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Effect of Mineral Npk and Bio-Fertilizers on Vegetative Growth 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 varieties for export were chosen for this investigation (Crimson seedless and Mid Night Beauty) to study the effect of NPK mineral and bio- fertilization on vegetative growth of transplants at one-year-old. Treatments were the combination of eleven fertilization treatments (T1): Chemical fertilizer (NPK) at 6 g ammonium sulphate, 3g calcium superphosphate and 3 g potassium sulphate (N6g + P3g + K3g), (T2): Chemical fertilizer (NPK) at 9 g ammonium sulphate, 6g calcium superphosphate and 6 g potassium sulphate (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, Crimson seedless transplants resulted in an increase in length, leaf area, shoot fresh and dry weight whereas, Mid Night Beauty transplants resulted in an increase in stem diameter, number of lateral shoot, leaves dry weight, root fresh weight and root dry weight. Fertilization with T8 (N 9g +P 6g +K 6g +Bio 15g) was superior in this respect where it was able to increase significantly all vegetative growth measurements as compared with the other different investigated fertilization during both seasons of study. On the other hand, treated transplants with T1 (Control) induced the lowest values in this concern in most cases.

Key words: Grape transplants, mineral NPK and bio-fertilizers and vegetative growth.

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 roles to improve 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 (**Shimbo *et al.*, 2001; Abdel-Hamid, 2002; Chirinos *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 those two varieties (Crimson seedless and Mid Night Beauty) were the plant materials involved in that investigation.

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

One year old grape own rooted cuttings of both investigated varieties 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-fertilizers:

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 by gram (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 Feb. 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:.

1-(6,3,3) NPK as control
2-(9,6,6) NPK
3-(6,3,3) NPK +5 g bio-fertilizer
4-(6,3,3) NPK+10 g bio-fertilizer
5-(6,3,3) NPK +15 g bio-fertilizer
6-(9,6,6) NPK +5 g bio-fertilizer
7-(9,6,6) NPK +10 g bio-fertilizer
8-(9,6,6) NPK +15 g bio-fertilizer
9-5 g bio-fertilizer
10-10 g bio-fertilizer
11-15 g bio-fertilizer

The measurement assigned to the investigation:

On the first week of October during both seasons the transplants (sixty six) of each investigated grape variety which have been allocated for this study, were subjected to the following estimation :

1- transplant length (Cm): Stem length of transplant (replicate) was determined as average.

2- Stem diameter (Cm): Stem diameter was determined as average.

3- Leaves number: Leaves per each transplant were individually recorded.

Furthermore, each individual transplant was pulled out from its growing medium and washed carefully with tap water in order to ride of any dust on the leaves as well as the remains of root growth medium.

The transplants were left sometimes in shading area to evaporate the remaining of washing tap water. Finally, each transplant was divided into its own three organs (root, shoot and leaves).

4-Fresh and dry weights of leaves, stems, roots as well as top/root ratio were estimated.

5- Average leaf area (cm^2) of each individual transplant was estimated by using planimeter.

6- Total assimilation area (cm^2) Total area, calculated by multiplying average leaf area by number of leaves of each transplant.

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**). In addition, significant differences among means were

differentiated according to the Duncan's, multiple range **(Duncan, 1955)**.

Results and Discussion

In this Concern 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. Vegetative growth measurements

The effect of grape cultivars and fertilizers treatments and their interactions on vegetative growth measurements during (2018-2019) and (2019-2020) seasons are presented in Tables (1,2,3,4 and 5).

1.1- Transplant length

A. Specific effect:

it is quite clear from Table (1) that, Crimson seedless grape scored the tallest transplants (47.84 &51.22 cm) as compared with the other investigated cultivar (Mid Night Beauty) it scored (39.65&40.26cm) during the first and second seasons, respectively.

