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Effect of Biofertilizers as a Partial Substitute for Nitrogen on Vegetative Growth, Yield, Fruit Quality and Leaf Mineral Content of Two Seedless Grape Cultivars I: Vegetative Growth and Yield

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Abstract: Using biofertilizers has been a good method in controlling chemical fertilization, especially N fertilizer for reducing environmental pollution and obtaining safe produce. This study was initiated as an attempt for replacing the excessive application of mineral nitrogen partially with four biofertilizers namely Nitrobeine, Rhizobacterine, Biogen and active dry yeast for achieving an economical yield and improving vegetative growth. Nitrogen was applied at zero % up to 100 % of the recommended nitrogen dose for Thompson seedless and Flame seedless cultivars with or without biofertilizers or biofertilizers alone. Generally, results proved that using nitrogen at 40 units for Thompson seedless and 30 units for Flame seedless plus Biogen have increased yield and improved fruit quality compared with using 80 units for Thompson seedless and 60 units for Flame seedless without biofertilizers. All vegetative growth parameters (trunk diameter, leaf area, leaf fresh and dry weight) were increased with increasing N rate in both seasons of the study in both cultivars. Biofertilizer treatments (Biogen, Rhizobacterine, Nitrobeine and active dry yeast) caused significant changes of the studied estimates in both seasons as compared with the control. Nitrogen doses and biofertilizers caused significant changes on the cane thickness in the second season but in the first one no significant differences between these treatments were observed. The treatment of 100 % nitrogen fertilizer plus 20 gm Biogen gave the highest values regarding vegetative growth parameters. However, the treatment zero % nitrogen fertilizer gave the least values in both cultivars during the two seasons. The yield and its components parameters (cluster weight and total yield) were increased with increasing N rate in both cultivars. Biofertilizer treatment caused significant changes of the studied characteristics as compared with the control in both cultivars. Number of cluster/vine was significantly increased with increasing N rate and biofertilizers treatment n the second season for both cultivars. The treatment of 50 % nitrogen fertilizer in the presence of 20 gm Biogen gave the highest values regarding yield parameters in both cultivars.

Key words: Grapes · Vitis vinifera · Biofertilizers · Vegetative growth · Yield

INTRODUCTION

Controlling chemical fertilization, especially N fertilizer is very important for reducing environmental pollution and obtaining safe produce. Using biofertilizers relatively a good method in this respect. Vegetative growth parameters of different grape cultivars such as the trunk diameter shoot growth, cane thickness and leaf area recorded a progressive increase with increasing N rate when the applied N ranged from 40 to 160 g / vine [1-3]. However, the thickest canes were produced by the middle N-rate (50 kg / ha) [4, 5]. Forty N units / ha per year is suggested as the best compromise between vegetative and berry production [6]. The number of clusters and yield / vine of different grape cvs. recorded a progressive increase with increasing N rate when the applied N ranged from 50 to150 g / vine [7-9]. Also the increment of the cluster weight and yield was associated with increasing nitrogen level [1, 6, 10, 3]. On the other hand, the nitrogen had no effect on the number of clusters / vine and total yield/vine [11, 5]. Biofertilizers such as phosphorene, active dry yeast, Biogen, Rhizobacterine, Microbene; and Nitrobine led to a significant increase in leaf area, shoot length and cane thickness of different grape cultivars

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[12, 13]. Also, mycorrhizas VAM fungi (*Colomus mosseae*, *Giga sporamargarite, Acaulospora* ap. and their mixture) improved vegetative growth of different grape cultivars [14]. Also, dual inoculation with *G. fasciculatum* and *A. chroccoum* produced larger apple plants [15]. Most yield components were also increased with bacterial inoculation with Azotoryza at different level of N. Bacterial inoculation could compensate for 20 % of the N fertilizer without changing the yield corresponding to 30 g N / plantlet [16]. Inoculation with Phosphorene, active dry yeast, mycorrhizae increased cluster weight, number of clusters / vine and yield of different grapevines [12]. Also, Biogen, Rhizobacterene and Microbein increased berry set percentage, yield, number of clusters / vine and cluster weight of different grape cultivars [13, 17]. The aim of this investigation was to study the effect of using commercially available Biofertilizers (Biogen, Rhizobacterine, Nitrobeine and active dry yeast)and ammonium nitrate (33% N) with different levels and their interaction on vegetative growth and yield of Thompson seedless and Flame seedless grapes

