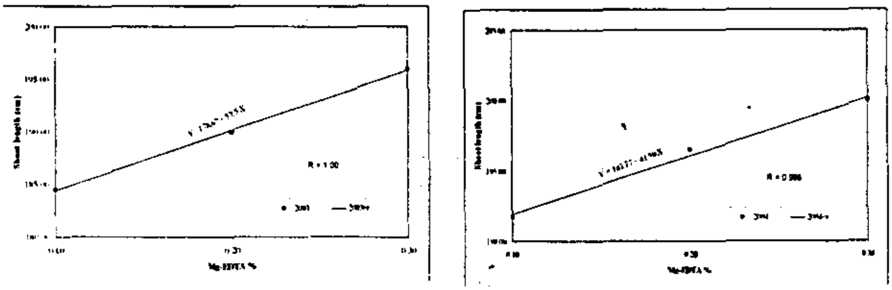


Fig (1): Relationship between concentrations of Mg – EDTA and shoot length.

Table (2): Effect of foliar mineral or chelated calcium and magnesium application on vegetative growth of Thompson Seedless grapevines at seasons (2003 & 2004).

Treatments	Shoot length (cm)		Number of Leaves/shoot		Cane thick-ness (cm)		Leaf area (cm^2)		Weight of pruning (kg)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Control	150.0 h	157.2 i	16.0 g	16.5 g	0.70 d	0.77 g	155.0 i	159.0 f	2.9 e	4.0 f
Ca Cl_2 0.5%	158.2 g	162.0 h	16.7 fg	18.0 f	0.72 d	0.78 g	160.0 h	163.0 ef	3.5 d	4.8 e
Ca Cl_2 1%	160.2 fg	165.0 h	17.0 efg	18.3 ef	0.73 d	0.81 fg	162.0 gh	163.0 ef	3.6 d	5.0 de
Ca Cl_2 2%	167.7 e	169.3 g	17.0 efg	18.5 ef	0.74 d	0.82 fg	164.2 fgh	165.0 ef	3.9 bc	5.3 cd
Ca – EDTA 0.1%	162.1 fg	170.0 g	17.3 ef	18.6 ef	0.80 c	0.86 ef	165.0 efg	168.2 d	5.1 a	5.8 ab
Ca – EDTA 0.2%	165.1 ef	173.2 f	17.7 ef	18.8 def	0.81 c	0.87 ef	166.1 efg	172.0 de	5.1 a	5.8 ab
Ca – EDTA 0.3%	170.0 e	175.0 ef	19.0 cd	19.0 def	0.83 c	0.89 de	167.1 ef	175.0 d	5.2 a	6.0 a
Mg So_4 0.5%	169.2 e	176.0 ef	18.0 de	19.3 de	0.81 c	0.90 de	170.0 e	180.1 d	3.7 cd	5.3 cd
Mg So_4 1%	175.7 d	177.7 e	19.3 c	20.0 cd	0.83 c	0.92 de	172.2 ef	187.3 d	3.9 bc	5.4 bcd
Mg So_4 2%	181.5 c	185.1 d	20.7 b	21.2 bc	0.85 c	0.95 cd	175.0 d	189.4 c	4.0 b	5.5 bc
Mg – EDTA 0.1%	184.5 c	191.7 c	18.9 cd	20.0 cd	0.86 c	1.00 bc	180.3 c	192.0 c	5.1 a	5.8 ab
Mg – EDTA 0.2%	190.0 b	196.5 b	19.9 bc	21.3 b	0.92 b	1.05 b	191.6 b	206.0 b	5.2 a	6.0 a
Mg – EDTA 0.3%	196.0 a	200.0 a	22.0 a	22.6 a	0.98 a	1.20 a	210.0 a	215.0 a	5.3 a	6.2 a

1.2 Number of leaves per shoot:

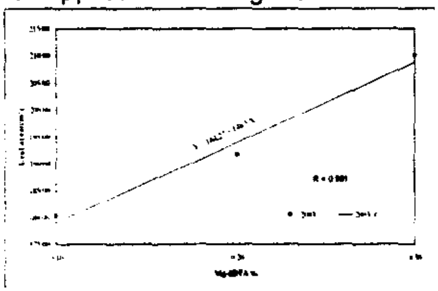
As shown in Table (2) Mg – EDTA at 0.3% gave the highest number of leaves per shoot, followed by Mg – EDTA at 0.2% in both seasons. Shoots of check vines had the least number of leaves. The other tested treatments indicated intermediate values in both seasons.

