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Effect of Mineral Npk and Bio-Fertilizers on Minerals Content of Crimson Seedless and Mid Night Beauty Grape Transplants

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Abstract

This investigation was designed and implanted during two successive seasons 2019 and 2020 in the Experimental Farm of Horticulture Department, Faculty of Agriculture at Moshtohor, Benha University Qalyubeia Governorate, Egypt. Two grape cultivars for export were chosen for this investigation (Crimson Seedless and Mid Night Beauty) to study the effect of mineral NPK and bio- fertilization on leaf mineral content of transplants at one-year-old. Treatments were the combination of eleven fertilization treatments (T1) as control: N6g + P3g + K3g, (T2): N9g + P6g + K6g, (T3): N6g + P3g + K3g + 5g mixture of bio-fertilizers (Nitrobein, Phosphorene and Potassein), (T4): N6g + P3g + K3g + 10g mixture of bio-fertilizer, (T5): N6g + P3g + K3g + 15g mixture of bio-fertilizer, (T6): N9g + P6g + K6g + 5g mixture of bio-fertilizer, (T7): N9g + P6g + K6g + 10g mixture of bio-fertilizer, (T8): N9g + P6g + K6g + 15g mixture of bio-fertilizer, (T9): 5g mixture of bio-fertilizers, (T10): 10g mixture of bio-fertilizers and (T11): 15g mixture of bio-fertilizers/ transplants. The results indicated that, in most cases there were significant differences in leaf mineral content between the two tested cultivars "Crimson and Mid Night Beauty" Fertilization with T8 (N 9g + P 6g + K 6g + Bio 15g) was superior treatment in increasing leaf minerals content as compared with the other different investigated fertilization treatments included the control in most cases during both seasons.

Key words: Grape transplants, mineral NPK, bio-fertilizers and leaf mineral content.

Introduction

Grape (*Vitis vinifera, L.*) is considered as one of the most popular and favorite fruit crops in the world, for being of an excellent flavor, nice taste and high nutritional value. In Egypt, it considered the second major fruit crop after citrus it comes and because of its precious properties, this area increased in the last few years especially in the newly reclaimed lands, it reached about 221709 hg/ha with a total production about 1626259 tones according to latest the statistics of the (**FAO, 2019**).

Fertilization is one of the most important management to improve the soil fertility and increase crop yield. Nitrogen, phosphorus and potassium had a pronounced role in improving vegetative growth, productivity and fruit quality. This fact is fluctuated according to the side of the area, amount applied, the dose as well as the sources and time applied.

Controlling chemical fertilization, especially N fertilizer is very important for reducing environmental pollution and obtaining safe produce. Using bio-fertilizers relatively a good method in this respect (**El-Haddad *et al.*, 1993; Verma, 1999; Ram Rao *et al.*, 2007 and El-Salhy *et al.*, 2011**).

Application of bio-fertilizers containing beneficial microorganisms instead of synthetic chemicals are known to improve plant growth through the supply of plant nutrients and may help to sustain environmental health and soil productivity. They are known to improve fixation of nutrients in the rhizosphere, produce growth stimulants for plants, improve soil stability, provide biological control, biodegrade substance, recycle nutrients, promote mycorrhiza symbiosis and develop bioremediation process in soil contaminated with toxic, xenobiotic and recalcitrant substances. Additionally, the use of bio-fertilizers can improve productivity per unit area in a relatively short time, consume smaller amounts of energy, mitigate contamination of soil and water, increase soil fertility, and promote autogonism and biological control of phytopathogenic organisms (**Abdel-Hamid, 2002; Chirinos *et al.*, 2006 and ElSalhy *et al.*, 2006**).

Supplying the various grapevine cultivar with bio-fertilizers only or beside mineral-N source caused a pronounced increase in vegetative growth and nutritional status of vines, as well as in yield components, cluster traits and berry quality (**Abdel-Hady, 2003; ElShenawy and Fayd, 2005; Abbas *et al.*, 2006; Mostafa, 2008; Abdel Monem *et al.*, 2008; El-Sabagh *et al.*, 2011 and El-Salhy *et al.*, 2011 and Masoud, 2012**).

