Effect of concentrations and number of spraying with Mg on growth yield and quality of grape (*Vitis vinifera* L.) cv. Tre-Rash.

Akram Othman Esmail
Salahaddin University / College of Agriculture / Erbil

Shawkat Mustafa Mohammed Atrushy
College of Agriculture / University of Dohuk

Shayan Akram Mustafa
Faculty of Agricultural Sciences / University of Sulaimani

Abstract

This study was carried out during growing season of 2014 on 18 years old grapevine cv. Tri-rash at a private vineyard located near Shar-Bazher town, Sulaimani governorate, Iraq in order to study the foliar spraying of three concentrations (0 , 0.2 and 0.4%) of magnesium, number of sprays and their interactions on yield and quality of grapevine. The results indicated that the interaction treatment of foliar application of 0.4% Mg and three sprays significantly increased leaf area, leaf fresh and dry weight, Leaf chlorophyll content with the values of 131.50 cm^2, 2.859 g, 1.062 g and 45.02 SPAD respectively, as soon as the highest cluster weight, (473.75g, number of berries per clu1sters (197.55) and yield per vine (16.65 kg) were recorded from the mentioned treatment combination.

Key words: Mg, Foliar spraying, grape, Tri-Rash.

Introduction

The grape is considered as an important horticultural crop in Iraq and around the worldwide. Its cultivation had been adopted in Iraq for a long time (Alsaidi, 2000). Alsaidi, (2000) mentioned that about 75 cultivars grown in Iraq now, most of them are in Kurdistan region /Iraq. Tre-Rash is a local grape variety that is planted in several areas of Erbil and Sulaymani. It has several names including Suleimani, Khoshnow and Rashka. It is a late black variety. It is a good table grape, and could be used as the juice, wine and raisin industries. The color of the berries is dark-black or red-violet.

Improving yield of grape could be achieved through the foliar application of some nutrients; the balanced supply of essential macronutrients particularly N , K and Mg has beneficial effect on growth, uptake of elements, yield and fruit quality of fruit trees (Nijjar, 1985 ; Imas, 2000). Magnesium is the center of the chlorophyll molecule. It is involved in photosynthesis and plays an important role as activator of several enzymes (Hagin and Tucker, 1982 ; Mongi and Thomas, 2003). Therefore, it was interesting to test the idea of examining a various concentrations and number of spraying of Mg for improving growth and productivity of Tre-Rash grapevines under environmental condition of Sulaimani area. Kocsis and Walker, (2003) studied the effect of two concentration of $MgSO_4$ solution (0.1% and 0.2%) applied by spraying of 15 rootstocks, results indicated that the shoot

weight and leaf weight of the grapevine increased compared to the control. Gabara *et al*., (2001) studied the influence of different concentrations of N and Mg on

Date of research received 13/4/2015 and accepted 26/10/2015

growth, leaf chemical composition, yield as well as physical and chemical properties of Banaty grapes, results showed that there was an outstanding influence on growth characters, leaf N, Mg and K, yield as well as cluster weight, berry weight. Salah-El-Din and Sayed, (1995) sprayed Romy grapevines with Boron and Magnesium, which added either separately or as a mixture, spraying was conducted after blooming and fruit setting stages by using solution of boric acid 2% and Magnesium sulphate (5%), results revealed that the increase in yield to more than 30 % by adding Boron separately. In addition, the above treatment led to increasing the percentage of juice and the acidity of fruits. (Mohammed and Abdul-Qader, 2007) found that spraying vines cv. Taifi with Mg resulted a significant increase in the total yield, cluster weight and leaf area compared with untreated vines. (Abdul-Hady and Ibrahim, 2001) showed that the best results of Red Roomy yield and quality were obtained from spraying with 0.2 % Magnesium sulphate. So, this study aimed to limit the best concentration of Mg application to the grapevine with best number of spraying to get maximum grape yield with best quality.