MATERIALS AND METHODS

A field experiment was conducted at the experimental farm of the Horticulture Research Station, Ali Moubark Village, Beheira governorate. The present work was carried out during 2003 and 2004 seasons on three years-old Thompson seedless and Flame seedless grapevines. Experimental vines were chosen as to be similar in growth as possible they were planted in a sandy soil at 2.0 × 3.0 m apart under drip irrigation system. The cane system of training was applied on Thompson seedless. Number of the retained eyes on each vine was 80 depending on knowledge that grape cultivars which the basel buds are less fruit full may be trained with cane system [18]. Flame seedless vines were trained to the double cordon system. Number of retained eyes on each vine was 60. Pruning for both cultivars was carried out at the first week of January in both seasons. Vines were sprayed with Dormex (4%) at the last week of January. All vines of both cultivars were subjected to the normal horticultural practice. The vines were fertilized by the recommended doses of phosphorus (40 units of P_2O_5) as calcium super phosphate 15.5% and potassium (100 units of K_2O) as potassium sulphate 48%. The recommended doses of nitrogen were 80 units for Thompson seedless and 60 units for Flame seedless as ammonium nitrate 33% per feddan. The experiment was comprised of 15 treatments for both cultivars (3 levels of nitrogen × 4 biofertilizers × 4 replicates in addition to the control as shown in Table 1:

The treatments were in split plots in randomized completely block design Soil analysis was carried out according to Wilde *et al*. [19] and the obtained data are shown in Table 2. The application of nitrogen fertilizer followed the same normal application practices as follow: 15% after bud burst and before flowering, 50% after flowering (at verasion) and 35% after harvest. Bio-fertilizers, nitrobeine, Rhizobacterine and biogen at 20 g from each / vine were mixed with the organic matter and then added to the soil before the second and the third irrigations. Active dry yeast was applied to the soil at 16 g / vines (sugar was added to the yeast solution at the rate of 3 kg/ ½ kg of dry yeast for activating their reproduction). The phosphorus was applied during winter. Potassium was added as follows 50% during winter and 50% during the growing seasons.

Table 1: The treatments of the experiment for Thompson seedless and Flame seedless grapevines.

Treatment number	Nitrogen doses	Biofertilizers
1	Zero nitrogen	Nitrobeine
2		Rhizobacterine
3		Biogen
4		Active dry yeast
5		Control
6	50% of the recommended Nitrogen	Nitrobeine
7		Rhizobacterine
8		Biogen
9		Active dry yeast
10		Control
11	100% of the recommended nitrogen	Nitrobeine
12		Rhizobacterine
13		Biogen
14		Active dry yeast
15		Control

Table 2: Chemical and mechanical analysis of the soil at the experimental site.

			Soluble cations (meq / L)				Soluble anions (meq / L)			Mechanical analysis			
Soil depth (cm)	EC dcm^{-1}	pH	Ca^{+2}	Mg^{2+}	Na^{+}	K	$HC\hat{O}_3$	CL^{-}	SO^{-2}	Sa%	Si%	Cl. %	Tex.
0 - 30	1.38	9.16	1.25	0.60	1.60	0.20	1.18	1.8	0.75	90.9	3.6	5..5	Sand.
30 - 60	1.32	9.25	1.10	0.55	1.44	0.15	1.02	1.6	0.63	91.5	2.8	5.7	Sand.

Vegetative Growth Parameters: Average leaf area (cm^2): Leaf area was determined using the leaf area meter, supplied by the automatic leaves area meter. Data were expressed as cm^2.

Cane thickness and Trunk diameter (cm): Cane thickness and trunk diameter were measured suing a venire caliper.

Leaf fresh and dry weight: Leaf fresh and dry weight were measured in (gm)

Productivity: Grape productivity including total yield (kg / vine), cluster weight (gm) were determined.

Statistical Analysis: The treatments were in split plot arrangement in completely randomized block design and analyzed according to Snedecor and Cochran [20]. Least significant differences were used to compare between treatment means according to Walter and Duncan [21].

RESULTS AND DISSCUSSION

Effect of Nitrogen and Biofertilizers on Vegetative Growth

Trunk Diameter and Cane Thickness: Results in Table 3 revealed high significant differences between Thompson seedless grape vines receiving zero nitrogen, 50% and 100% of the recommended nitrogen. The high values of trunk diameter and cane thickness in both seasons were recorded by vines received 100% of the recommended nitrogen. In addition, biofertilizers application increased significantly trunk diameter as compared the control. The highest values of trunk diameter and cane thickness resulted with Biogen followed in descending order by active dry yeast, Rhizobacterine and Nitrobeine. The effect of the interaction was significant and the highest trunk diameter and cane thickness was that of vines receiving 100% nitrogen plus Biogen followed by 100% nitrogen in the presence of active dry yeast. However, the least trunk diameter was obtained with control vines (Table 4).

Data in Table 5 cleared that, trunk diameter and cane thickness of Flame seedless grape were increased significantly when nitrogen level was increased. The highest values of trunk diameter and cane thickness in both seasons were recorded by 100% of the recommended nitrogen fertilizer. Moreover, the high value of trunk diameter and cane thickness were found in vines fertilized with Biogen followed in descending order by active dry yeast, Rhizobacterine and Nitrobeine compared with untreated vines. Results in Table 6 showed that, the higher trunk diameter and cane thickness were obtained with vines receiving 100% of the recommended nitrogen plus Biogen in both seasons. The least trunk diameter and cane thickness were obtained with vines of the control which did not receive any nitrogen or biofertilizers.