The main objective of this study is an attempt for reducing or eliminating the use of mineral fertilizers and relying on bio-fertilizers through the possibility of using bio-fertilization partially instead of completed mineral fertilizers because of seriousness of these mineral fertilizers for human health as well as their high prices.

Materials and Methods

This investigation was designed and implanted during two successive seasons 2019 and 2020 in the Experimental Farm of Horticulture Department, Faculty of Agriculture at Moshtohor, Benha University Qalyubeia Governorate, Egypt. Two

grape varieties for export were chosen for this study. The transplants of these Two cultivars (Crimson Seedless and Mid Night Beauty) were the plant materials involved in this investigation.

During the third week of January in both seasons of study. sixty six transplants of each studied grape cultivars were chosen and prepared with superior care for this investigation.

One year old grape own rooted cuttings of both investigated cultivars were pruned into a single super with two eyes.

The transplants were carefully transferred in black plastic bags (27×18×28 cm) filled with 4.960 kg of growing mixture medium (sand + clay at 1:1 ratio) and irrigated with tap water until the new developed shoots reached acceptable length. The longest and most healthy sprouted shoot per each rooted cutting transplant was left, and allowed to grow, while the rest ones were removed.

The transplants of both investigated grape varieties were soil treated with:

A-Mineral fertilizers:

1-Ammonium nitrate NH_4-NO_3

2-Modified mono-phosphate

3- Potassium sulphate

B-Bio-fertilizer:

1-Nitrobein: a commercial nitrogenous bio-fertilizer which contains special bacteria (*Azotobacter choroccoocum*) having the ability for free nitrogen fixation.

2-Phosphorene: a commercial bio-fertilizer which contains some active bacterial strains (*Arbuscular mycrohiza* and silicate bacteria that play an important nutritional role in P uptake through changing the unavailable phosphate form (insoluble tri-calcium phosphate) into available soluble one (mono-calcium phosphate).

3-Potassein: a commercial bio-fertilizer which contains Special bacteria (*Bacillus pasleurii*) which releasing the potassium in available form.

The three mineral fertilizers (N,P,K) were added as soil application in two levels (6,3,3) and (9,6,6) where the low level (6,3,3) represent the control treatment. The NPK mineral fertilizers were added on the first week of (March, May and July) during both season of study.

The three bio-fertilizers were mixed and soil added as unique dose on the last week of March. Three levels of bio-fertilizers (5, 10 and 15 g/pot) were investigated.

Ten treatments assignment were the main skeleton of that study beside the control. One treatment represented (NPK)-mineral fertilizers, 3 treatments represented three levels of bio-fertilizers while the rest treatments (6) represented the combinations between the two abovementioned investigated factors.

Sixty Six health transplants of each studied grape variety which were devoted for this study were graded into three categories (blocks) according to their vigour in order to receive the studied treatments which arranged in a completed randomized block design. Each treatment was replicated three times, and each replicated represented by 2 transplants (two pots).

Treatments:

T1-(6g ,3g ,3g) NPK as(control)
T2-(9g ,6g ,6g) NPK
T3-(6g ,3g ,3g) NPK +5 g bio-fertilizer
T4-(6g ,3g ,3g) NPK+10 g bio-fertilizer
T5-(6g ,3g ,3g) NPK +15 g bio-fertilizer
T6-(9g ,6g ,6g) NPK +5 g bio-fertilizer
T7-(9g ,6g ,6g) NPK +10 g bio-fertilizer
T8-(9g ,6g ,6g) NPK +15 g bio-fertilizer
T9-5 g bio-fertilizer
T10-10 g bio-fertilizer
T11-15 g bio-fertilizer

Leaf mineral contents:

Leaf mineral contents (macro and microelements) of dried leaf samples (4-6th leaf from the base) which were collected at last week of Octoper. Leaves were taken as previously described, dried at 70^{o} until constant weight, then used for the following analysis:

1- Total nitrogen:

leaf Total nitrogen content of dried leaves samples was determined by the modified micro-kyeldahl method as described by **(Pregl, 1945).**

2- Total phosphorus:

Total leaf phosphorus content was determined using a spectrophotometer at 882-OVV according to the method described by **(Murphy and Riely 1962).**

3- Leaf K, Mg, Fe, Zn and Mn content:

K, Mg, Fe, Zn and Mn content were determined by using the atomic absorption (3300) according to **(Jackson and Ulrich 1959)** and (**Chapman and Pratt 1961)**.