1.3 Cane thickness:

It is obvious from data of Table (2) that, the chelated magnesium at 0.3% statistically increased thickness of the basal internode of shoot. The other fertilization treatments were found to increase significantly the shoot basal diameter as compared to the control and foliar sprays of Ca Cl_2 at all concentrations, but the increase was less than that of Mg – EDTA at 0.3%. In accordance, Ahmed, (2000) concluded that, application of Mg – EDTA increased cane thickness.

1.4 Leaf area:

As shown in Table (2) treatment of chelated Mg at 0.3% followed by 0.2% significantly increased the leaf area in both seasons of the study. The smallest leaf area resulted from the control. In both seasons and the mineral form of Ca in the second season only. The other treatments had in between values. Fig (2) illustrates the presence of a strong positive correlation (R = 0.991 & 0.992) between concentrations of Mg – EDTA and leaf area. Similarly, Kilany, (1992); Rizk and Rizk, (1994) and Ahmed, (2000), achieved an increase in leaf area of Thompson Seedless grapevines by either foliar or soil application of magnesium.



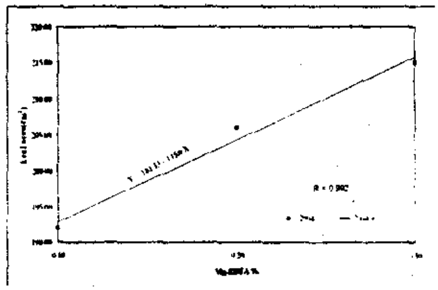


Fig (2): Relationship between concentrations of Mg – EDTA and leaf area.

1.5 Pruning wood weight:

Data of Table (2) obviously reveal that, treatments of Mg – EDTA and Ca – EDTA at all tested concentrations greatly increased the weight of pruning wood. Mineral magnesium and calcium treatments also increased of prunings weight. Control vines had the lowest values of this estimate. These results proved that all nutritional treatments had increased the growth vigor of the treated grapevines and consequently the weight of pruning wood of these vines. These results are in line with those obtained by Rizk and Rizk (1994 a, b); Ahmed, (2000) and Marwad *et al.*, (2001)

2. Yield components:

2.1 Number of clusters per vine & bud fertility coefficient:

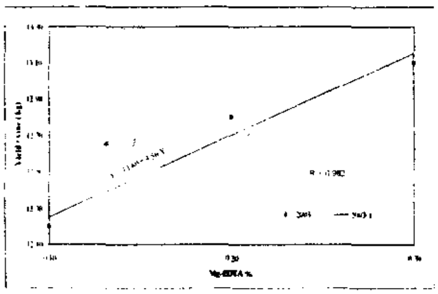
Data illustrated in Table (3) disclosed that, in the first season there were no significant differences between the treatments as far as number of clusters per vine and bud fertility coefficient are concerned. In the second season Mg – EDTA at 0.3% resulted in the highest values of number of clusters per vine and bud fertility coefficient, followed by Ca – EDTA at 0.3%. On the other hand, the least values of number of clusters / vine resulted from the control and the mineral form of Ca but the least values of bud fertility coefficient resulted from the control only.

2.2 Yield / vine:

Table (3) indicates the effect of tested treatments on yield per vine. The data show that chelated Mg at 0.3% gave statistically the highest yield / vine (13.1 & 13.9 kg / vine) in both seasons, respectively, followed by chelated Ca at 0.3% in both seasons. The other treatments considerably increased the yield / vine more than the control which had the lowest yield. These results may be due to the effect of chelated Mg on increasing bud fertility coefficient and number of clusters per vine, cluster weight and consequently the yield per vine. Fig (3) showed a strong positive correlation (R = 0.982 & 0.990) between concentrations of Mg – EDTA and shoot length. Similarly, Ahmed, (2000) mentioned that, yield / vine of Flame Seedless cv. was significantly increased as a result of chelated Mg application.

Table (3): Effect of foliar mineral or chelated calcium and magnesium application on Yield components of Thompson Seedless grapevines at seasons (2003 & 2004).