Concerning the specific effect of mineral and bio-fertilizer treatments on transplant length, tabulated data in Table (1) reveals that the tallest transplants (73.77&73.64 cm) was scored by fertilized transplants with N9g+P6g+K6g+Bio15g (T8), followed in a descending order by fertilized transplants with N9g+P6g+K6g+Bio 10g (68.42&67.54 cm) then N 9g +P 6g +K 6g +Bio 5g (60.47&61.78 cm) in the first and second seasons, respectively. On reverse, transplants fertilized with chemical NPK only at low level as control (N 6g +P 3g +K 3g)recorded the shortest height (22.55&24.94 cm) during the first and second seasons, respectively. 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 transplant length, data in Table (1) demonstrates that Crimson seedless transplants fertilized with N 9g +P 6g +K 6g +Bio 15g had significantly the tallest stem (81.66 & 84.44 cm). Meanwhile, the reverse was true with Mid Night Beauty transplants fertilized with NPK at the rate of 6 +3 +3 (21.33 & 23.20 cm) in the first and second seasons, respectively. All other combinations took an intermediate position between the previously two mentioned categories.

Table 1. Effect of mineral and bio-fertilizers on transplant length (cm) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Transplant length (cm)					
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)	23.17	21.33	**22.25 H**	26.67	23.20	**24.94 I**
T2 - (N 9 g+ P 6 g+ K 6 g)	24.52	28.39	**26.45 G**	28.47	27.83	**28.15 H**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio5g	46.37	40.82	**43.59 E**	49.68	41.69	**45.68 E**
T4- (N 6 g+P 3 g+ K 3 g) + Bio 10 g	48.95	41.81	**45.38 E**	53.57	43.76	**48.66 D**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	53.47	46.20	**49.83 D**	54.39	46.03	**50.21 D**
(N 9g+P 6g+K 6g) + Bio 5 gT6 -	72.17	48.76	**60.47 C**	75.84	47.73	**61.78 C**
(N 9g+P 6g+K 6g) + Bio 10 gT7 -	75.94	60.91	**68.42 B**	78.56	56.51	**67.54 B**
(N 9g+P 6g+K 6g) + Bio 15 gT8 -	81.66	65.88	**73.77 A**	84.44	62.83	**73.64 A**
T9 - Bio 5 g	25.51	21.97	**23.74 H**	29.40	24.75	**27.07 H**
T10 - Bio 10 g	35.77	29.27	**32.52 F**	40.16	33.03	**36.59 G**
T11 - Bio 10 g	38.71	30.82	**34.77 F**	42.25	35.53	**38.89 F**
Mean	**47.84 A**	**39.65 B**		**51.22A**	**40.26B**	
L.S.D for interaction		3.182			3.159	

1.2- Stem thickness (cm)

A. Specific effect:

Regarding the effect of two grape cultivars (Crimson seedless and Mid Night Beauty) on stem diameter, data presented in Table (2) illustrates that Mid Night Beauty transplant gave the highest values of stem diameter as compared with the other investigated cultivar (Crimson seedless) during the two seasons of study.

As for the specific effect of mineral and bio-fertilizer treatments of Crimson seedless and Mid Night Beauty cultivars on stem diameter, Table (2) displays that, the stem was thickness in transplants fertilized mixed minerals and bio fertilizers at high level (T8 - N 9g +P 6g +K 6g +Bio 15g) rather than in other treatments especially NPK only at N 6g +P 3g +K 3g (control) during both seasons. The other tested treatments came in-between the previously mentioned two categories in this respect.