Table 3: Effect of nitrogen and biofertilizers on cane thickness and trunk diameter of Thompson seedless grapevine in 2003 and 2004 seasons.

	Cane thickness (cm)		Trunk diameter (cm)	
Treatments	2003	2004	2003	2004
N_0	1.14	1.19	2.69	3.02
½ N	1.26	1.31	2.88	3.18
1 N	1.37	1.42	3.01	3.26
$LSD_{0.05}$	N.S	0.031	0.11	0.069
B_1	1.23	1.27	2.70	3.02
B_2	1.23	1.27	2.87	3.13
B_3	1.41	1.46	3.17	3.39
B_4	1.31	1.35	2.99	3.25
B_5	1.11	1.17	2.55	2.92
$LSD_{0.05}$	N.S	0.03	0.08	0.08

N_0 = Zero nitrogen, B1 = Nitrobeine, B_2 = Rhizobacterine, B_3 = Biogen, B4 = Active dry yeast, ½ N = 50% of the recommended nitrogen, B_5 = the control, 1 N = 100% of the recommended nitrogen

Table 4: The interaction effect of nitrogen and biofertilizers on cane thickness and trunk diameter of Thompson seedless grapevine in 2003 and 2004 seasons.

Treatments		2003 Season		2004 Season	
Nitrogen	Biofertilizers	Cane thickness (cm)	Trunk diameter (cm)	Cane thickness (cm)	Trunk diameter (cm)
0	B_1	1.10	2.50	1.14	3.02
	B_2	1.12	2.67	1.16	3.05
	B_3	1.30	2.95	1.33	3.30
	B_4	1.19	2.90	1.23	3.20
	B_5	1.02	2.35	1.08	3.00
½	B_1	1.23	2.70	1.28	3.15
	B_2	1.27	2.95	1.32	3.20
	B_3	1.40	3.02	1.45	3.37
	B_4	1.30	3.00	1.35	3.25
	B_5	1.10	2.52	1.16	3.12
1	B_1	1.30	2.90	1.35	3.15
	B_2	1.35	3.07	1.40	3.17
	B_3	1.55	3.30	1.60	3.50
	B_4	1.43	3.20	1.48	3.35
	B_5	1.22	2.80	1.28	3.15
$LSD_{0.05}$		N.S	0.13	0.064	0.14

Table 5: Effect of nitrogen and biofertilizers on cane thickness and trunk diameter of Flame seedless grapevine in 2003 and 2004 seasons.

	Cane thickness (cm)		Trunk diameter (cm)	
Treatments	2003	2004	2003	2004
N_0	1.03	1.00	2.01	2.52
½ N	1.13	1.09	2.15	2.96
1 N	1.66	1.18	2.36	3.08
$LSD_{0.05}$	N.S	0.058	0.10	0.098
B_1	1.09	1.05	2.11	2.60
B_2	1.11	1.07	2.20	2.77
B_3	1.20	1.23	2.42	3.10
B_4	1.18	1.14	2.33	2.90
B_5	0.91	0.97	2.02	2.45
$LSD_{0.05}$	N.S	0.04	0.08	0.12

N_0 = Zero nitrogen, B1 = Nitrobeine, B_2 = Rhizobacterine, B_3 = Biogen, B4 = Active dry yeast, ½ N = 50% of the recommended nitrogen, B_5 = the control, 1 N = 100% of the recommended nitrogen

Table 6: The interaction effect of nitrogen and biofertilizers on cane thickness and trunk diameter of Flame seedless grapevine in 2003 and 2004 seasons.

Treatments		2003 season		2004 season	
Nitrogen	Biofertilizers	Cane thickness (cm)	Trunk diameter (cm)	Cane thickness (cm)	Trunk diameter (cm)
0	B_1	0.85	1.92	0.97	2.52
	B_2	0.98	2.02	1.05	2.47
	B_3	1.10	2.20	1.10	2.67
	B_4	0.98	2.10	1.05	2.60
	B_5	0.80	1.82	0.86	2.45
½	B_1	0.98	2.02	1.05	2.87
	B_2	1.00	2.10	1.06	2.97
	B_3	1.20	2.50	1.25	3.22
	B_4	1.06	2.20	1.12	3.00
	B_5	0.93	2.00	1.00	2.72
1	B_1	1.07	2.27	1.12	2.97
	B_2	1.09	2.32	1.15	2.95
	B_3	1.30	2.60	1.36	3.50
	B_4	1.20	2.40	1.25	3.05
	B_5	1.01	2.22	1.07	2.92
$LSD_{0.05}$		N.S	0.13	0.08	0.21

Table 7: Effect of nitrogen and biofertilizers on leaf area, leaf fresh weight and leaf dry weight of Thompson seedless grapevine in 2003 and 2004 seasons.