Leaf nutrient elements content were expressed as a ratio of the leaf dry weight, i.e., percentage for the macro elements (N, P, K, Ca and Mg) and part per million (ppm) with micro nutrient elements (Fe, Zn and Mn).

Statistical analysis:

All data obtained during both seasons were subjected to analysis of variance and significant differences among means were determined according to (**Snedecor and Cochran, 1980**).

Results And Discussion

In this Concern the specific effect of two investigated factors namely, i.e., grape cultivars (Crimson seedless and Mid Night Beauty) and fertilizer treatments (mineral and bio-fertilizers) and their combinations were studied pertaining the response of the following parameters.

1- Leaf nitrogen content:

A. Specific effect:

Data tabulated in **Table (1)** show that, Mid Night Beauty transplants, Mid Night Beauty cultivar gave the highest significant values of leaf nitrogen content as compared with Crimson seedless cultivar in both seasons. All tasted fertilizer treatments succeeded in increasing leaf nitrogen content when compared with the control treatment (T1): N 9g + P 6g + K 6g + Bio 15gfertilizer treatment (T8) induced statistically the highest values in comparison with other treatments, with non significant differences between them and T7 (N 9g +P 6g +K 6g +Bio 10g) treatment in the second seasons. On the opposite, control treatment (N 6g +P 3g +K 3g) recorded the lowest values of leaf N content in both seasons. The other tested treatments came in-between the previously mentioned two categories in this respect.

B. Interaction effect:

Focusing on the interaction effect between grape cultivars and fertilizer treatments, it is clear from Table (1) that, the highest values of N content were obtained when Crimson seedlees and Mid Night Beauty transplants fertilized withT8(N 9g + P 6g + K 6g + Bio 15g) and T7 with non significant differences between them during the two seasons of study. While, Crimson seedless and Mid Night Beauty transplants fertilized with T1 (control) gave the lowest values. The other combinations came statistically in-between.

Table 1. Effect of mineral and bio-fertilizers on leaf N content (%) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaf N content (%)					
Cultivar	Crimson	Mid Night Beauty	Mean	Crimson	Mid Night Beauty	Mean
Treatments	First season (2018- 2019)			Second season (2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	1.39	1.46	**1.42 K**	1.41	1.51	**1.46 F**
T2 - (N 9 g+ P 6 g+ K 6 g)	1.64	1.57	**1.61 I**	1.66	1.67	**1.66 E**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	1.97	1.77	**1.87 F**	1.99	1.83	**1.91 D**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	2.07	2.10	**2.09 E**	2.10	2.15	**2.12 C**
T5 - (N 6 g+P 3g+K 3g) + Bio 15 g	2.19	2.20	**2.20D**	2.22	2.20	**2.21C**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	2.36	2.45	**2.40 C**	2.38	2.48	**2.42 B**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	2.57	2.71	**2.64 B**	2.59	2.73	**2.65 A**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	2.67	2.67	**2.68 A**	2.69	2.70	**2.69 A**
T9 - Bio 5 g	1.48	1.64	**1.56 J**	1.50	1.60	**1.55 EF**
T10 - Bio 10 g	1.79	1.81	**1.80 H**	1.81	1.83	**1.82D**
T11 - Bio 15 g	1.86	1.87	**1.86 G**	1.87	1.89	**1.87D**
Mean	**1.99 B**	**2.02 A**		**2.02 B**	**2.05 A**	
L.S.D for interaction		0.2148			0.2084	

2- Leaf phosphorus content:

A. Specific effect: Regarding the specific effect of the two factors involved in this study, data presented in **Table (2)** clear obviously that, leaf P contents did not response to the investigated cultivars and all fertilizer treatments .Hence, the statistically differences were in between the two cultivars "Crimson and Mid Night Beauty" and all mineral and bio-fertilizer treatments when leaf P content were concerned in both seasons of study.