Table 2. Effect of mineral and bio-fertilizers on stem diameter (cm) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Stem diameter (cm)					
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)	0.54	0.59	**0.57 H**	0.57	0.55	**0.56 G**
T2 - (N 9 g+ P 6 g+ K 6 g)	0.63	0.77	**0.70 G**	0.69	0.79	**0.74 F**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	0.87	0.93	**0.90 DE**	0.92	0.95	**0.93 D**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	0.91	0.95	**0.93 D**	0.94	1.05	**0.99 D**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	1.04	1.05	**1.05 C**	1.11	1.09	**1.10 C**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	1.05	1.11	**1.08 C**	1.12	1.15	**1.14 C**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	1.16	1.27	**1.22 B**	1.22	1.29	**1.26 B**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	1.32	1.31	**1.32 A**	1.36	1.32	**1.34 A**
T9 - Bio 5 g	0.55	0.62	**0.58 H**	0.58	0.63	**0.61 G**
T10 - Bio 10 g	0.74	0.81	**0.77 F**	0.79	0.81	**0.80 F**
T11 - Bio 10 g	0.81	0.89	**0.85 E**	0.85	0.89	**0.87 E**
Mean	**0.87 B**	**0.93 A**		**0.92 B**	**0.95 A**	
L.S.D for interaction		**0.1042**			**0.09025**	

B. Interaction effect:

Referring to the interaction effect of various (grape cultivars x fertilizer treatments) combinations on stem diameter Table (2) reveals that Crimson seedless and Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g had the thickened stem with non significant differences between them during the two seasons of study. On the other hand, the reverse was found with Crimson seedless and Mid Night Beauty transplants fertilized with (T1 - N 6g +P 3g +K 3g). In addition other combinations were in between during the both seasons of study.

1.3- Number of shoots /transplant:

A. Specific effect:

Table (3) shows that Mid Night Beauty grape cultivar scored the highest number of lateral shoot per transplant (9.44 & 9.58) as compared with the other tested cultivar(Crimson seedless) that scored (8.37& 8.97) during the first and second season , respectively.

Considering the specific effect of fertilizer treatments, it is quite evident that, transplants fertilized with NPK at9 +6 + 6gand 15g bio fertilizers (T8) gave highest number of lateral shoots/ transplant, followed in a descending order by fertilized transplants with N 9g +P 6g +K 6g +Bio 10g rather than in other treatments especially T1 (N 6g +P 3g +K 3g) as control that gave the lowest number of lateral shoot per transplant on both seasons (Table, 3).

Table3. Effect of mineral and bio-fertilizers on number of lateral shoots/transplant of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons .

Character	Number of lateral shoots/transplant					
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)	3.66	5.10	**4.38 I**	4.17	5.27	**4.72 H**
T2 - (N 9 g+ P 6 g+ K 6 g)	6.38	7.00	**6.68 G**	7.11	7.27	**7.19 F**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	8.00	9.02	**8.51 F**	8.53	9.40	**8.98 E**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	9.05	10.20	**9.63 E**	9.77	10.36	**10.06 D**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	9.22	11.52	**10.37 D**	10.24	11.70	**10.97 C**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	10.33	11.98	**11.15 C**	11.06	11.97	**11.51 BC**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	10.65	12.73	**11.69 B**	11.28	12.90	**12.09 B**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	12.90	13.13	**13.02 A**	13.51	13.22	**13.36 A**
T9 - Bio 5 g	5.60	5.00	**5.30 H**	6.34	4.83	**5.58 G**
T10 - Bio 10 g	7.33	8.73	**8.03 F**	7.95	8.94	**8.44 E**
T11 - Bio 10 g	9.00	9.46	**9.23 E**	8.75	9.55	**9.15 E**
Mean	**8.37 B**	**9.44 A**		**8.97 B**	**9.58 A**	
L.S.D for interaction		0.2708			0.5052	

B. Interaction effect:

Regarding the response of number of lateral shoots per transplant to interaction effect of various combinations between grape cultivars and fertilizer treatments, it was so clear to notice from Table (3) that, the Crimson seedless and Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g gave the highest number of lateral shoots per transplant with non significant differences between them during the two seasons of study. On the other hand, Crimson seedless transplants fertilized with T1 (control) reported the lowest number of lateral shoots/ transplant. The other combinations came statistically in-between the previously mentioned two categories in this regard during the two seasons of study.