	Leaf fresh weight (g)		Leaf dry weight (g)		Leaf area $(cm)^2$	
Treatments	2003	2004	2003	2004	2003	2004
N_0	2.35	2.54	1.23	1.26	130.85	131.20
½ N	2.66	2.86	1.39	1.44	133.00	136.20
1 N	2.87	3.08	1.54	1.67	137.00	139.70
$LSD_{0.05}$	0.10	0.17	0.08	0.14	1.64	1.68
B_1	2.46	2.68	1.29	1.29	130.41	132.16
B_2	2.60	2.83	1.40	1.33	133.16	136.00
B_3	2.9	3.16	1.62	1.66	140.50	143.41
B_4	2.74	2.99	1.52	1.51	136.16	138.91
B_5	2.32	2.51	1.17	1.13	129.83	129.08
$LSD_{0.05}$	0.13	0.14	0.08	0.14	2.33	2.54

N_0 = Zero nitrogen, B1 = Nitrobeine, B_2 = Rhizobacterine, B_3 = Biogen, B4 = Active dry yeast, ½ N = 50% of the recommended nitrogen, B_5 = the control, 1 N = 100% of the recommended nitrogen

Table 8: The interaction effect of nitrogen and biofertilizers on leaf area, leaf fresh weight and leaf dry weight of Thompson seedless grapevine in 2003 and 2004 seasons.

Treatments		2003 Season			2004 Season		
Nitrogen	Biofertilizers	Leaf fresh weight (g)	Leaf dry weight (g)	Leaf area $(cm)^2$	Leaf fresh weight (g)	Leaf dry weight (g)	Leaf area $(cm)^2$
0	B_1	2.27	1.17	130.00	2.37	1.15	128.00
	B_2	2.42	1.20	130.00	2.62	1.25	132.25
	B_3	2.65	1.37	134.70	2.90	1.45	138.25
	B_4	2.45	1.25	133.20	2.65	1.32	135.50
	B_5	1.97	1.15	128.00	2.15	1.15	125.25
½	B_1	2.45	1.27	131.00	2.77	1.37	133.25
	B_2	2.70	1.42	132.20	2.97	1.40	135.50
	B_3	2.92	1.55	142.00	3.05	1.60	144.50
	B_4	2.80	1.45	134.20	3.00	1.52	137.50
	B_5	2.45	1.27	130.00	2.52	1.35	130.25
1	B_1	2.75	1.40	135.20	2.97	1.62	135.25
	B_2	2.85	1.47	137.20	3.02	1.65	140.25
	B_3	3.12	1.85	144.70	3.52	1.95	147.50
	B_4	3.02	1.60	140.70	3.10	1.70	143.75
	B_5	2.62	1.40	135.00	2.77	1.47	131.75
$LSD_{0.05}$		0.22	0.15	4.05	0.24	0.20	4.41

Average Leaf Area: It was apparent from Table 7 that, the highest value of leaf area of Thompson seedless grape in both seasons was recorded when vines received 100% of the recommended nitrogen. Concerning the effect of biofertilizers application, it was obvious that the highest value of leaf area was found in vines received Biogen followed in a descending order by active dry yeast, Rhizobacterine and Nitrobeine. The interaction effect was significant as shown in Table 8. The highest leaf area was obtained with vines received 100% nitrogen in the presence of Biogen followed respectively by 100% nitrogen plus active dry yeast. However, the least leaf area was recorded with vines of the control.

It was obvious from Table 9 that, the level of nitrogen significantly affected leaf area in both seasons. The highest value of leaf area of Flame seedless grape in both seasons was recorded by vines received 100% of the recommended nitrogen fertilizer. As for the effect of biofertilizers application data showed that, all biofertilizer treatments significantly improved leaf area than the control. The highest value of leaf area was observed in vines receiving Biogen followed in descending order by active dry yeast, Rhizobacterine and Nitrobeine. The interaction between the two studied factors was significant as shown in Table 10.The highest leaf area was obtained with vines fertilized with 100% of the recommended nitrogen plus Biogen followed by 100% of the recommended nitrogen plus active dry yeast. However, the least leaf area was noticed in vines of the control.

Table 9: Effect of nitrogen and biofertilizers on leaf area, leaf fresh weight and leaf dry weight of Flame seedless grapevine in 2003 and 2004 seasons.

	Leaf fresh weight (g)		Leaf dry weight (g)		Leaf area (cm)^2	
Treatments	2003	2004	2003	2004	2003	2004
N_0	2.45	2.21	1.18	1.27	110.15	112.70
½ N	2.83	2.35	1.73	1.75	118.30	121.70
1 N	3.02	2.66	1.87	1.83	125.20	127.70
$LSD_{0.05}$	0.13	0.06	0.08	0.06	5.07	5.60
B_1	2.62	2.40	1.41	1.39	108.08	117.33
B_2	2.75	2.57	1.53	1.52	116.16	117.75
B_3	3.02	2.90	1.77	1.74	128.08	130.66
B_4	2.89	2.70	1.65	1.63	122.80	123.50
B_5	2.49	2.26	1.30	1.27	100.33	111.25
$LSD_{0.05}$	0.12	0.09	0.09	0.10	5.11	4.87

N_0 = Zero nitrogen, B1 = Nitrobeine, B_2 = Rhizobacterine, B_3 = Biogen, B4 = Active dry yeast, ½ N = 50% of the recommended nitrogen, B_5 = the control, 1 N = 100% of the recommended nitrogen

Table 10: The interaction effect of nitrogen and biofertilizers on leaf area, leaf fresh weight and leaf dry weight of Flame seedless grapevine in 2003 and 2004 seasons.

