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

B – Fruit quality and keeping quality during storage at room temperature

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ABSTRACT

This experiment was carried out during the two successive seasons of 2003 and 2004 to study the effect of foliar application of mineral or chelated calcium and magnesium on fruit quality and keeping quality during storage at room temperature of Thompson Seedless grapevines, grown in a sandy soil under drip irrigation system at El – Sadat region, Menoufeya Governorate. The vines were quadrilateral cordon shaped and trellised by the Spanish Parron system. Ten years old Thompson Seedless grapevines 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 tested foliar spray treatments included control (water spray), 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, Mg – EDTA at 0.3% gave the heaviest clusters and increased number of berries / cluster and berry dimensions. Moreover, Mg – EDTA and Ca – EDTA at 0.3% increased dimensions of cluster, berry weight and size. All calcium treatments, especially in the chelated form, increased significantly the berry firmness, adherence strength of berry, decreased berry shattering percentage before and after storage at room temperature and decreased the decay and loss in fresh weight percentage estimated 4 days after harvesting at room temperature compared to the control and Mg applications. The best results of these parameters were obtained by Ca – EDTA spray at 0.3% followed by Ca – EDTA at 0.2%. T.S.S. (%), acidity (%) and T.S.S / acid ratio were not affected by Ca or Mg applications either in the mineral or in the chelated form. The obtained results suggested spraying 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 properties of fruit quality and keeping quality during storage at room temperature.

INTRODUCTION

Grapes are one of the most important and favorable fruits in Egypt. Thompson Seedless is still one of the leading grape cultivars in the world and Egypt as well. Improving quality of grape clusters and berries is a main goal of this investigation. Foliar fertilization is an important method for improving grape quality. Efforts have always been exerted to improve the grapevine growth and production through a better understanding of the physiological behaviour of the vine and its response to various horticultural practices. The essential elements, either as macro or micro nutrients play a main role in this respect, Calcium (Ca^{++}) and magnesium (Mg^{++}) have an important role in improving the production and quality of fruits (Chesnin, 1972; Chuntanaparb & Cummings, 1980; Rizk and Rizk, 1994 a and b and Spiers & Braswell, 1994). Berries of Thompson Seedless cultivar are exposed to damage and

shattering during transportation and handling. Spraying with calcium leads to an increase in fruit firmness owing to the essentiality of calcium for the structure and function of cell walls and membranes (Poovaiah, 1986). Therefore, it decreases the damage and increases tolerance of the berries during transportation and handling. Calcium application during the growing season is often used to enhance the storage life of fruits (Gupta *et al.*, 1980; Lu and Ouyang, 1990; Subburamu *et al.*, 1990; Waskar *et al.*, 1996; Turky, 1996 and Mohamed, 1998). Magnesium plays several important roles in the plant. It appears to be involved in the stabilization partisles, binding together the subunits that make up the ribosome (Bidwell, 1979).

This experiment was designed to throw some light on the beneficial effects of spraying mineral or chelated calcium (Ca^{++}) and magnesium (Mg^{++}) on fruit quality of Thompson Seedless cultivar and keeping quality during the marketing period (4 days) was also considered.

MATERIALS AND METHODS

This study was conducted during 2003 and 2004 seasons on 10-year-old Thompson Seedless grapevines grown at El – Sadat region, Menoufeya Governorate. The vines were planted at (3 x 3) meters in a sandy soil under drip irrigation system. The vines were quadrilateral cordon shaped and trellised by the Spanish Parron system. Canes were pruned during the 3rd week of Jan. in the first season and during 4th week of December in the second one at the length of 12 buds / cane with a load of 72 buds / vine. The study aimed to throw some light on the effect of foliar applications 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). 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 character	%	Chemical characters	%
Field capacity	11.8	$CaCo_3$	12.9
Available water	1.78	Organic matter	0.25
Wilting point	4.32	Water pH(1:25)	8.9
Coarse Sand	35	Ec (mmohs / 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
		H	0.39
		Cl	0.48

