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EFFECT OF BIOFERTILIZATION ON GROWTH, YIELD AND BERRY QUALITY OF SOME SEEDLESS GRAPE CULTIVARS.*

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Abstract: This study was conducted in the Experimental Orchard, Faculty of Agriculture, Assiut University, Egypt, to investigate the influence of biofertilization on growth, leaf nutrient status and fruiting of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

The experiment was arranged in a split-plot complete randomized block design with four replicates, being a vine as an experimental unit and consisted of 7 treatments. The first three treatments were application of 60 g N/vine as mineral form plus 50 g of either microbin, biogen or nitrobin as N biofertilizer. Whereas, the other four treatments were application of 40 g N/vine plus 100 g of either microbin, biogen or nitrobin, additional the application of 80 g N/vine as mineral source control.

- The obtained results indicated that leaf area, pruning wood weight and leaf nutrient composition were significantly increased by using biofertilizers i.e. microbein, biogen and nitrobien. The promotion of such traits was associated with increasing the proportion of biofertilizers and decreasing the applied of mineral ones.

- Fertilizing the vines with RDN *via* mineral form combined with biofertilizers was very effective on improving berry set %, number of clusters and yield/vine compared to RDN in mineral form alone. Ruby Seedless cv. fertilized at different treatments gave the highest number of cluster as well as heavy yield than analogous ones resulted from the combination of Flame Seedless and Thompson Seedless cultivars.

- Application of the RND *via* mineral combined with bio-fertilizer improving the cluster and berry attributes compared to using RND *via* mineral form only. The best results were obtained from vines fertilized with N at RDN as 50% *via* mineral plus 100 g biogen/vine.

- Thompson Seedless grapes surpassed Ruby Seedless and Flame Seedless grapes in its quality from the chemical

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properties stand point, since it contained higher TSS% and reducing sugars %.

- All combinations significantly improved the cluster and berry attributes.

It is evident from the foregoing results that biofertilizer plus ½ recommended dose of nitrogen was sufficient to get good nutritional status, healthy and productivity of Flame seedless, Thompson seedless and Ruby seedless grapevines.

It could be recommended that 100 g of biofertilizer plus ½ RDN was sufficient to get a high yield with good quality and very useful in saving N fertilization cost and reducing nitrate pollution.

Key words: Biofertilization, growth, yield, berry quality, Seedless grape cultivars.

Introduction

Grape is considered as one of most popular and favourite fruit crop in the world, for being of an excellent flavour, nice taste and high nutritional value. In Egypt, it occupies the second position regarding the cultivated area and fruit production. The total cultivated area attained 138499 feddans with 1275288 tons (annual statistical of the Ministry of Agriculture, 2005).

Fertilization is one of the important tools to improve the soil fertility and increase crop yield. Nitrogen has a pronounced role on improving production and quality of fruits. In Egypt, fertilizer consumption per hectare of the cultivated area is 10 times more than consumption average per hectare of the whole world for all nutrients (FAO, 1994)*. Mineral fertilizers and other chemicals commonly used in agricultural production not only have harmful effects on the environment but also they are a very great danger that harmful residues may remain in food (Bogatyre, 2000). So, biofertilizers are very safe for human, animal nutrition and in harmony with environment (Subba Rao, 1984; Verna, 1990 and Abdel-Hamid, 2002). Merits of biofertilizers application were reducing plant requirements of NPK 25%, enhancing the resistance of plants to diseases, stimulating growth of roots and improving the productive performance of the fruit trees (Gaur *et al*., 1980 and Subba Rao, 1984).

Biofertilizers are organisms that enrich that nutrient quality of soil and plant, the main sources of biofertilizers are bacteria, fungi and cynobacteria using bio-fertilizers is considered a promising alternative for chemical fertilizers under

* FAO, 1994: Fertilizer yearbook, 44.

Egyptian soil conditions (El-Haddad *et al.*, 1993; Abdel-Hamid, 2002 and El-Akkad, 2004).

Supplying the grapevines with biofertilizers caused a pronounced increase in the leaf area and weight of pruning wood and effectively enhanced the nutritional status of the vines. In addition, biofertilizer application along with mineral N source was effective in improving bud burst and fruiting buds percentages. Berry set %, cluster number and cluster weight were greatly improved when biofertilizer was combined with mineral source of N compared to N mineral source only. Moreover, application of biofertilizer aside from their mineral sources was very effective in enhancing the quality of berries in terms of increasing the berry weight, size, TSS and total sugars and decreased acidity % (Gaur *et al.*, 1980; Maronek *et al.*, 1981; Ahmed *et al.*, 1997; Mahmoud, 1999; Abdel-Hamid, 2002; Abdel-Hady, 2003; El-Akkad, 2004; Tawfik, Rania, 2005; Ibrahim, 2006 and Abbas, *et al.*, 2006).

Therefore, the objective of this investigation is study the possibility of using biofertilizers partially instead of completed mineral fertilizers of some seedless grapes cultivars.