Materials and Methods

This study was carried out on a private vineyard located near Shar-Bazher town, Sulaimani governorate, Kurdistan region, Iraq, during growing season of 2014 to investigate the effect of foliar application of three concentrations (0 , 0.2 and 0.4%) of magnesium using ($MgSO_4$ 10.5% Mg) and the number of spraying (once, twice and three times of spraying) on the growth, productivity and berries quality of grapevine cv. Tre-Rash. So this experiment included two factors, the first factor included three concentrations of Mg (0 , 0.2 and 0.4%), while the second factor was the number of Mg spraying which were:

1- Once (two weeks after growth began).
2- Twice (at the same previous date and just before bloom).
3- Three times (at the same two previous dates and two weeks after berry setting).

Therefore, the experiment consisted of nine interaction treatments with three replicates with one individual vine (4 eyes per T-shape vine) for each experiment unites and applied as factorial experiment by using (RCBD) design. So the numbers of vines used were 27 vines. A detergent powder as wetting agent at (1-2 $g.L^{-1}$) was added to all the spraying solution including 0.0% Mg (control). The vines were sprayed with Mg solutions till run off 2 L/vine. Horticultural practices except the addition of Mg were used as usual. Potential effects of Mg were

evaluated in terms of the change in growth vine, leaf area was calculated by (leaf area meter AM 300), leaf fresh and dry weight, chlorophyll content according to (SPAD), number of cluster per vine, cluster weight, No. of berries per cluster and yield as well as weight and size of 100 berries and length and width of berries. The results were analyzed statistically by using SAS programs (2003), depending on Duncan's multiple range test at 5% level of significant to compare the mean of treatments according to (Al-Rawi and Kalafalla, 2000).

Results and Discussion

1- Vegetative growth properties:

Data presented in table (1) shows that vegetative growth properties for vines sprayed with magnesium is superior significantly on that untreated. The highest leaf area, Leaf fresh and dry weight and total chlorophyll (139.85 cm^2 , 2.986 g , 1.117g and 44.60 SPAD) were recorded from vines spraying with magnesium at conc. (0.4 %) respectively while the lowest values of them (104.04, 2.185, 0.840 and 40.63) were recorded from untreated vines.

Increasing number of spraying were also significantly increased vegetative growth properties. The highest values of leaf area, Leaf fresh and dry weight and total chlorophyll (131.50 cm^2 , 2.859 g , 1.062 g and 45.02 SPAD) were obtained from vines sprayed three times per season respectively. On the other hand the lowest values of them (107.57 cm^2 , 2.315 g , 0.904 g and 41.06 SPAD) were recorded from control (untreated) vines respectively.

The reason of increasing leaf area, leaf fresh, dry weight and chlorophyll content with increasing magnesium levels could be due to the fact that Mg is the center of the chlorophyll molecule and it is involved in photosynthesis and plays an important role as activator of several enzymes, it's also involved in carbo- hydrate metabolism and synthesis of nucleic acids (Bavaresco, 2001 ; Mongi and Obreza, 2003).

Table (1): Effect of foliar application with Magnesium and No. of application on vegetative growth characteristics grapevine (*Vitis vinifera* L.) cv. Tre-Rash.*

Treatment		Parameters		
Magnesium (%)	Leaf area (cm^2)	Leaf fresh weight (g)	Leaf dry weight (g)	Total chlorophyll (SPAD)
0.0	04.04 c	2.185 b	0.840 c	40.63 b
0.2	120.65 b	2.778 a	0.994 b	42.84 ab
0.4	139.85 a	2.986 a	1.117 a	44.60 a
No. of sprays				
Once	107.57 b	2.315 b	0.904 b	41.06
Twice	125.47 a	2.774 a	0.984 ab	42.0 b
Three times	131.50 a	2.859 a	1.062 a	45.02 a

Mg×No. of sprays				
$Mg_0 \times No._1$	94.99 c	1.802 c	0.749 d	38.73 c
$Mg_0 \times No._2$	108.50 cd	2.403 bc	0.860 cd	39.23 bc
$Mg_0 \times No._3$	108.63 cd	2.403 bc	0.910 bcd	43.93ab
$Mg_{0.2} \times No._1$	106.62 cd	2.349 bc	0.900 bcd	41.57 abc
$Mg_{0.2} \times No._2$	122.73 a-d	2.364 bc	0.981 abc	42.03 abc
$Mg_{0.2} \times No._3$	132.61 a-c	2.885 ab	1.101 abc	44.93 a
$Mg_{0.4} \times No._1$	121.11 b-d	2.779 ab	1.063 ab	42.87 abc
$Mg_{0.4} \times No._2$	145.17 ab	3.035 a	1.112 ab	44.73 a
$Mg_{0.4} \times No._3$	153.27 a	3.144 a	1.176 a	46.20 a

* Means with the same letter are not significantly different according to Duncan multiple ranges test at 5% level.