Treatments	Number of cluster/vines		Fertility Coefficient		Yield / vine (kg)	
	2003	2004	2003	2004	2003	2004
Control	26.0 a	25.7 c	0.36 a	0.36 c	9.8 i	10.1 h
Ca Cl_2 0.5%	26.3 a	26.0 c	0.37 a	0.36 c	10.1 h	10.3 g
Ca Cl_2 1%	26.7 a	26.0 c	0.37 a	0.36 c	10.8 g	10.8 f
Ca Cl_2 2%	26.7 a	26.0 c	0.37 a	0.36 c	11.3 f	11.6 e
Ca – EDTA 0.1%	27.0 a	27.0 b	0.38 a	0.38 b	12.4 c	12.7 d
Ca – EDTA 0.2%	27.0 a	27.1 b	0.38 a	0.38 b	12.4 c	13.0 c
Ca – EDTA 0.3%	27.0 a	27.2 ab	0.38 a	0.39 a	12.9 b	13.4 a
Mg So_4 0.5%	26.0 a	26.0 c	0.36 a	0.36 c	11.3 f	11.5 e
Mg So_4 1%	26.0 a	26.0 c	0.36 a	0.36 c	11.9 e	11.6 e
Mg So_4 2%	26.0 a	27.0 b	0.36 a	0.38 b	12.0 e	12.7 d
Mg – EDTA 0.1%	26.0 a	27.0 b	0.36 a	0.38 b	12.2 d	13.1 c
Mg – EDTA 0.2%	26.7 a	27.1 b	0.37 a	0.38 b	12.8 b	13.4 b
Mg – EDTA 0.3%	27.0 a	28.0 a	0.38 a	0.39 a	13.1 a	13.9 a



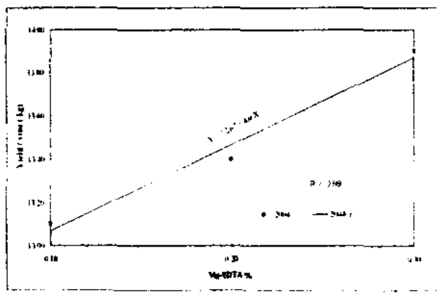


Fig (3): Relationship between concentrations of Mg – EDTA and yield / vine.

3. Leaf mineral content:

Table (4) illustrates the effect of tested treatments on N, P, K, Ca and Mg levels in leaf petioles of the tested vines in the two experimental seasons. It is obvious that the levels of N, K, and Mg were significantly higher in vines receiving foliar sprays with Mg – EDTA at 0.3% (1.9 & 1.5% N), (1.8 & 1.9% K) and (1.06 & 1.2% Mg) in both seasons, respectively in vines received the other treatments followed by the vines received Mg – EDTA at 0.2%. These results are in agreement with those obtained by Cook and Wheeler, (1978); Rizk and Rizk, (1994 a) and Ahmed, (2000). The increase in N & Mg (%) resulted from Mg – EDTA application which led to an increase in the chlorophyll content of leaved due to the fact that nitrogen and magnesium are components of chlorophyll molecules (Wareing and Phillips, 1973). The increase in leaf chlorophyll content results in an increase in photosynthetic activity and thus vegetative growth is improved. Calcium treatments either in the mineral or in the chelate form increased significantly petiole Ca content. The highest increase was observed in chelated calcium treatment, especially at its highest rate 0.3% (1.3 & 1.1% Ca) followed by Ca – EDTA at 0.2%. The obtained results are in line with those of Rizk and Rizk, (1994 b) and Ahmed, (2000). On the other hand, the lowest levels of the determined elements were observed in the control. Phosphors nutrient in the petiole tissues was the least of the determined nutrients to be influenced by the applied treatments. No significant differences could be detected between the tested treatments in any of the two experimental seasons. Thompson Seedless vines percentage of P nutrient did not approach its threshold of deficiency (Cook and Wheeler, 1978 and Cook *et al.*, 1983).

Table (4): Effect of foliar mineral or chelated calcium and magnesium application on N,P,K and Ca Content in leaf petioles of Thompson Seedless grapevines at seasons (2003 & 2004).