1.4- Number of leaves /transplant:

A. Specific effect:

Referring to the specific effect of grape cultivars (Crimson seedless and Mid Night Beauty) on number of leaves /transplant, it is quite clear from Table (4) that, the number of leaves/ transplant was influenced by grape cultivars. Herein, Mid Night Beauty transplants resulted in an increase in leaves number / transplant in the first season, whereas Crimson seedless resulted in an increase in leaves number / transplant in the second one.

Regarding the specific effect of mineral and bio-fertilizer treatments on number of leaves /transplant of Crimson seedless and Mid Night Beauty cultivars**,** Table (4) indicates that in both seasons, N 9g +P 6g +K 6g +Bio 15g fertilizer treatment (T8) induced statistically the highest number of leaves /transplant in comparison with other treatments, followed in a descending order by N 9g +P 6g +K 6g +Bio 10g treatment (T7) in the both seasons. On reverse, control treatment (N 6g +P 3g +K 3g) recorded the lowest number of leaves /transplant in both seasons. The other tested treatments came in-between the previously mentioned two categories in this respect.

B. Interaction effect:

As for the interaction effect of various combinations between grape cultivars and fertilizer treatments on number of leaves /transplant, Table (4) reveals that Mid Night Beauty and Crimson seedless transplants fertilized with N 9g +P 6g +K 6g +Bio 15g had the highest number of leaves /transplant with non significant differences between them in both seasons. Meanwhile, Crimson seedless transplants fertilized with N 9g +P 6g +K 6g (control) scored significantly the lowest number of leaves / transplant. In addition other combinations were in between during the both seasons of study.

Table 4. Effect of mineral and bio-fertilizers on number of leaves/transplant of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Number of leaves/transplant					
Cultivar / Treatments	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
	First season(2018- 2019)			Second season(2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	8.42	11.37	**9.89 I**	9.85	11.60	**10.73 I**
T2 - (N 9 g+ P 6 g+ K 6 g)	19.50	21.00	**20.25H**	22.00	22.46	**22.23 H**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	29.48	26.40	**27.94 F**	31.43	26.77	**29.10 F**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	35.00	35.38	**35.19 E**	37.15	36.88	**37.02 E**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	37.55	37.73	**37.64 D**	39.69	38.77	**39.23 D**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	39.48	39.50	**39.49 C**	41.81	40.77	**41.29C**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	42.38	42.72	**42.55 B**	44.10	44.71	**44.40 B**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	43.75	45.35	**44.55 A**	46.47	47.85	**47.16 A**
T9 - Bio 5 g	8.73	12.68	**10.71 I**	10.57	12.87	**11.72 I**
T10 - Bio 10 g	21.33	25.00	**23.17G**	24.53	26.75	**25.64 G**
T11 - Bio 10 g	27.75	27.07	**27.40 F**	30.88	27.75	**29.32 F**
Mean	**28.49 B**	**29.47 A**		**30.77 A**	**30.65 B**	
L.S.D for interaction		2.333			2.407	

1.5- Average leaf area (cm^2):

A. Specific effect:

Data presented in Table (5) indicated that, Crimson seedless grape scored a greater value of leaf area (46.10and 48.45cm^2)as compared with the other investigated cultivar (Mid Night Beauty) it scored (44.80&46.10cm^2) during the first and second seasons, respectively.

Concerning the specific effect of mineral and bio-fertilizer treatments on leaf area, tabulated data in Table (5)indicate that N9g + p6g +k6g + Bio 15 g (T8) and N9g + p6g +k6g + Bio 10 g (T7) scored the highest values of leaf area, followed in a descending order byN9g + p6g +k6g + Bio 5 g (T6) with non significant differences between that and the previous two categories (T8 and T7) in the second season only. On reverse, transplants fertilized with control treatment (N 6g +P 3g +K 3g)and T9 (Bio 10 g) recorded the lowest value with non significant differences, 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 area per transplant to interaction effect of various combinations between grape cultivars and fertilizer treatments, it was so clear to notice from Table (5) that, the Crimson seedless and Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g (T8)gave the highest value of leaf area per transplant with non significant differences between them during the two seasons of study. On the other hand, Crimson seedless and Mid Night Beauty transplants fertilized with T1 (control) reported the lowest values of leaf area per transplant. The other combinations took statistically an intermediate position between the previously mentioned two categories in this regard during the two seasons of study.