B. Interaction effect: Concerning the response of leaf phosphorus content to interaction effect of various combinations between grape cultivars and fertilizer treatments, **Table (2)** indicated that, Crimson seedless and Mid Night Beauty transplants fertilized with N 9g + P 6g + K 6g + Bio 15g (T8) gave the highest values when compared with Crimson and Mid Night Beauty transplants fertilized with T1 (control) which recorded the lowest value of leaf P content with non significant differences. The other combinations came statistically in-between the previously mentioned two categories in this regard during the two seasons of study.

Table 2. Effect of mineral and bio-fertilizers on leaf P content (%) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaf P content (%)					
Cultivars	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
Treatments	First season (2018- 2019)			Second season (2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	0.18	0.19	**0.18 A**	0.19	0.21	**0.19 A**
T2 -(9 g+ P 6 g+ K 6 g)	0.23	0.20	**0.23 A**	0.23	0.25	**0.24 A**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	0.28	0.28	**0.28 A**	0.28	0.29	**0.29 A**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	0.30	0.30	**0.30 A**	0.30	0.30	**0.30 A**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	0.32	0.32	**0.32 A**	0.32	0.33	**0.32 A**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	0.34	0.34	**0.34 A**	0.34	0.34	**0.34 A**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	0.35	0.34	**0.35 A**	0.35	0.35	**0.35 A**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	0.36	0.35	**0.36 A**	0.35	0.31	**0.33 A**
T9 - Bio 5 g	0.20	0.23	**0.22 A**	0.20	0.23	**0.22 A**
T10 - Bio 10 g	0.25	0.25	**0.25 A**	0.26	0.26	**0.26 A**
T11 - Bio 10 g	0.27	0.27	**0.27 A**	0.24	0.27	**0.25 A**
Mean	**0.282 A**	**0.283 A**		**0.281 A**	**0.287 A**	
L.S.D for interaction		0.001648			0.005211	

3- Leaf potassium content:

A. Specific effect:

Regarding the specific effect of the two factors in this study on leaf potassium content**, Table (3)** showed that leaf K content did not response specifically to the two investigated cultivars "Crimson and Mid Night Beauty" in both seasons and all tasted fertilizer treatments in the two seasons. On the reverse, control treatment (N 6g +P 3g +K 3g) recorded the lowest values in both seasons. The other tested treatments came in-between the previously mentioned two categories in this respect.

B. Interaction effect:

Regarding the response of leaf potassium content to interaction effect of various combinations between grape cultivars and fertilizer treatments, it is easy to notice from **Table (3)** that, the Crimson seedless and Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g (T8) gave the high value. On the other hand, Crimson and Mid Night Beauty transplants fertilized with T1 (control) registered the low value. The other combinations came statistically in-between during the two seasons of study.

Table 3. Effect of mineral and bio-fertilizers on leaf K content (%) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaf K content (%)					
Cultivar	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
Treatments	First season (2018- 2019)			Second season(2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	0.35	0.35	**0.35 A**	0.35	0.35	**0.35 A**
T2 - (N 9 g+ P 6 g+ K 6 g)	0.39	0.38	**0.39 A**	0.39	0.59	**0.49 A**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	0.49	0.49	**0.49 A**	0.48	0.49	**0.49 A**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	0.51	0.51	**0.51 A**	0.51	0.52	**0.51 A**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	0.55	0.55	**0.55 A**	0.55	0.55	**0.55 A**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	0.63	0.63	**0.63 A**	0.59	0.63	**0.61 A**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	0.68	0.68	**0.68 A**	0.68	0.67	**0.68 A**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	0.78	0.76	**0.77 A**	0.78	0.76	**0.77 A**
T9 - Bio 5 g	0.38	0.40	**0.39 A**	0.38	0.38	**0.38 A**
T10 - Bio 10 g	0.45	0.43	**0.44 A**	0.41	0.43	**0.42 A**
T11 - Bio 10 g	0.48	0.45	**0.47 A**	0.48	0.46	**0.47 A**
Mean	**0.518 A**	**0.513 A**		**0.514 A**	**0.532 A**	
L.S.D for interaction		**0.001648**			**0.001165**	