Treatments	N (%)		P (%)		K (%)		Ca (%)		Mg (%)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Control	0.90 f	0.83 g	0.3367 a	0.2667 a	1.06 f	1.07 e	0.50 f	0.55 f	0.73 e	0.75 g
Ca Cl_2 0.5%	0.93 f	0.85 fg	0.3367 a	0.2667 a	1.07 f	1.07 e	0.95 d	0.86 d	0.78 de	0.82 fg
Ca Cl_2 1%	0.95 f	0.86 fg	0.3400 a	0.2667 a	1.08 f	1.08 e	0.98 cd	0.90 cd	0.80 cde	0.83 efg
Ca Cl_2 2%	0.96 ef	0.88 efg	0.3333 a	0.2633 a	1.09 f	1.08 e	0.99 cd	0.90 cd	0.82 bcd	0.82 fg
Ca – EDTA 0.1%	1.10 e	0.90 def	0.3333 a	0.2633 a	1.10 f	1.10 e	1.05 bc	0.95 bc	0.82 bcd	0.83 efg
Ca – EDTA 0.2%	1.30 d	0.93 cde	0.3333 a	0.2633 a	1.20 ef	1.30 d	1.10 b	1.00 b	0.80 cde	0.84 def
Ca – EDTA 0.3%	1.50 c	0.95 cd	0.3367 a	0.2700 a	1.40 cd	1.50 c	1.30 a	1.10 a	0.80 cde	0.85 cdef
Mg So_4 0.5%	1.30 d	0.92 cde	0.3400 a	0.2667 a	1.20 ef	1.20 de	0.68 e	0.68 e	0.85 bcd	0.90 bcdef
Mg So_4 1%	1.40 cd	0.95 cd	0.3400 a	0.2667 a	1.30 de	1.30 d	0.68 e	0.67 e	0.86 bcd	0.91 bcde
Mg So_4 2%	1.50 c	0.96 c	0.3400 a	0.2633 a	1.50 bc	1.50 c	0.67 e	0.66 e	0.90 b	0.92 bcd
Mg – EDTA 0.1%	1.70 b	0.97 c	0.3400 a	0.2667 a	1.20 ef	1.60 bc	0.71 e	0.70 e	0.88 bc	0.93 bc
Mg – EDTA 0.2%	1.80 ab	1.10 b	0.3400 a	0.2667 a	1.60 b	1.70 b	0.70 e	0.69 e	0.90 b	0.95 b
Mg – EDTA 0.3%	1.90 a	1.50 a	0.3400 a	0.2667 a	1.80 a	1.90 a	0.68 e	0.67 e	1.06 a	1.20 a

4. Leaf pigments:

Data concerning leaf pigments (mg / g. F. w.) are presented in Table (5). It could be concluded that, chelated magnesium treatment at 0.3% gave the highest leaf pigments (chlorophyll a and b) contents followed by the applications of chelated magnesium at 0.2% and 0.1% in both seasons. The least values resulted from the control and $CaCl_2$ applications at 0.5% in the first season but in the second one, the least values resulted from the control and the two forms of Ca (mineral or chelated). These results could be interpreted via the role of magnesium as a part of the chlorophyll molecule. It is note worthy that chlorophyll (a) content surpassed chlorophyll (b). Fig (4 &5) illustrates the presence of a strong positive correlation between concentrations of Mg – EDTA and chlorophyll (a) and chlorophyll (b). In this regard, Bucher, (1978); Kilany, (1992) and Ahmed, (2000) mentioned that magnesium is required for chlorophyll formation.

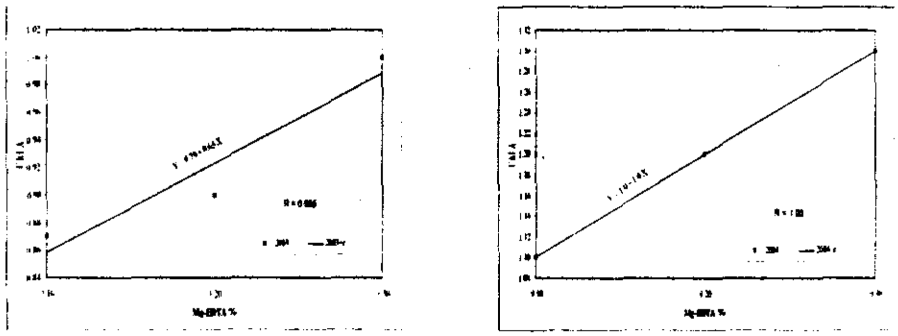


Fig (4): Relationship between concentrations of Mg – EDTA and chl. A.

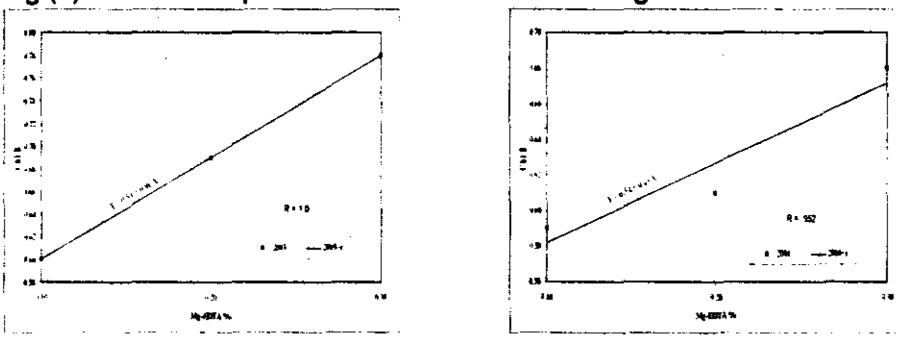


Fig (5): Relationship between concentrations of Mg – EDTA and chl. B.