Table 5. Effect of mineral and bio-fertilizers on leaf area $(cm)^2$ of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaf area $(cm)^2$					
Cultivar / Treatments	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
	First season(2018- 2019)			Second season(2019- 2020)		
T1 -Control (N 6 g+P 3 g+K 3 g)	32.92	21.40	**27.16G**	36.15	31.43	**33.79 F**
T2 - (N 9 g+ P 6 g+ K 6 g)	36.08	38.55	**37.31 F**	53.41	39.17	**46.29 CD**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	42.42	44.15	**43.28DE**	42.94	45.09	**44.01 CD**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	46.68	46.61	**46.64CD**	47.23	47.34	**47.28 CD**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	49.49	48.70	**49. 09 C**	49.99	49.80	**49.89 BC**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	57.04	54.05	**55.54 B**	57.67	54.72	**56.19AB**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	61.04	57.33	**59.19 A**	61.72	58.33	**60.03 A**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	63.23	60.37	**61.80 A**	63.87	61.01	**62.44 A**
T9 - Bio 5 g	33.23	33.21	**33.22 G**	33.52	33.96	**33.74 EF**
T10 - Bio 10 g	39.62	44.12	**41.87EF**	40.33	41.42	**40.87 DE**
T11 - Bio 10 g	45.39	44.31	**44.85 D**	46.13	44.89	**45.51 CD**
Mean	**46.10 A**	**44.80 B**		**48.45 A**	**46.10 B**	
L.S.D for interaction		8.524			11.07	

I.6- Leaves fresh weight (g):

A. Specific effect:

Regarding the specific effect of mineral and bio-fertilizer treatments on leaves fresh weight of Crimson seedless and Mid Night Beauty cultivars**, Table (6)**, displayed that leaves fresh weight did not responded to the tested cultivars in the first season. Meanwhile ,Mid Night Beauty cultivar recorded the highest values in the second season. N 9g +P 6g +K 6g +Bio 15g fertilizer 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)with non significant differences in 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 concern.

B. Interaction effect:

Regarding the response of leaves fresh weight to interaction effect of various combinations between grape cultivars and fertilizer treatments, Table (6) relives that, the Crimson seedless and Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g gave the highest value. On the other hand, Cirmson seedless and Mid Night Beauty transplants fertilized with T1 (control) reported the lowest value with non significant differences in both seasons. The other combinations came statistically in-between the previously mentioned two categories in this sphere during the two seasons of study.

Table 6. Effect of mineral and bio-fertilizers on leaves fresh weight (g) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaves fresh weight (g)					
Cultivar	Crimson seedless	Mid Night Beauty	Mean	Crimson seedless	Mid Night Beauty	Mean
Treatments	First season(2018- 2019)			Second season(2019- 2020)		
T 1 Control (N 6 g+P 3 g+K 3 g)	6.50	5.43	**5.97 J**	7.02	7.46	**7.24 H**
T2 (N 9 g+ P 6 g+ K 6 g)	11.50	12.47	**11.98 H**	12.17	16.46	**14.31 F**
T3 (N 6 g +P 3 g+ K 3 g) + Bio 5 g	20.08	18.49	**19.29 E**	20.91	18.83	**19.87D**
T4 (N 6 g+P 3 g+ K 3 g) + Bio 10 g	22.25	23.50	**22.88 D**	22.98	25.82	**24.40 C**
T5 (N 6 g+P 3g+K 3g) + Bio 15 g	24.40	24.87	**24.64 C**	22.93	27.05	**24.99 C**
T6 (N 9g+P 6g+K 6g) + Bio 5 g	27.47	30.46	**28.97 B**	28.27	29.77	**29.02 B**
T7 (N 9g+P 6g+K 6g) + Bio 10 g	29.17	28.34	**28.76 B**	28.70	29.31	**29.00 B**
T8 (N 9g+P 6g+K 6g) + Bio 15 g	31.50	30.66	**31.08 A**	32.51	33.08	**32.79A**
T9 Bio 5 g	9.32	8.77	**9.05 I**	9.93	10.52	**10.22G**
T10 Bio 10 g	13.43	14.12	**13.78 G**	14.28	17.92	**16.10 E**
T11 Bio 15 g	15.62	16.19	**15.90 F**	16.92	19.73	**18.32 D**
Mean	**19.21 A**	**19.39 A**		**19.69 B**	**21.45 A**	
L.S.D for interaction		2.379			2.913	