4- Leaf magnesium content:

A. Specific effect:

Dealing with the specific effect of two tasted factors involved in this study i.e. cultivars and fertilizer treatments on leaf magnesium content, data obtained in **Table (4)** reveal that, non significant differences between the two cultivars "Crimson seedlees and Mid Night Beauty" in both seasons.

Concerning the specific effect of mineral and bio-fertilizer treatments on leaf magnesium content, tabulated data in **Table (4)** illustrates that , all tasted fertilizer treatments failed to induced an significant increase on leaf magnesium content in both season while ,T8 (9g + P 6g + K 6g + Bio 15g) scored the highest value of magnesium content followed in a descending order by fertilized transplants with T7(N 9g +P 6g +K 6g +Bio 10g) then (N 9g +P 6g +K 6g +Bio 5g) in both seasons. On reverse, control transplants fertilized with chemical NPK only at low level recorded the lowest value . The other tested treatments came in-between the previously mentioned two categories in this respect.

B. Interaction effect:

Focusing on the interaction effect of various combinations between grape cultivars and fertilizer treatments on leaf magnesium content, data in **Table (4)** demonstrates that Crimson transplants fertilized with T8(N 9g +P 6g +K 6g +Bio 15g) had significantly value. Meanwhile, the reverse was true with Crimson transplants fertilized with NPK at the rate of (6g +3g +3g) in the first and second seasons. All other combinations took an intermediate position between the previously two mentioned categories.

Table 4. Effect of mineral and bio-fertilizers on leaf Mg content (ppm) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaf Mg content (ppm)					
Cultivar	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
Treatments	First season(2018- 2019)			Second season(20-19 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	0.56	0.57	**0.56 A**	0.57	0.57	**0.57 A**
T2- (N 9 g+ P 6 g+ K 6 g)	0.63	0.58	**0.60 A**	0.64	0.64	**0.64 A**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	0.77	0.77	**0.77 A**	0.77	0.77	**0.77 A**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	0.82	0.83	**0.83 A**	0.83	0.83	**0.83 A**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	0.85	0.86	**0.86 A**	0.85	0.86	**0.86 A**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	0.88	0.90	**0.89 A**	0.88	0.90	**0.89 A**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	0.93	0.95	**0.94 A**	0.93	0.95	**0.94 A**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	0.97	0.99	**0.98A**	0.97	0.99	**0.98 A**
T9 - Bio 5 g	0.62	0.63	**0.63A**	0.63	0.58	**0.60 A**
T10 - Bio 10 g	0.68	0.68	**0.68 A**	0.68	0.68	**0.68 A**
T11 - Bio 10 g	0.72	0.71	**0.72A**	0.73	0.71	**0.72 A**
Mean	**0.769 A**	**0.772 A**		**0.772 A**	**0.774 A**	
L.S.D for interaction		0.001648			0.001648	

5- Leaf iron content:

A. Specific effect:

Concerning the specific effect of two cultivars and fertilizer treatments on leaf iron content, tabulated data in Table (5) reveal that a fluctuated trend was shown between the two grape cultivars (Crimson and Mid Night Beauty) from the first season to the second one. However, all tasted fertilizer treatments induced an increment on Fe content in comparison with the control treatment (T1). The highest value was scored byT8 (N 9g +P 6g +K 6g +Bio 15g),followed in a descending order by fertilized transplants withT7(N 9g +P 6g +K 6g +Bio 10g) in both seasons with non-significant differences between them and T6 (N 9g +P 6g +K 6g +Bio 5g) in the second season.