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 (water spraying).
2- Ca Cl_2 at conc. 0.5 %.
3- Ca Cl_2 at conc. 1 %.
4- Ca Cl_2 at conc. 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- Ca – 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 parameters were recorded:

1. Physical and chemical characteristics of clusters and berries (Fruit quality):-

At harvest time (1st week of July), samples of 24 bunches per each treatment were taken to the laboratory to carry out the following estimations:

- Average weight of cluster, average dimensions of cluster, average number of berries per cluster, average weight of rachis berry weight and size as an average of 100 berries / replicate, berry dimensions.
- Berry firmness and adherence strength using shatilon's instrument.
- Shattering percentage was calculated according to the following equation:

$$\frac{\text{Weight of shattered berries}}{\text{The initial weight of the cluster}} \times 100$$

- T.S.S (%) in berry juice using a hand refractometer, acidity (%) and T.S.S / acid ratio were determined according to A.O.A.C. (1975).

2. Keeping quality of clusters at room temperature:

At harvesting time, samples of ten clusters each, were picked, cleaned and packed in 39 boxes (13 treatments x 3 replicates). Only one layer of clusters was packed in the boxes; the boxes were then kept at room temperature (about 28 – 30°C. Four days after packing the clusters, which nearly represents the marketing period, the following determinations were carried out: shattering percentage, berry firmness, berry adherence strength. Decay percentage and loss in fresh weight were calculated according to the following equation:

$$\text{Decay percentage} = \frac{\text{Decayed berries}}{\text{Initial weight of the cluster}} \times 100$$

$$\text{Loss in fresh weight} = \frac{\text{Loss in fresh weight}}{\text{Initial weight of the cluster}} \times 100$$

T.S.S (%), acidity (%) and T.S.S / acid ratio were determined 4 days after storage the bunches at room temperature. The obtained data were

statistically analyzed according to Snedecor and Cochran (1972) using Duncan's test.

RESULTS AND DISCUSSION

1. Physical characteristics of the cluster:

Data presented in Table (2) reveal the physical characteristics of cluster; i. e. cluster weight, rachis weight, cluster length and width and number of berries / cluster. It is clear that, the treatments which resulted in the heaviest clusters in the two seasons were Mg – EDTA at 0.3% followed by Ca – EDTA at 0.3%. The least cluster weight was detected in the control treatment in both seasons. Rachis weight followed the same trend. The increase in cluster weight may be due to the beneficial effect of Mg – EDTA on growth and nutritional status of the plant. These results are in harmony with those obtained by Kilany, (1992); Rizk and Rizk, (1994 a) and Ahmed, (2000) who found that spraying of Mg SO_4 tended to increase the cluster weight of Thompson Seedless grapevines. Regarding cluster dimensions (length and width), it is noticed from the data of Table (2) that, the highest significant increase was found with Mg – EDTA at 0.3% in the first season and Ca – EDTA and Mg – EDTA at 0.3% in the second one. However, clusters of check vines had the least dimensions in the two seasons. Similar results were obtained by Rizk and Rizk, (1994 a) and Ahmed, (2000) as they mentioned that chelated Ca treatments at 4 to 20 g / vine increased the cluster dimensions of Thompson Seedless grapevines.

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 67 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

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.

2. Physical characteristics of berries:

It is apparent from data of Table (3) that, Mg – EDTA at 0.3% resulted in the heaviest and biggest berries of Thompson Seedless grapes followed by Mg – EDTA at 0.2%, Ca – EDTA at 0.3% and 0.2%. Mineral Ca or Mg slightly

increased this parameter as compared to the control. These results were confirmed in both seasons of study. The increase in berry weight and size may be due to the increase in plant growth promoters as a result of Mg – EDTA and Ca – EDTA spraying, which might have activated berry growth. The results agree with Kilany, (1992); Rizk and Rizk, (1994 b) and Ahmed, (2000).