I.7- Leaves dry weight (g):

A. Specific effect:

Data in Table (7) shows clear that the leaves dry weight for Crimson seedless and Mid Night Beauty transplants, Mid Night Beauty transplants scored the highest value (7.54&8.09) with high significant differences between them and those reported by Crimson seedless transplants (6.80&7.25) during the first and second seasons, respectively.

Regarding the specific effect of mineral and bio-fertilizer treatments on leaves dry weight of Crimson seedless and Mid Night Beauty cultivars**,** Table (7) indicates that T8(N 9g +P 6g +K 6g +Bio 15gfertilizer treatment)induced statistically the highest weight of leaves /transplant in comparison with other treatments, followed in a descending order byT7(N 9g +P 6g +K 6g +Bio 10g treatment)in both seasons. On reverse, control treatment (N 6g +P 3g +K 3g) recorded the lowest value in both seasons. The other tested treatments came in-between in both seasons.

B. Interaction effect:

Focusing on the interaction effect of various combinations between grape cultivars and fertilizer treatments on leaves dry weight, data in Table (7) demonstrates that Mid Night Beauty transplants fertilized with N 9g +P 6g +K 6g +Bio 15g had significantly the highest value (14.66& 15.18). On reverse, Crimson seedless and Mid Night Beauty transplants fertilized with control treatment 6g +3g +3g (T1) recorded the lowest value with non significant differences in both seasons. All other combinations took an intermediate position between the previously two mentioned categories.

Table 7. Effect of mineral and bio-fertilizers on leaves dry weight (g) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	Leaves dry weight (g)					
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)	2.12	1.95	**2.03 H**	2.29	2.63	**2.46 I**
T2-(N 9 g+ P 6 g+ K 6 g)	4.02	5.66	**4.84 G**	4.35	6.33	**5.34 G**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	6.89	6.50	**6.60 EF**	7.28	7.00	**7.14 F**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	7.74	7.47	**7.60 DE**	8.22	7.91	**8.07 E**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	8.72	8.65	**8.68 CD**	9.14	9.27	**9.20 D**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	9.53	9.53	**9.53 BC**	10.03	10.21	**10.12 C**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	10.16	11.51	**10.84 B**	11.01	11.85	**11.43 B**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	11.82	14.66	**13.24 A**	12.40	15.18	**13.79 A**
T9 - Bio 5 g	3.17	3.27	**3.22 H**	3.79	3.89	**3.84 H**
T10 - Bio 10 g	4.85	6.13	**5.49 FG**	5.02	6.68	**5.85 G**
T11 - Bio 10 g	5.78	7.65	**6.72 EF**	6.23	8.06	**7.14 F**
Mean	**6.80 B**	**7.54 A**		**7.25 B**	**8.09 A**	
L.S.D for interaction		1.098			1.11	

I.8- Shoot fresh weight (g):

A. Specific effect:

Regarding the specific effect of mineral and bio-fertilizer treatments on shoot fresh weight of Crimson seedless and Mid Night Beauty cultivars**,** Table (8), Crimson seedless cultivar gave the highest significant values (29.42& 32.10 g) as compared with Mid Night Beauty cultivar (25.31) in the first and second seasons. N 9g +P 6g +K 6g +Bio 15g fertilizer treatment (T8) produced 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 first season and (T7) in the second season. 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 regard.