B. Interaction effect:

Focusing on the interaction effect of various combinations between grape cultivars and fertilizer treatments on leaf iron content, data in Table (5) demonstrate that Crimson and Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g(T8) had significantly the highest value. Meanwhile, the reverse was true with Crimson seedless and Mid Night Beauty transplants fertilized with NPK at the rate of 6 +3 +3(Control) in both seasons. All other combinations took an intermediate position between the previously two mentioned categories.

Table 5. Effect of mineral and bio-fertilizers on leaf Fe content (PPm) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaf Fe content (PPm)					
Cultivar	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
Treatments	First season (2018- 2019)			Second season (2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	109.00	110.40	**109.6K**	109.70	110.40	**110.00 G**
T2 - (N 9 g+ P 6 g+ K 6 g)	132.00	137.20	**123.00 I**	132.00	137.20	**134.6EF**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	174.40	176.10	**175.28F**	174.40	176.10	**175.25 D**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	189.30	191.60	**190.48E**	179.30	111.30	**145.30 E**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	206.60	207.70	**207.1D**	206.60	208.00	**207.30 C**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	232.26	229.30	**230.7C**	232.30	229.30	**230.80 B**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	253.70	251.90	**252.80B**	253.80	251.90	**252.90B**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	277.00	276.20	**276.60A**	277.00	276.20	**276.60 A**
T9 - Bio 5 g	119.30	123.00	**128.23 J**	119.60	123.00	**121.30 FG**
T10 - Bio 10 g	149.50	148.30	**148.90H**	149.50	148.30	**148.90 E**
T11 - Bio 10 g	146.30	164.00	**155.15G**	146.40	165.40	**155.87 DE**
Mean	**180.86 B**	**182.42 A**		**180.05 A**	**176.10 B**	
L.S.D for interaction		13.66			12.97	

6- Leaf zinc content:

A. Specific effect:

A fluctuated trend was shown between the two tasted cultivars (Crimson seedless and Mid Night Beauty) from the first season to the anther one. Regarding the specific effect of mineral and bio-fertilizer treatments on leaf zinc content Crimson and Mid Night Beauty cultivars**, Table (6) ,** shows that ,N 9 g +P 6 g +K 6 g +Bio 15g fertilizer treatment (T8) induced statistically the highest values in comparison with other treatments, followed in a descending order by N 9 g +P 6 g +K 6 g +Bio 10 g treatment (T7) then N 9 g + P 6 g +K 6 g +Bio 5g treatment (T6) in the both seasons. On reverse, control treatment (N 6 g +P 3g +K 3g) recorded the lowest values in both seasons. The other tested treatments came in-between the previously mentioned two categories in this respect.

B. Interaction effect:

Dealing with the response of leaf zinc content to interaction effect of various combinations between grape cultivars and fertilizer treatments, it was so clear to notice from **Table (6)** that, the Crimson seedless and Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g (T8) gave the highest value with non significant differences between them during the two seasons of study. On the other hand, Mid Night Beauty transplants fertilized with T1 (control) reported lowest value. The other combinations came statistically in-between the previously mentioned two categories in this regard during the two seasons of study.

Table 6. Effect of mineral and bio-fertilizers on leaf Zn content (ppm) of Crimson and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaf Zn content (ppm)					
Cultivar	Crimson seedless	Mid Night Beauty	Mean*	Crimson seedless	Mid Night Beauty	Mean*
Treatments	First season(2018- 2019)			Second season(2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	30.77	28.90	**29.83 J**	30.92	28.93	**29.92 J**
T2 - (N 9 g+ P 6 g+ K 6 g)	37.27	31.11	**34.19 I**	37.31	36.81	**37.06 H**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	45.81	44.47	**45.09 F**	45.84	44.41	**45.13F**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	48.38	57.14	**52.76D**	48.41	48.17	**48.29 E**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	52.33	51.56	**51.94 E**	52.36	49.90	**51.13 D**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	55.10	54.54	**54.82 C**	55.14	54.58	**54.86 C**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	57.96	57.75	**57.86 B**	58.00	57.78	**57.89 B**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	61.46	61.56	**61.51 A**	61.50	61.60	**61.55 A**
T9 - Bio 5 g	32.77	36.79	**34.78 H**	32.79	31.12	**31.95 I**
T10 - Bio 10 g	39.51	43.13	**41.32 G**	39.54	37.17	**38.36 H**
T11 - Bio 10 g	42.48	41.31	**41.89G**	42.50	41.34	**41.92 G**
Mean	**45.80 B**	**46.19 A**		**45.85 A**	**44.71 B**	
L.S.D for interaction		1.48			1.16	