As for berry dimensions (berry length and width), it is evident that, treatment of Mg – EDTA at 0.3% obviously increased berry dimensions in both seasons. Regarding berry firmness data reported in Table (3) disclosed that all calcium treatments, especially in the chelate form, statistically increased berry firmness. Magnesium treatments came next in this respect. On the contrary, control berries were more soft and had the least values of firmness. The increase in berry firmness may be attributed to the important role of Ca in the structure of cell walls and membranes (Poovaiah, 1986). The importance of calcium in increasing or retaining the fruit firmness was mentioned by Chang and Kliewer, (1991), Ahmed, (2000) on grapes. Data in Table (3) indicated that berry adherence strength was more higher as affected by foliar applications of calcium than the other applications. Spraying Ca – EDTA at 0.3% exerted a slight effect on berry adherence strength followed by Ca – EDTA at 0.2% and the control which had the lowest values in the both seasons of the study. These results agree with those obtained by Abbas and Mohamed (2000). Data of Table (3) indicate that, spraying Ca – EDTA at all concentrations decreased berry shattering. Ca – EDTA at 0.3 & 0.2% resulted in the lowest berry shattering percentage. 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 (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

3. Chemical characteristics of berries:

In assessing the effect of different treatments of Ca and Mg on the chemical characteristics of berries; i. e. total soluble solids, acidity and total

soluble solids / acid ratio, it is clear from Table (4) that neither Ca nor Mg treatments in the chelated or mineral form significantly differed of the control in this respect. These results were obtained in both seasons of the study. Similarly, Larson *et al.*, (1963) mentioned that T.S.S. of Concord grapes were not affected by Mg application.

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. Effect of the tested treatments during the marketing period:

Table (5) represents juice T.S.S., acidity and T.S.S / acid ratio 4 days after harvesting when the clusters were kept under room conditions, which can be considered as the marketing period. Table (5) includes also berry firmness, berry adherence strength, berry shattering (%), decay (%) and loss in fresh weight (%) after the same period.

It is clear that, in most cases, changes in T.S.S., acidity and T.S.S. acid ratio after 4 days under room conditions were not obvious if compared with the corresponding values at harvest. However, T.S.S., acidity and T.S.S. acid ratio after 4 days under room temperature were not affected by pre – harvest foliar application of Ca and Mg. Regarding to berry firmness and adherence strength after room storage. Data presented in Table (5) indicate that all calcium applications generally gave higher values than the other applications. In both seasons the highest firmness and adherence strength were obtained by application of Ca – EDTA at 0.3% followed by 0.2%. The least values resulted from control berries in both seasons. These results are in harmony with those obtained by Gupta *et al.*, (1980) who reported that calcium application helps in maintaining fruit firmness and adherence strength.

Data presented in Table (5) indicated that calcium treatments either in the mineral or the chelated form significantly decreased shattering percentage than magnesium treatments and control. Data also clarified that Ca – EDTA at 0.3% was found to give the lowest values of shattering percentage which recorded (0.00 & 0.58%) in the two seasons, respectively, followed by Ca – EDTA applications at 0.1% and 0.2%. On the other hand, the highest berry shattering percentage resulted from control in the two

seasons under the study. The other tested treatments exerted intermediary values. These results are in line with those obtained by Gupta *et al.*, (1980); Subburamu *et al.*, (1990); Turky, (1996); Mohamed, (1998) and Marwad *et al.*, (2001). As for decay (%) 4 days after harvesting, it is clear from Table (5), that all tested treatments greatly depressed berry decay percentage as compared with the control. The least values (0.0 & 0.0%) in the first season and (0.58 & 0.59%) in the second one came from spraying with Ca – EDTA at 0.3% and 0.2%, respectively. It's clear from Table (5) that, the highest fresh weight losses (%) 4 days after harvesting were observed with the control and either as in the mineral or chelated form of Mg without significant differences among them in the two seasons of the study. On the other hand, calcium treatments significantly decreased the percentage of fresh weight losses. Ca – EDTA at 0.3% and 0.2% had the lowest values of this estimate. The results go in line with Waskar *et al.*, (1994); Turky, (1996); Mohamed, (1998) and Marwad, (2001).