Materials and Methods

This study was conducted during three successive seasons of 2004, 2005 and 2006 on three cultivars of *Vitis vinifera* L., i.e. Ruby seedless, Flame seedless and Thompson seedless, grown in the experimental vineyard of the Faculty of Agriculture, Assiut University, Egypt, where the soil is clay and well drained. The vines were trained as a traditional double cordon with three wires. The vines were pruned at middle of January to leave 16, 16 and 12 fruiting spurs with 3, 3 and 5 buds/spur in Flame Seedless, Ruby Seedless and Thompson Seedless, respectively. Some physical and chemical properties of the soil are present in Table (A).

Twenty-eight healthy vines with no visual nutrient deficiency symptoms for every cultivar were chosen and devoted for achieving this experiment. The chosen vines were divided into seven different treatments including the control. The experiment was arranged in a split-plot complete randomized block design with four replications per treatments one vine each. The cultivars were occupied the main plots while the fertilization ranked the sub-plots.

Table (A): Some physical and chemical properties of the soil of the experimental site.

Soil property	Value (0-60 cm)	
	Ruby Seedless, soil	Thompson Seedless and Flame Seedless, soil
Sand (%)	15.43	15.50
Silt (%)	33.22	34.50
Clay (%)	51.35	50.00
Texture	Clay	Clay
Field capacity	48.43	48.10
$CaCO_3$ (%)	3.66	3.66
Organic matter (%)	1.32	1.40
pH (1:1 suspension)	8.10	7.95
Ece (dS/m^{-1})	2.69	2.56
Total N (%)	0.16	0.20
$NaHCO_3$-extractable P (ppm)	21.61	22.25
NH_4OAC-exractable K (ppm)	401.33	415.00
DTPA extractable Fe (ppm)	13.19	14.00
DTPA extractable Mn (ppm)	15.16	15.80
DTPA extractable Zn (ppm)	2.35	2.41
DTPA extractable Cu (ppm)	2.11	2.05

* Each value represents the mean of 3 samples.

The treatments were as follows:

1- The application of 60 g N/vine as mineral form + 50 g of microbin as N biofertilizer.

2- The application of 60 g N/vine as mineral form + 50 g of biogen as N biofertilizer.

3- The application of 60 g N/vine as mineral form + 50 g of nitroben as N biofertilizer.

4- The application of 40 g N/vine as mineral form + 100 g of microbin.

5- The application of 40 g N/vine as mineral form + 100 g of biogen

6- The application of 40 g N/vine as mineral form + 100 g of nitroben.

7- The application of 80 g N/vine as mineral source (control).

Ammonium nitrate (33.3%) as a mineral N source was applied at three times: growth start, after berry set and at 45 days later.

Fertilizers were mixed with 30 cm surface layer of the soil under the vines foliage and about 0.75 m around the vine trunk. The biofertilizers were added once at growth start, where mixed with surface layer of the soil. The following parameters were determined to evaluate the effects of different fertilization treatments on growth, nutrient status, yield and berry quality.

1 – Some vegetative growth parameters:

- The average leaf area (cm^2) that was estimated by weighing ten mature leaves/vine and the weighing 40 sections of 1 cm^2 (4 sec. of 1 cm^2/leaf), then the leaf area(cm^2)=

$$\frac{\text{Leaves weight (g)} \times \text{Sections area } (cm^2)}{\text{Sections weight (g)}}$$

- Weight of pruning wood was recorded immediately after pruning (January, 15) and was expressed as kg/vine.

2 – Leaf nutritional status:

In order to determine the leaf nutrient content samples of 30 leaves for each replicate were collected from the first full mature leaves from the top of growing shoots in mid of July in three seasons and leaf petioles were separated from the blads. The petioles were washed with tap water, distilled water, air-dried, oven-dried at 70°C to constant weight, then ground in a stainless steel mill and kept for chemical analysis (Nijjar, 1985).

One part of each ground sample was analysed for total nitrogen by the semi-microkjeldahl technique (Bremner and Mulvaney, 1982). Other part of each ground sample was wet-digested using a 2:1 nitric to perchloric acid mixture. Phosphorus and potassium in the digests were determined by colorimetry and flame photometry methods respectively (Jackson, 1958).

3 – Yield components:

Berry set percentage was estimated by caging two flower clusters on each vine in perforated white cheese bags before bloom. After berry set, the berry set percentage was calculated as follows:

Berry set % = No. of berries per cluster / Total No. of flowers per cluster x 100

Moreover, at harvesting date (when TSS% at least reached about (15-16%), (19-20%) and (16-17%) for Flame Seedless, Thompson Seedless and Ruby Seedless grapes, respectively), the yield per vine was recorded in terms of weight (kg/vine) and the number of clusters per vine was recorded.

4-Cluster and berry characteristic:

At harvest, two clusters were taken at random from the yield of each vine and the following characters were determined.