B. Interaction effect:

Regarding the response of shoot fresh weight to interaction effect of various combinations between grape cultivars and fertilizer treatments, it was so clear to notice from Table (8) that, Crimson seedless transplants fertilized with N 9g +P 6g +K 6g +Bio 15g gave the highest value with non significant differences between them and Mid Night Beauty transplants fertilized with the same treatment in the second season. On the other hand, two cultivars fertilized with T1 (control) scored the lowest value. The other combinations came statistically in-between during the two seasons of study.

Table 8. Effect of mineral and bio-fertilizers on shoot fresh weight (g) of Crimson seedless and Mid Night Beauty grape transplants during 2019 and 2020 seasons.

Character	**Shoot fresh weight (g)**					
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)	12.85	13.99	**13.42 K**	14.36	17.28	**15.82 I**
T2 - (N 9 g+ P 6 g+ K 6 g)	21.13	17.79	**19.46 I**	23.47	21.59	**22.53H**
T3 - (N 6 g +P 3 g+ K 3 g) + Bio 5 g	32.27	24.50	**28.39F**	34.43	27.91	**31.17 F**
T4 - (N 6 g+P 3 g+ K 3 g) + Bio 10 g	34.34	26.99	**30.67E**	37.04	31.30	**34.17 E**
T5 -(N 6 g+P 3g+K 3g) + Bio 15 g	36.02	30.51	**33.26D**	39.11	34.49	**36.80 D**
T6 - (N 9g+P 6g+K 6g) + Bio 5 g	38.09	33.40	**35.74 B**	40.50	37.32	**38.91C**
T7 - (N 9g+P 6g+K 6g) + Bio 10 g	33.29	34.94	**34.11 C**	42.61	39.22	**40.92B**
T8 - (N 9g+P 6g+K 6g) + Bio 15 g	42.39	37.13	**39.76 A**	43.12	43.19	**43.15 A**
T9 - Bio 5 g	14.80	15.29	**15.05 J**	16.03	18.73	**17.38I**
T10 - Bio 10 g	27.44	20.04	**23.74 H**	30.44	25.47	**27.96 G**
T11 - Bio 10 g	31.05	24.03	**27. 54G**	32.09	28.08	**30.08F**
Mean	**29.42 A**	**25.33 B**		**32.10 A**	**29.50 B**	
L.S.D for interaction		**4.146**			**2.562**	

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 findings were in agreement with these reported by **(Osman and Abd El-Rhman, 2010)** on fig trees, (**Dhillon, 2011)** on pomegranate trees cv. 'Kandhari', **(Darwesh, 2012)** on Costata persimmon trees, **(Habashy, 2016)** on Zebda mango trees, **(EL-Gioushy, 2016)** on young Manfalouty Pomegranate trees, **(Amin, *et al*., 2017)** on Young Pomegranate

trees, **(Baiea *et al*., 2017)** on Young Wonderful Pomegranate trees **(El-Badawy and Ali, Maha, 2019)** on Banana Grande Naine Cultivar, **(El-Gioushy and Eissa, 2019)** on Washington navel orange trees.

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تأثير الاسمدة المعدنية والحيوية على النمو الخضرى 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 مخلوط حيوى, التسميد الحيوى بمعدل 10 جم مخلوط حيوى, التسميد الحيوى بمعدل 15جم مخلوط حيوىوأوضحت 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 النمو الخضرى بالمقارنة بباقى معاملات الدراسة شاملة معاملة الكنترول(التسميد المعدني (NPK) بمعدل(6جم و3جم و3جم) خلال موسمى الدراسة.