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
Ca Cl_2 0.5%	0.50 jk	0.76 e	0.27 ij	0.40 f	18.5 l	21.6 k
Ca Cl_2 1%	0.51 ij	0.77 e	0.28 hi	0.41 f	20.1 k	22.8 j
Ca Cl_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
Mg So_4 0.5%	0.65 f	0.95 d	0.44 e	0.45 e	23.7 g	25.3 f
Mg So_4 1%	0.71 e	1.00 d	0.49 d	0.46 e	23.9 f	25.7 e
Mg So_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

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.

Generally, the obtained results clarified the obvious positive effect of foliar application of chelated magnesium at 0.3% on cluster weight, number of berries / cluster and berry dimensions. Moreover, Mg – EDTA and Ca – EDTA at 0.3% increased cluster dimension and berry weight and size. The most prominent effects of chelated calcium spray was the obvious improvement in berry firmness, adherence strength of berry and decreased berry shattering percentage before and after storage at room temperature and decreased the decay and loss in fresh weight percentage estimated 4 days after harvesting. It is recommended to spray Thompson Seedless grapevines with chelated calcium and magnesium at 0.3% 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 fruit quality and keeping quality during storage at room temperature.

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تأثير الرش بالكالسيوم والماغنسيوم المعدنى أو المخلبى على كرمات العنب الطومسون عديم البذور النامية فى الأراضى الرمليه
ب- جودة الثمار – الإحتفاظ بجودة الثمار أثناء التخزين فى درجة حرارة الغرفه

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أجريت هذه الدراسه خلال موسمى ٢٠٠٣ & ٢٠٠٤ لدراسة تأثير الرش بالكالسيوم والماغنسيوم المعدنى أو المخلبى على جودة الثمار والإحتفاظ بالجوده أثناء التخزين على درجة حرارة الغرفه للعنب الطومسون العديم البذور المنزرع فى أرض رمليه تحت ظروف الرى بالتنقيط فى منطقة السادات التابعه لمحافظة المنوفيه وذلك على كروم العنب صنف الطومسون اللابذرى عمر ١٠ سنوات. وقلمت الأشجار بطريقة الكردون الرباعى تحت نظام تدعيم الإسبانش بارون . تلقت الكروم ثلاث رشات فى كل موسم 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) وكانت المعاملات الثلاثه عشر للرش هى : 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 الماغنسيوم المخلبى عند تركيز ٠,٣% قد أعطى أثقل العناقيد وزنا كما أدى إلى زيادة عدد الحبات / العنقود وكذلك أبعاد العنقود . أعطت المعاملات بالماغنسيوم المخلبى والكالسيوم المخلبى بتركيز ٠,٣% زياده فى وزن وحجم وأبعاد الحبه . أدت جميع معاملات الكالسيوم خاصة المخلبى منها إلى زيادة صلابة الثمار ، قوة الشد للحبه وقللت النسبه المئويه لفرط الحبات سواء قبل أو بعد التخزين على درجة حرارة الغرفه كما قللت العفن والنسبة المئويه لفقد الوزن الطازج وذلك بعد التخزين لمدة ٤ أيام فى درجة حرارة الغرفه بالمقارنه بالكنترول وكذلك معاملات الماغنسيوم وكانت أفضل النتائج بالنسبة للقياسات السابقه نتيجة الرش بالكالسيوم المخلبى بتركيز ٠,٣% تليها الرش بالكالسيوم المخلبى بتركيز ٠,٢% . لم تتأثر النسبه المئويه للمواد الصلبه الذائبه الكليه ، النسبه المئويه للحموضه و النسبه المئويه للمواد الصلبه الذائبه الكليه : الحموضه بالمعامله بالكالسيوم أو الماغنسيوم سواء فى الصوره المعدنيه أو المخلبيه . ومن النتائج التى تم التوصل إليها يمكن التوصيه برش الكالسيوم والماغنسيوم فى الصوره المخلبيه بتركيز ٠,٣% على صنف الطومسون اللابذرى فى ثلاث مواعيد فى كل موسم 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 جودة العناقيد والحفاظ على جودة العناقيد أثناء التخزين على درجة حرارة الغرفه .