The increasing of vegetative properties with increasing number of Mg application may be attributed to that the increase in number of application may be helped in continuous supply of Mg to the plant which causes increase metabolic processes in plant (Garcia, *et al*., 1999; Ksouri, et al., 2005). Or continuous spraying of Mg caused decrease in competition between calcium and magnesium ,since calcium is the dominate cation in calcareous soil.

For the interaction treatments, data in table (1) showed that the highest values of them (153.27cm2 , 3.144 g , 1.176 g and 46.20 SPAD) were obtained from interaction treatments of vines sprayed with 0.4 % Mg and three times spraying respectively in compared with lowest values from untreated vines (control treatment).

2- Yield characteristics:

It's clear from table (2) that foliar application of Mg especially at (0.4%) significantly increased cluster weight, number of berries per cluster, yield and yield per vine. The highest values of them (503.55 g , 214.11 and 17.86 $kg.vine^{-1}$) were recorded from foliar application of Mg at 0.4% concentration respectively compared to the lowest values which were obtained from untreated vines. The number of spraying also had significant effect on the properties mentioned above; the highest values (473.75 g , 197.55 and 16.65 $kg.vine^{-1}$) were resulted from vines sprayed three times per season respectively compared to the minimum values from untreated vines Concerning the interaction between Mg concentrations and the number of applications, the same table shows that the maximum values (638.83 g , 232.66 and 23.57 $kg.vine^{-1}$) were resulted from the interaction of 0.4 % Mg + three time of Mg spraying respectively whereas the minimum values was with untreated vines. Whereas, number of cluster per vine appeared to be not affected neither by Mg concentration nor by the number of applications.

Table (2): Effect of foliar application with magnesium and No. of application on yield characteristics of grape (*Vitis vinifera* L.) cv. Tre-Rash.*

Treatment		Parameters		
Magnesium (%)	No. of clusters per vine	Cluster weight (g)	No. of berries per cluster	Yield ($Kg.vine^{-1}$)

0.0	29.33 a	303.17 c	174.66 b	9.05 c
0.2	32.88 a	390.87 b	193.00 ab	12.81 ab
0.4	35.00 a	503.55 a	214.11 a	17.86 a
No. of sprays				
Once	31.00 a	325.52 c	174.77 b	10.25 b
Twice	31.66 a	398.31 b	174.77 ab	12.63 b
Three times	34.55 a	473.75 a	197.55 a	16.65 a
Mg×No. of sprays				
Mg 0.0 × No.1	27.33 a	235.38 e	150.66 b	6.40 c
Mg 0.0 × No.2	27.66 a	311.23 de	176.66 bc	8.77 cd
Mg 0.0 × No.3	33.00 a	362.88 cd	196.66 abc	11.97 b-d
Mg 0.2 × No.1	31.33 a	349.74cd	184.66 bc	10.88 b-d
Mg 0.2 × No.2	33.00 a	403.35bcd	195.33 abc	13.17 bc
Mg 0.2 × No.3	34.33 a	419.53bc	199.00 ab	14.38 bc
Mg 0.4 × No.1	34.33 a	391.45 bcd	189 abc	13.45 bc
Mg 0.4 × No.2	34.33 a	480.36 b	220.66 ab	16.53 b
Mg 0.4 × No.3	36.33 a	638.83 a	232.66 a	23.57 a

*Means with the same letter are not significantly different according to Duncan multiple ranges test at 5% level.

The reason related the increase in yield from spraying by Mg could be due to the role of Mg in the physiological process and their effect on plant growth also magnesium has involved in photosynthesis and plays an important role as activator of several enzymes; it's also involved in carbohydrate metabolism and synthesis of nucleic acids (Garcia, *et al*., 1999 ; Fawzi, et al., 2010).