Treatments		2003 season			2004 season		
Nitrogen	Biofertilizers	Leaf fresh weight (g)	Leaf dry weight (g)	Leaf area (cm)^2	Leaf fresh weight (g)	Leaf dry weight (g)	Leaf area (cm)^2
0	B_1	2.42	1.09	99.00	2.15	1.15	112.50
	B_2	2.45	1.13	99.70	2.22	1.22	114.50
	B_3	2.52	1.32	104.00	2.40	1.42	117.25
	B_4	2.50	1.32	103.00	2.30	1.42	115.50
	B_5	2.40	1.06	96.20	2.00	1.12	110.75
½	B_1	2.70	1.67	113.50	2.22	1.77	112.00
	B_2	2.82	1.75	113.50	2.30	1.82	123.00
	B_3	3.12	1.82	115.50	2.60	1.85	129.25
	B_4	2.87	1.87	114.20	2.40	1.80	127.25
	B_5	2.62	1.62	105.00	2.10	1.72	120.00
1	B_1	2.95	1.84	117.70	2.50	1.80	127.50
	B_2	2.97	1.86	120.20	2.60	1.85	123.75
	B_3	3.22	1.90	125.20	3.00	1.87	132.50
	B_4	3.00	1.88	122.70	2.82	1.82	129.75
	B_5	2.75	1.82	116.20	2.40	1.82	126.00
$LSD_{0.05}$		0.21	0.16	8.85	0.15	0.17	8.45

Leaf Fresh and Dry Weight: The results tabulated in Table 7 revealed that, the highest value of leaf fresh and dry weight of Thompson seedless in both seasons was recorded by vines received 100% of the recommended nitrogen. With regard to the biofertilizers application, they significantly increased leaf fresh weight and leaf dry weight than untreated vines. The highest value of leaf fresh weight was recorded by vines treated with Biogen followed by active dry yeast, Rhizobacterine and Nitrobeine, respectively. The interaction effects indicated that, the highest values of both leaf fresh and dry weight were those of vines received 100% nitrogen plus Biogen followed by 100% nitrogen plus active dry yeast (Table 8). However, the least leaf fresh weight was found in control vines.

With respect to Table 9 the data showed that, the highest values of leaf fresh and dry weight of Flame seedless grape were given by vines received 100% of the recommended nitrogen. Regarding the effect of biofertilizers, data showed that the application of biofertilizers significantly caused an increase in leaf fresh weight and leaf dry weight relative to that found in untreated vines. The highest values of leaf fresh and dry weight were those of vines received Biogen followed by active dry yeast, Rhizobacterine and Nitrobeine, respectively. The interaction effects in Table 10 proved that, the highest values of leaf fresh and dry weight in both seasons was observed in vines receiving 100% of the recommended nitrogen + Biogen followed by 100% of recommended nitrogen + active dry yeast.

Table 11: Effect of nitrogen and biofertilizers on number of clusters per vine, yield and average cluster weight of Thompson seedless grapevines cultivar in 2003 and 2004 seasons.

	Number of clusters per vine		Yield / Vine (kg)		Av. Cluster weight (g)	
Treatments	2003	2004	2003	2004	2003	2004
N_0	27.35	25.02	11.04	11.53	403.75	417.00
½ N	26.75	27.00	12.25	12.95	457.50	483.65
1 N	26.35	27.70	12.90	13.66	489.50	498.50
$LSD_{0.05}$	N.S	0.59	0.38	0.57	12.10	14.08
B_1	27.16	26.00	11.41	12.17	420.41	427.33
B_2	26.66	26.95	11.67	12.20	439.16	455.00
B_3	27.08	28.41	13.94	14.43	516.66	545.00
B_4	26.75	27.25	12.42	12.73	466.25	467.08
B_5	26.41	26.00	10.51	10.81	398.75	415.83
$LSD_{0.05}$	N.S	0.75	0.51	0.50	13.63	11.35

N_0 = Zero nitrogen, B1 = Nitrobeine, B_2 = Rhizobacterine, B_3 = Biogen, B4 = Active dry yeast, ½ N = 50% of the recommended nitrogen, B_5 the control, 1 N = 100% of the recommended nitrogen

Table 12: The interaction effect of nitrogen and biofertilizers on number of clusters, yield per vine and average cluster weight of Thompson seedless grapevine in 2003 and 2004 seasons.