5. Cane carbohydrate content:

Table (5) shown that all treatments tended to increase total carbohydrates of canes compared to the control. Mg – EDTA at 0.3% gave the highest content of the values, followed by Mg – EDTA at 0.2% in both seasons. However, the control had the lowest values, the other treatments recorded intermediate values in both seasons of the study. These results may be due to the effect of magnesium on increasing leaf chlorophyll content, photosynthetic activity and consequently cane carbohydrate content. The results in this connection go in line with those of Devlin, (1972); Kilany, (1992) and Ahmed, (2000) who mentioned that, Mg SO_4 at 1 or 2% as foliar application increased cane carbohydrate content.

Table (5): Effect of foliar mineral or chelated calcium and magnesium application on leaf pigments content (mg / g fresh weight) and cane content of total Carbohydrates (%) of Thompson Seedless grapevines at seasons (2003 & 2004).

Treatments	Chl A		Chl B		Total carbohydrates (%)	
	2003	2004	2003	2004	2003	2004
Control	0.49 k	0.78 e	0.26 j	0.41 f	15.5 m	20.2 l
$CaCl_2$ 0.5%	0.50 jk	0.76 e	0.27 ij	0.40 f	18.5 l	21.6 k
$CaCl_2$ 1%	0.51 ij	0.77 e	0.28 hi	0.41 f	20.1 k	22.8 j
$CaCl_2$ 2%	0.52 i	0.78 e	0.29 h	0.41 f	21.0 j	23.1 i
Ca – EDTA 0.1%	0.54 h	0.78 e	0.33 g	0.40 f	22.2 i	23.5 h
Ca – EDTA 0.2%	0.55 h	0.79 e	0.34 g	0.41 f	23.4 h	25.0 g
Ca – EDTA 0.3%	0.57 g	0.79 e	0.40 f	0.41 f	25.5 c	26.9 c
$MgSo_4$ 0.5%	0.65 f	0.95 d	0.44 e	0.45 e	23.7 g	25.3 f
$MgSo_4$ 1%	0.71 e	1.00 d	0.49 d	0.46 e	23.9 f	25.7 e
$MgSo_4$ 2%	0.82 d	1.00 d	0.68 b	0.55 d	24.8 e	25.8 e
Mg – EDTA 0.1%	0.87 c	1.10 c	0.60 c	0.59 c	25.2 d	26.5 d
Mg – EDTA 0.2%	0.90 b	1.20 b	0.69 b	0.61 b	26.5 b	27.9 b
Mg – EDTA 0.3%	1.00 a	1.30 a	0.78 a	0.68 a	27.5 a	28.6 a

6. Economical study of applying Mg – EDTA:

It is clear from the data of Table (6) that the application of Mg – EDTA at 0.3% gave the maximum net profit than the other treatments and control.

As a conclusion of this study it can be concluded that, foliar application of chelated magnesium (Mg) at 0.3% sprayed three times in each season, i.e. at the beginning of vegetative growth, immediately after fruit set and 4 weeks later is recommended to obtain the highest yield besides improving vegetative growth and nutritional status.

The very slight raise in the cost of production (as compared to the control) as a result of spraying Mg – EDTA is considered economically nothing in view of the substantial increase in the production.

Table (6): Some economical data on costs and profit per fed. of the recommended treatment (Mg-EDTA at 0.3%) compared to control .

Seasons	Price of the fertilizers (L.E.)		labor cost (L.E)		transport cost (L.E.)		Total cost (L.E)		Yield / fed. (ton)		Increase in yield over control per fed. (ton)	increase in yield expressed in L.E*	net profit (L.E.)
	Control	Recommended	Control	Recommended	Control	Recommended	Control	Recommended	Control	Recommended			
2003	250	335	50	50	100	100	400	485	6.9	9.2	2.3	1610	1125
2004	250	335	50	50	100	100	400	485	7.1	9.7	2.6	1820	1335

* The average price of ton of fruits is 700 L.E.