Berries quality: Data presented in table (3) shows that berries quality properties represented in term of weight and size of 100 berries and length and width of berry for vines sprayed with magnesium is overtopped significantly on that untreated. Highest weight and size of 100 berries and length and width of berry (232.90 g , 221.26 cm^3 , 18.61 mm and 16.23 mm) were obtained from spraying vines with (0.4%) Mg respectively compared with the lowest values (173.29 g , 164.62 cm^3 , 15.47 mm and 13.48 mm) from untreated vines. Increasing number of spraying were also significantly increased berries quality properties. The highest values of properties mentioned above (223.15 g , 211.99 cm^3 , 18.41 mm and 15.69 mm) were given by vines sprayed three times compared with lowest values (184.74 g , 175.50 cm^3 , 15.55 mm and 13.69 mm) respectively which were recorded from untreated vines.

Table (3): Effect of foliar application with magnesium and No. of application on berries characteristics of grape (*Vitis vinifera* L.) cv. Tre-Rash.*

Treatment		Parameters		
Magnesium (%)	No. of clusters per vine	Cluster weight (g)	No. of berries per cluster	Yield ($Kg.vine^{-1}$)

0.0	173.29 c	164.62 c	15.47 c	13.48 c
0.2	202.14 b	192.03 b	16.99 b	14.64 b
0.4	232.90 a	221.26 a	18.61a	16.23 a
No. of sprays				
Once	184.74 b	175.50 b	15.55 c	13.69 b
Twice	200.44 b	190.42 b	17.11 b	14.98 a
Three times	223.15 a	211.99 a	18.41 a	15.69 a
Mg×No. of sprays				
Mg 0.0 × No.1	157.44 d	149.57 d	13.34 d	11.48 d
Mg 0.0 × No.2	177.76 cd	168.87 cd	15.52 c	13.74 c
Mg 0.0 × No.3	184.66 bcd	175.42 b-d	17.57ab	15.23 a-c
Mg 0.2 × No.1	189.50 bcd	180.02 b-d	15.52 c	13.99 c
Mg 0.2 × No.2	205.96 bc	195.66 bc	16.97 bc	14.78 bc
Mg 0.2 × No.3	210.95 bc	200.40 bc	18.48 ab	15.16 a-c
Mg 0.4 × No.1	207.27 bc	196.91 bc	17.79ab	15.61 ab
Mg 0.4 × No.2	217.60 b	206.72 b	18.84 a	16.42 a
Mg 0.4 × No.3	273.84 a	260.15 a	19.20 a	16.68 a

*Means with the same letter are not significantly different according to Duncan multiple ranges test at 5% level.

Data in table (3) show that the highest value (273.84 g , 260.15 cm^3 , 19.20 mm and 16.68 mm) were obtained from vines sprayed with 0.4 % Mg three times compared with the lowest values from untreated vines.

The significant effect of the spraying vines with Mg and number of application on chemical characters may be referring to the role of this elements in the plant metabolism and its effect on the cell plant growth and activity, or may be attributed to the role of Mg in activation of vegetative growth characteristics (table,1) of grapevine which in turn reflected on the supplement of more accumulation of carbohydrates in plants and resulting in the stimulation of ripening (Garcia, *et al*., 1999 ; Mongi and Thomas 2003).

References

1- Abdel Hady M. A. H. and A. H. Ibrahim (2001). Effect of using ascorbic acid with some macro and micronutrients on yield and quality of 'Red Roomy' grapes. The Fifth Arabian Horticulture Conference, Ismailia, Egypt. March 24-28 Pp: 9-15.

2- Al-Rawi, KH and khalaf Allah, A. (2000). Agricultural experimental design and analysis. Ministry of Higher Education and Scientist Research. Mosul University. Iraq.

3- AL-saidi, I. H. (2000). Grape production. Mousl University press.