Treatments		2003 season			2004 season		
Nitrogen	Biofertilizers	Number of clusters per vine	Yield / vine (kg)	Av. Cluster weight (g)	Number of clusters per vine	Yield / vine (kg)	Av. Cluster weight (g)
0	B_1	27.75	10.52	378.70	28.50	11.02	386.25
	B_2	26.75	10.77	402.50	27.75	11.52	416.25
	B_3	27.50	12.50	456.20	27.50	13.11	477.50
	B_4	27.75	11.51	415.00	28.50	12.09	428.75
	B_5	27.00	9.90	366.20	26.50	9.94	376.25
½	B_1	26.75	12.1	455.00	28.50	12.92	452.00
	B_2	26.75	12.40	466.20	27.00	12.97	480.00
	B_3	27.25	15.25	560.00	26.50	15.76	595.00
	B_4	26.75	12.90	486.50	27.75	13.52	487.50
	B_5	26.25	10.61	405.00	27.00	10.85	403.75
1	B_1	27.00	11.55	427.20	28.25	12.63	445.75
	B_2	26.50	11.78	448.70	27.25	12.71	468.75
	B_3	26.50	14.10	533.00	27.25	14.43	562.50
	B_4	25.75	12.80	497.50	26.50	12.86	485.00
	B_5	26.00	11.10	425.00	26.50	12.60	440.50
$LSD_{0.05}$		N.S	0.99	28.80	1.29	0.87	19.67

However, the least leaf fresh weight and leaf dry weight were obtained with vines of control. Nijjar [22] cleared the role of N as a constituent of amino acids and proteins as well as its important effect in encouraging cell division and the development of meristematic tissue this can give an explanation for the role of N in activating growth in the present study. These results were in agreement with those obtained by Gobara *et al*. [9].

The important role of biofertilizers on increasing availability of mineral organic nutrients to the vines is surely reflected on improving both cell division and cell enlargement. Consequently a great promotion of vine growth was attained. Similar results were obtained by Gaur *et al*. [23]. The important role of yeast in stimulating the development of roots due to the higher content of amino acids and the natural cytokinins could be resulted in increasing the availability of water and minerals as in favor of promoting growth portions. Similar results were also obtained by El-Morsy [24].

Effect of Nitrogen and Biofertilizers on Vine Productivity

Number of Clusters / Vine: It is obvious from data of Table 11 that, the effect of both mineral nitrogen and biofertilizers application on number of clusters / vine of Thompson seedless grape did not significantly differ at different concentrations in the first season. However, in the second one, data revealed high significant differences between these treatments. The highest number of clusters / vine was given by vines received 100% of the recommended nitrogen. Concerning the biofertilizer effect

Table 13: Effect of nitrogen and biofertilizers on number of clusters per vine, yield and average cluster weight of Flame seedless grapevine cultivar in 2003 and 2004 seasons.

	Number of clusters per vine		Yield / vine (kg)		Av. Cluster weight (g)	
Treatments	2003	2004	2003	2004	2003	2004
N_0	29.80	24.74	10.52	8.73	353.50	364.75
½ N	28.00	28.07	11.23	11.20	404.75	400.00
1 N	30.20	30.01	12.88	12.45	424.50	413.75
$LSD_{0.05}$	N.S	1.18	0.41	0.44	10.38	5.61
B_1	29.50	27.55	10.76	10.08	365.83	365.08
B_2	30.00	27.30	11.46	10.80	382.91	387.08
B_3	30.75	28.55	12.90	12.21	422.50	428.75
B_4	30.41	27.92	12.17	11.49	400.83	411.66
B_5	29.40	26.10	10.40	9.81	349.16	352.58
$LSD_{0.05}$	N.S	1.17	0.43	0.61	10.88	11.50

N_0 = Zero nitrogen, B1 = Nitrobeine, B_2 = Rhizobacterine, B_3 = Biogen, B4 = Active dry yeast, ½ N = 50% of the recommended nitrogen, B_5 the control, 1 N = 100% of the recommended nitrogen

the highest number of clusters / vine was recorded by Biogen treatment. The interaction between the two studied factors was not significant in the first season (Table 12). However in the second one average cluster numbers was significantly higher than the control for both Nitrobeine and active dry yeast accompanied with zero nitrogen.

With respect to Table 13 data showed that, number of clusters of Flame seedless grape significantly increased in the second season when nitrogen level increased. However, no significant difference was found in the first season. The highest number of clusters / vine in the second season was obtained by vines received 100% of the recommended nitrogen. Concerning the effect of biofertilizers application, no significant differences could be detected between biofertilizers and the control in the first season. However, in the second one biofertilizers significantly increased number of clusters / vine. The interaction between the two studied factors was not significant in the first season as shown in Table 14. However in the second one; the highest number of clusters was found with Biogen plus 50 % of recommended nitrogen.

Total Yield: Results in Tables 11 and 13 demonstrated high significant differences between yield of vines of both Thompson seedless and Flame seedless grapes received zero nitrogen fertilizers, 50% of and 100% of the recommended nitrogen. The highest yield in both seasons was recorded by vines receiving 100% of the recommended nitrogen. Regarding the effect of biofertilizers application, it was clear that they significantly increased total yield than untreated vines. The high value of total yield was found with vines received Biogen followed by active dry yeast, Rhizobacterine and Nitrobeine, respectively for both cultivars in both seasons of the study. The interaction between the two studied factors was significant as shown in Tables 12 and 14. The highest value of total yield was obtained with vines received 50% of the recommended nitrogen plus Biogen. The least total yield was obtained with vines of the control for both cultivars in both seasons of the study.