From the previous results, it can be concluded that, the best treatments for improving vegetative growth, yield, nutritional status, leaf pigments and cane carbohydrate content of Thompson Seedless grapevines are chelated magnesium at 0.3% followed by chelated calcium at 0.3% as foliar application in the three tested dates in each season. i. e. at the beginning of vegetative growth (2nd week of March), immediately after fruit – set (1st week of May) and 4 weeks later (1st week of June).

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تأثير الرش بالكالسيوم والماغنسيوم المعدنى أو المخلبى على كرمات العنب الطومسون سيدلس فى الأراضى الرمليه:
أ – النمو الخضرى و الحاله الغذائيه والإنتاجيه

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أجريت هذه الدراسه خلال موسمين متتاليين (٢٠٠٣ & ٢٠٠٤) فى مزرعه خاصه بمدينة السادات بمحافظة المنوفيه على كرمات عنب صنف الطومسون سيدلس عمر ١٠ سنوات منزرعه بتربه رمليه تحت ظروف الرى بالتنقيط . قلمت الأشجار بطريقة الكردون المتعدد والمدعمه بطريقة التكاعيب الأسبانيه. وكان الهدف من إجراء البحث هو دراسة تأثير الرش بالكالسيوم والماغنسيوم المخلبى أو المعدني على النمو الخضرى والحاله الغذائيه للأوراق والقصبات وكذلك محصول الشجرة . رشت الأشجار فى ثلاث مواعيد هى : عند بداية النمو الخضرى (الأسبوع الثانى من مارس) وبعد العقد مباشرة (الأسبوع الأول من مايو) ثم بعد ٤ أسابيع أخرى (الأسبوع الأول من يونيه) . وقد إشتملت المعاملات على : الكنترول (الرش بالماء) – الرش بكلوريد الكالسيوم بتركيز ٠,٥% – الرش بكلوريد الكالسيوم بتركيز ١% – الرش بكلوريد الكالسيوم بتركيز ٢% – الرش بالكالسيوم المخلبى بتركيز ٠,١% – الرش بالكالسيوم المخلبى بتركيز ٠,٢% – الرش بالكالسيوم المخلبى بتركيز ٠,٣% – الرش بكبريتات الماغنسيوم بتركيز ٠,٥% – الرش بكبريتات الماغنسيوم بتركيز ١% – الرش بكبريتات الماغنسيوم بتركيز ٢% – الرش بالماغنسيوم المخلبى بتركيز ٠,١% – الرش بالماغنسيوم المخلبى بتركيز ٠,٢% – الرش بالماغنسيوم المخلبى بتركيز ٠,٣% .

وقد أوضحت النتائج أن جميع المعاملات أدت إلى زياده معنويه فى طول الفرع مقارنة بالكنترول وقد أعطت المعامله بالماغنسيوم المخلبى بتركيز ٠,٣% أعلى زياده معنويه لطول الفرع الجديد وعدد الأوراق على الفرع ومساحة الورقه وسمك القصبه وعدد العناقيد على الكرمه ومعامل الخصوبه وكذلك المحصول للكرمه تليها المعامله بالكالسيوم المخلبى بتركيز ٠,٣% . أدت المعامله بالماغنسيوم المخلبى بتركيز ٠,٣% إلى زيادة نسبة الأزوت ونسبة البوتاسيوم وكذلك نسبة الماغنسيوم فى عنق الورقه ومحتوى الأوراق من الصبغات وكذلك المحتوى الكلى للكربوهيدرات فى القصبه . كل معاملات الكالسيوم سواء المعدنى أو المخلبى أعطت زياده معنويه فى محتوى الكالسيوم فى عنق الورقه . وقد حققت المعامله بالكالسيوم المخلبى بتركيز ٠,٣% أعلى زيادة. أما الماغنسيوم المخلبى والكالسيوم المخلبى بتركيز ٠,٣% فقد أدت إلى زيادة وزن خشب التقليم .

بناء على النتائج التى تم التوصل إليها فانه يمكن التوصيه برش الكالسيوم والماغنسيوم فى الصوره المخلبيه بتركيز ٠,٣% على العنب الطومسون اللا بذرى في ثلاث مواعيد هى : عند بداية النمو الخضرى (الأسبوع الثانى من مارس) وبعد العقد مباشرة (الأسبوع الأول من مايو) ثم بعد ٤ أسابيع أخرى (الأسبوع الأول من يونيه) وذلك لتحسين النمو الخضرى والحاله الغذائيه للأشجار وكذا المحصول .