4- Bavaresco L. (2001). Portinnesto e nutrizione minerale della vite, Vignevini, 11:53-62

5- Fawzi, M. I. F.; F. M. Sahin; Elham A. D. and E. A. Kandil (2010). Effect of organic and biofertilizers and magnesium sulfate on growth yield, chemical

composition and fruit quality of "Le- Conte" Pear trees. Nature and Science. 8(12).
6- Gabara, A. Abdul-Aziz; Faissal F. Ahmed and El-shamaa, M.S. (2001). Effect of varying N, K and Mg application ratios on growth, leaf chemical composition and productivity of Banaty grapevines. The fifth Arabian Horticulture Conference. Ismailai, Egypt, Pp. 83-90.
7- Garcia M., Daverede C., Gallego P., Toumi M. (1999). Effect of various potassium-calcium ratios on cation nutrition of grape grown hydro-ponically, Journal of Plant Nutrition, 22:417-425
8- Hagin J., Tucker B. (1982). Fertilization of dry land and irrigated soils. Springer Verlag, New York, USA.
9- Imas P. (2000). Integrated nutrient management for sustaining crop yields in calcareous soils, National symposium on balanced nutrition of groundnut and other field crops grown in calcareous soils of India. Gujarat, India.
10- Kocsis, L.; Walker, M. A. (2003). Screening vitis species for use in breeding magnesium tolerant rootstocks. Acta Horticulture 603, p: 411-416.
11- Ksouri R., Gharsalli M., Lachaal M. (2005). Physiological responses of Tunisian grapevine varieties to bicarbonate-induced iron deficiency, J. Plant Physiology. 162:335-341.
12- Leaf area meter AM 300: ADC BioScientific Ltd. 1st Floor Charles House, Furlong Way, Great Am-well, Hertfordshire SG12 9TA, UK.
13- Mohammed, Sh. M. and Sh. M. AbdulQader (2008). Effect of Foliar Application of Nitrogen and Magnesium on Grapevine cv. Taifi under non-Irrigated Condition. *University of Dohuk*, Vol.10 (2)-2007
14- Mongi zekri and Thomas A.Obreza (2003). Plant nutrients for citrus trees. Institute of food and agricultural sciences. University of Florida, Gaine-sville, 32611-0290.
15- Nijjar, G. S. (1985). Nutrition of fruit trees. Mrs Usha Raj kumar kalyani, New Delhi India p. 1-9.
16- Salah El-Din Faizy and Sayed Eid (1995). Effect of foliar fertilization with Boron and Magnesium on Romy grapevine productivity. Fifth- symposium micro elements nutrient. December 16-21. 1989. Ismailai, Egypt.
17- SAS (2000). Proprietary soft ware release, 6.12 TS Licensed to North Carolina State University. By SAS Institute Inc., Cary. USA.

تأثير تركيز و عدد مرات الرش بالمغنسيوم فى نمو و انتاج و نوعية العنب صنف (Tre-Rash)

اكرم عثمان اسماعيل
كلية الزراعة / جامعة صلاح الدين

شوكت مصطفى محمد الاتروشي
كلية الزراعة و الغابات / جامعة دهوك

شايان اكرم مصطفى
فاكلتى العلوم الزراعية / جامعة السليمانية

الخلاصة

اجريت هذه الدراسة خلال موسم النمو 2014 على كرمات العنب ذى عمر 18 سنة فى احدى بساتين العنب قرب مدينة شاربازير فى محافظة السليمانية، لدراسة تاثير الرش بثلاثة تراكيز من المغنسيوم (0 و 0.2 و 0.4) % وعدد مرات الرش (مرة واحدة و مرتان و ثلاث مرات) و التداخل بينهما فى حاصل و نوعية العنب. اشارت النتائج الى ان المعاملة التداخلية الناتجة من تركيز 0.4 % مغنسيوم و ثلاث مرات رش ادت الى تفوق معنوى لمساحة الورقة والوزن الطرى و الجاف للورقة و محتوى الكلوروفيل حيث بلغ قيمتهم (130.50سم^2 و 1.062 غم و 2.859 غم و 473.75 سباد على التواتي) في حين أعلى وزن العنقود (473.75غم) و عدد الحبات /عنقود (197.55 حبة/العنقود والانتاج/كرمة (16.65 كغم) سجلت في المعاملة العاملية السابقة الذكر.