7- Leaf manganese content:

A. Specific effect:

Regarding the specific effect of cultivars and fertilizer treatments on leaf manganese content data obtained in **Table (7)** reveal that, Crimson seedless cultivar surpassed statistically the highest values Mid Night Beauty cultivar on their contenting of leaf manganese in both seasons. In addition ,N 9g +P 6g +K 6g +Bio 15gfertilizer treatment (T8) induced statistically the highest values in comparison with other treatments, followed in a descending order by N 9g +P 6g +K 6g +Bio 10g treatment (T7) and N 9g +P 6g +K 6g +Bio 5g treatment (T6)in the both seasons. On reverse, control treatment (N 6g +P 3g +K 3g) recorded the lowest values in both seasons. The other tested treatments came in-between the previously mentioned two categories in this respect.

B. Interaction effect:

Looking at the response of leaf manganese content to interaction effect of various combinations between grape cultivars and fertilizer treatments, it is easy clear to notice from **Table (7)** that, the Crimson transplants fertilized with N 9g +P 6g +K 6g +Bio 15g (T8)gave the highest value during the two seasons of study. On the other hand, Crimson and Mid Night Beauty transplants fertilized with T1 (control) reported lowest value with non significant differences between them during the two seasons. The other combinations came statistically in-between the previously mentioned two categories .

Table 7. Effect of mineral and bio-fertilizers on leaf Mn content (ppm) of Crimson and Mid Night Beauty grape transplants during 2019 and 2020 seasons

Character	Leaf Mn content (ppm)					
Cultivars	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
Treatments	First season(2018- 2019)			Second season(2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	68.45	67.53	**67.99 K**	68.48	67.55	**68.02 C**
T2 - (N 9 g+ P 6 g+ K 6 g)	73.24	68.21	**70.72 I**	77.29	75.13	**76.21 C**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	87.33	85.07	**86.20 F**	87.36	85.11	**86.23C**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	91.07	90.10	**90.58 E**	91.09	90.13	**90.61 C**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	98.29	98.57	**98.43 D**	198.10	98.56	**148.30A**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	122.00	118.90	**120.43 C**	122.20	118.90	**120.50B**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	151.06	137.26	**144.16 B**	151.10	137.26	**144.2AB**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	162.66	155.40	**159.03 A**	162.70	155.40	**159.10 A**
T9 - Bio 5 g	71.09	75.11	**73.10 J**	71.12	68.21	**69.67 C**
T10 - Bio 10 g	79.65	75.49	**77.57H**	79.44	75.51	**77.47C**
T11 - Bio 10 g	83.07	82.92	**82.99 G**	83.11	82.86	**82.98 C**
Mean*	**98.902 A**	**95.868 B**		**108.36 A**	**95.88 B**	
L.S.D for interaction		3.110			3.508	

The gained results of this study may be due to the role of fertilization in growth and development of grape transplants; hence the use of organic fertilizers (compost) and bio NPK added to the soil, it led to decrease soil pH which led to increase solubility of the nutrients for plant uptake, in some cases organic materials may act as low release fertilizer.

Recently, on the way of sustainable agriculture with minimum effects, the use of organic fertilization (compost or bio NPK, etc) as natural soil amendments is recommended to substitute the soluble chemical fertilizers. They enhance the structure of weak structured soils and improve their water holding capacity. Also, they increase soil fertility, and activate root growth, create active biological conditions and enhancing activities of microorganisms, especially those related with mineralization **(Suresh *et al.*, 2004)**. Furthermore, to interpret and evaluate the influence of chemical fertilization of this work, on increasing the different studied vegetative growth criteria and chemical composition of grape transplants, it is important to refer to the physiological roles of nitrogen, phosphorus and potassium in plant growth and development. Such three macronutrient elements are the basic elements usually used in chemical fertilizers. Plant supplement with these macronutrients in form of fertilizers is necessary because the soil is usually in deficient of them due to plant removal leaching or they are not readily available for plants **(Marschener, 1997).** Therefore, such addition of NPK fertilization quantities insured high growth of vegetative traits and chemical composition of grape transplants.