Average Cluster Weight: The results listed in Tables 11 and 13 showed high significant differences between vines of both cultivars Thompson seedless and Flame seedless grapes received zero nitrogen 50% and 100% of the recommended nitrogen in average cluster weight. The highest values of cluster weight in both seasons were recorded by vines fertilized with 100% of the recommended nitrogen for both cultivars. As for the effect of biofertilizers application, the highest value of cluster weight was obtained by vines received Biogen followed by active dry yeast, Rhizobacterine and Nitrobeine, respectively for both cultivars. The interaction between the two studied factors was significant as shown in Tables 12 and 14. The highest value of cluster weight was given by vines received 50% of the recommended nitrogen plus Biogen. However, the least cluster weight was obtained with vines of the control for both cultivars in both seasons.

The improvement occurring in vine growth and nutritional status certainly reflected their effect on improving yield as well as number of clusters / vine and cluster weight. Another interpretation of the positive role of N is the beneficial effect of N in raising the number of reproductive shoots and berry set.

Table 14: The interaction effect of nitrogen and biofertilizers on number of clusters, yield per vine and average cluster weight of Flame seedless grapevine in 2003 and 2004 seasons.

Treatments		2003 season			2004 season		
Nitrogen	Biofertilizers	Number of clusters per vine	Yield / vine (kg)	Av. Cluster weight (g)	Number of clusters per vine	Yield / vine (kg)	Av. Cluster weight (g)
0	B_1	29.00	9.82	340.00	23.92	10.70	348.75
	B_2	29.70	10.50	353.70	24.57	10.90	358.75
	B_3	30.70	12.12	395.00	26.37	12.32	407.50
	B_4	30.00	11.15	372.20	25.80	11.92	387.50
	B_5	29.50	9.50	306.20	23.05	10.12	321.25
½	B_1	29.70	11.27	380.00	28.15	11.80	397.50
	B_2	30.20	12.10	401.20	27.67	12.55	408.75
	B_3	30.70	13.82	451.20	30.42	13.37	451.25
	B_4	30.70	13.22	431.20	28.85	13.12	440.00
	B_5	30.00	10.72	360.00	25.27	10.80	367.50
1	B_1	35.50	11.60	387.00	27.57	11.42	385.00
	B_2	30.00	11.80	394.00	26.65	11.97	393.75
	B_3	30.50	12.70	421.20	28.85	13.10	427.50
	B_4	30.50	12.15	399.00	29.12	12.42	407.50
	B_5	30.20	11.50	381.20	27.87	11.47	390.00
$LSD_{0.05}$	N.S	0.74	18.87	2.03	1.23	19.95	

N_0 = Zero nitrogen, B1 = Nitrobeine, B_2 = Rhizobacterine, B_3 = Biogen, B4 = Active dry yeast, ½ N = 50% of the recommended nitrogen, B_5 the control, 1 N = 100% of the recommended nitrogen

The present results were in agreement with those obtained by Ali - Mervet [25]. However, the effect of biofertilizers was studied by James [26] and Akl *et al*. [27] who worked on Nitrobeine and active dry yeast they reported that, the positive action of Nitrobein in improving vine productivity may be attributed to reducing plant requirements of N, improving the availability of various nutrients, reducing pollution induced by the application of chemical fertilizers. They also supported the effect of active dry yeast on growth, through its basic functions i.e. carbon dioxide production and formation of natural hormone namely cytokinins which after their decomposition, develop a wide group of amino acids and B vitamins.

REFERENCES

1. Giorgessi, F., G.T. Mazzocco. F. Donuso and R. Giovanardi, 2000. Response of grapevine to the nitrogen fertilization and environmental impact in the grave area of friuli. Irrigation E. Drenaggi, 47: 59-63 .
2. Spayed, S.E., R.G. Stevens. R.L. Wample. R.G. Evans, C. G. Edwards. D. Webster. J.V. Possigham and G.H. Neilsen, 2000. Impact of nitrogen fertilization on vine performance and juice and wine composition of "Riesling" grape (*Vitis vinifera* L.) in Washington state. Acta. Horticulture, 512: 65-75.
3. El-Sayed, H.A., 2002. Selecting the best sources and levels of N applied via fertigation for Flame seedless grapevines. Minia J. Agricultural Research and Develop., 22: 1785-1796.
4. Zanathy, G., O. Lohnetz. I. Balogh and P. Molnar, 1996. Effect of nitrogen on the carbohydrate content of grapevine canes. Hort. Sci., 28: 75-78.
5. Bell, S.J. and A. Robson, 1999. Effect of nitrogen fertilization on growth, canopy density and yield of *Vitis vinifera* L. cv. cabernet sauvignon. American J. Enology and Viticulture, 50: 351-358.
6. Lovisolo, C., A. Morando and G.G. Eynord, 2000. Effects of nitrate nutrition on the vegetative productive characteristics of "Moscato bianco" Irrigazione (e) Drenaggio, 47: 4 and 53-57.
7. Dhillon, W.S., A.S. Bindra and S.S. Cheema, Sohan Singh. S. Singh and S. Subhadabandhu, 1992. Effect of graded doses of nitrogen on vine growth, fruit yield and quality of Perlete grape. Acta. Hort., 321: 667-671.
8. Gay, G., A. Morando and S. Lembo, 1998. Effect of three nitrogen rates on vineyard ecosystems. Proceedings of Giornate Filopaologiche held at Sicli-e-Ragusa, Italy from 3-7 May. Atti, Giornate Filopathologie Scicli-e-Ragusa, 3-7 Maggio, pp: 269-274.