These results are in agreement with those obtained by **Nijjar, 1985**, who reported that the improving effect of organic fertilizers on leaf content of nitrogen, phosphorus and potassium can be attributed to their influence manifested in increasing the organic matter in the soil. Also, **Kassem and Marzouk, 2002** stated that adding organic manure increase leaf mineral content due to availability of nutrients in the soil. However, **El-Karamany *et al.*, 2000** found that, biofertilizers help in availability of

mineral and their forms in the composted material and increase levels of extractable NPK. **Shaheen *et al.*, 2013** Saied that, used organic fertilizer and natural rocks fertilizers in combination with NPK bio-fertilizers can reduce the need for about 50% of NPK mineral fertilizers. In addition, minimized the production cost and the environmental pollution which could be occurred by excess of chemical fertilizers.

Aly *et al.*, 2015 reported that, foliar Potassium and Boron treatments gave the highest leaves nitrogen %, phosphorus % and potassium % compared with control treatment.

Ahmed *et al.*, 2016 found that, the highest values of N were recorded on the vine that received N completely via mineral N and the lowest values of leaf pigments P, K and Mg were recorded on the vines that received N via 100% mineral N alone (un organic and bio-fertilization).

Also, these results are in harmony with those obtained by **Madian (2010), Refaai (2011), Uwakiem (2011)** and **Abd El- Razek (2014)** who worked in different grapevines cvs.

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تأثير الاسمدة المعدنية والحيوية على المحتوى المعدنى لشتلات العنب الكرمسون والميدنيت بيوتى

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أجريت الدراسة خلال موسمى(2018–2019) و (2019 – 2020) بمزرعة قسم البساتين بكلية الزراعة جامعة بنها محافظة القليوبية تم إختيارصنفين من عنب التصدير لإجراء هذه الدراسة (الكريمسون – الميدنيت بيوتى) لدراسة تأثير التسميد المعدنى والحيوى على المحتوى المعدنى لشتلات عنب عمر سنة. وكانت المعاملات هى:التسميد المعدنى بمعدل(6جم و3جم و3جم) الكنترول, التسميد المعدني بمعدل(9جم و6جم و6جم), التسميد المعدني بمعدل(6جم و3جم و3جم) + 5جم مخلوط حيوى, التسميد المعدني معدل(6جم و3جم و3جم) + 10جم مخلوط حيوى , التسميد المعدني بمعدل(6جم و3جم و3جم) + 15جم مخلوط حيوى ,التسميد المعدني بمعدل(9جم و6جم و6جم) + 5جم مخلوط حيوى, التسميد المعدني بمعدل(9جم و6جم و6جم) + 10جم مخلوط حيوى, التسميد المعدني بمعدل(9جم و6جم و6جم) + 15جم مخلوط حيوى,التسميد الحيوى بمعدل 5 جم محلوط حيوى, التسميد الحيوى بمعدل 10 جم محلوط حيوى, التسميد الحيوى بمعدل 15جم محلوط حيوى.أوضحت النتائج أنه فى معظم الحالات لا يوجد فروق معنوية فى المحتوى المعدنى بين صنفى العنب الكريمسون والميدنيت بيوتى بينما تفوقت المعاملة رقم 8(التسميد المعدني(NPK) بمعدل(9جم و6جم و6جم) + 15جم مخلوط حيوى)حيث أدت إلى زيادة فى محتوى الأوراق من العناصر المعدنية بالمقارنة بباقى معاملات الدراسة شاملة معاملة الكنترول(التسميد المعدني (NPK) بمعدل(6جم و3جم و3جم) خلال موسمى الدراسة.