9. Gobara, A.A., 1998. Behaviour of Flame seedless grapevines to fertilizer with some micro and macro-nutrients and vine load. J. Agric. Sci. Mansoura Univ., 24: 1307-1329.
10. Treeby, M.T., 2001. Sultana fruitfulness and yield response to rootstock and nitrogen supply. Australian J. Experimental Agriculture, 41: 681-687.
11. Larcheveque, C., A. Casanova. V. Dupuch and R. Renard, 1998. Influence of nitrogen fertilizer on *Vitis vinifera* cv. Merot with permanent grass cover (nitrogen content. Type and concentration of amino acids of grape musts and wines). J. International Des Sciences De. La. Vigne. Et. Du. Vin., 32: 27-43.
12. El-Sayed, H.A., 2002. Relation between yeast and nitrogen application in Flame seedless vines. Annals of Agric. Sc. Moshtohor, 40: 2415-2427.
13. Abdel-Hady, A.M., 2003. Response of Flame seedless vines to application of some biofertilizers. Minia J. Agric. Res and Develop., 23: 667- 680.
14. Sonawane, R.B., B.K. Konde. D.V. Indi and P.V. Wani, 1997. Symposium between grapevine varieties and VAM fungi for uptake of nitrogen and phosphorus. J. Maharashtra Agricultural Universities, 22: 184-186.
15. Sharma, S.D. and V.P. Bhutani, 1998 . Response of apple seedlings to VAM, Azotobacter and inorganic fertilizers. Horticulture J., 11(1): 1-8.
16. Dibut-Alvarez, B., A. Rodriguez-Nodals. A. Perez and R. Martinez-Vinera, 1996. The effect of Azotoryza's double function on banana (*Mu sa spp*.). Experimental Conditions in Formusa, 5: 20-23.
17. Abdel-Hamid, N., S.M. Selem. G.F. Ghobrial and Khairy abdel-Aziz, 2004. Effect of different nitrogen doses and bio-fertilizer application on yield and quality of "Crimson seedless" grapes. Institute of Environmental Studies and Research - Ain Shams University, 8: 837-862.
18. Sourial, G.F., 1976. Effect of pruning severity on "Thompson seedless" vines. 1- Yield and fruit quality. Annals of Agric. Sci. Moshtohor, Egypt, 5: 195-202.
19. Wilde, S.A., R.B. Corey.J.G. Layer and K. Voigt, 1985. Soils and Plant analysis for tree culture. Oxford and IBH Publishing Co. New Delhi.
20. Snedecore, G.W. and W.G. Cochran, 1972 . Statistical methods 6th Ed. The Iowa State Univ.Press, Amer. Iowa, USA, pp: 593.
21. Walter, A. and D.B. Duncan, 1969. Multiple range and multiple test. Biometers, 11: 1-24.
22. Nijjar, G.S., 1985 . Nutritional of fruit trees. Mrs. Usha. Raj Kumar for Kalyani, Publishers, New Delhi. India, pp: 1-89.
23. Gaur, A.C., K.P. Ostwal and R.S. Mathur, 1980. Save superphosphate by suing phosphobacteria. Kheti. 32: 23-25.
24. El-Morsy, F.M., 1997. Response of Banaty grapevines to application of the organic fertilizers filter mud and sludges. Annals of Agricultural Science, Moshtohor. 1: 477-488.
25. Ali-Mervet, A., 2000 . Response of Flame seedless grapevines to slow release nitrogen fertilizers. Minia J. Agric. Res and Develop., 20: 239-255.
26. James, B., 1994. Chapters from life. Ann. Rev. Pl. Physiol. Plant Mol. Biol., 45: 1-23.
27. Akl, A.M., F.F. Ahmed, F.M. El-Morsy and M.A. Ragab, 1997. The effect of soil and foliar application of nitrogen, phosphorus and potassium on some vegetative and fruiting characteristics in White Banaty seedless grapevines. II Bud behavior, yield and fruit quality. Minia. First. Cnf. For Hort. Crops. (19-21 Oct.) pp: 453-476.