- Cluster weight (g).

-Cluster compactness coefficient according to Winkler *et al.* (1974).

- Average weight of berry (g).

- Percentage of total soluble solids in the juice using the hand refractometer.

- Percentage of reducing sugars in the juice according to Lane and Eynon procedure which outlined in A.O.A.C. (1985).

- Percentage of total acidity (expressed as g. of tartaric acid per 100 ml of juice) by titration with (0.1 N) NaOH using phenolphthaline as an indicator.

All obtained data were tabulated and statistically analysed according to Gomez and Gomez (1984) and Snedecor and Cochran (1990). The differences were compared using LSD at 5% level.

Results and Discussion

1 – Vegetative growth and N, P and K in the leaves:

Data presented in Tables (1-5) indicated that leaf area, pruning wood weight and leaf nutrient composition were significantly increased by using biofertilizers i.e. microbein, biogen and nitrobien. The promotion of such growth characters was associated with increasing the proportion of biofertilizers and decreasing the applied of mineral form. Application of nitrobein, biogen and microbien in descending order was accompanied with improving such traits. Combined application of mineral N form at 50% of RDN plus biofertilizers gave the maximum values. These finding could be attributed to the important role of biofertilizer on facilitating the fixation of atmospheric N as well as activating the availability and uptake of nutrients and reducing the incidence of soil born plant diseases. These findings emphasized the role of biofertilize in enhancing growth due to its important role in the uptake and translocation of most nutrients as well as accelerating carbohydrate and protein synthesis and movement which aids in encouraging cell division

Table (1): Effect of some biofertilization treatments on leaf area (cm^2) of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→	2004				2005				2006			
Treat. (B) ↓ cvs. →(A)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1- 75% M + 50 g Micro.	166.4	188.6	175.8	176.9	172.5	192.8	182.6	182.6	164.4	192.3	180.2	179.0
2- 75% M + 50 g Bio.	169.7	192.8	180.1	180.9	176.3	197.5	187.3	187.0	166.9	195.3	185.6	182.6
3- 75% M + 50 g Nitro.	171.3	193.3	181.3	182.0	178.0	197.5	188.6	188.0	167.3	196.0	186.1	183.1
4- 50% M + 100g Micro.	173.5	195.2	184.0	184.2	180.3	201.1	190.0	190.5	169.8	197.8	188.6	185.4
5- 50% M + 100g Bio.	177.1	198.8	187.3	187.7	182.0	203.5	192.6	192.7	173.8	202.0	190.3	188.7
6- 50% M + 100g Nitro.	179.6	201.3	190.1	190.3	184.3	206.1	195.8	195.4	175.7	204.5	193.8	191.3
7- 100% M, control	163.8	186.1	173.6	174.5	170.1	190.3	180.2	180.2	161.8	188.9	178.4	176.4
Mean (A)	171.6	193.7	181.7		177.6	198.4	188.2		168.5	196.7	186.1	
L.S.D. 5%	A:4.61	B: 5.66	AB: 9.79		A:6.02	B: 4.39	AB: 7.59		A:4.50	B: 4.98	AB: 8.61	

Table (2): Effect of some biofertilization treatments on pruning wood weight (kg) of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→	2004/2005				2005/2006				2006/2007			
Treat. (B) ↓ cvs. →(A)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1- 75% M + 50 g Micro.	1.39	2.04	0.94	1.46	1.11	1.54	1.01	1.22	1.43	1.61	1.14	1.39
2- 75% M + 50 g Bio.	1.44	2.09	0.96	1.50	1.14	1.58	1.04	1.25	1.47	1.66	1.18	1.44
3- 75% M + 50 g Nitro.	1.48	2.15	0.99	1.54	1.17	1.62	1.06	1.28	1.52	1.70	1.21	1.48
4- 50% M + 100g Micro.	1.51	2.17	1.01	1.56	1.20	1.65	1.08	1.31	1.53	1.73	1.23	1.50
5- 50% M + 100g Bio.	1.55	2.23	1.03	1.60	1.23	1.70	1.11	1.35	1.58	1.78	1.27	1.54
6- 50% M + 100g Nitro.	1.59	2.32	1.06	1.66	1.26	1.75	1.14	1.38	1.63	1.84	1.33	1.60
7- 100% M, control	1.32	1.92	0.88	1.37	1.05	1.45	0.95	1.15	1.35	1.52	1.08	1.32
Mean (A)	1.47	2.13	0.98		1.17	1.61	1.06		1.50	1.69	1.21	
L.S.D. 5%	A:0.11	B: 0.14	AB: 0.24		A:0.08	B: 0.11	AB: 0.19		A:0.08	B: 0.13	AB: 0.22	

Table (3): Effect of some biofertilization treatments on the percentage of nitrogen in leaves of some seedless grape cultivars during2004, 2005 and 2006 seasons.

Season→ Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1- 75% M + 50 g Micro.	1.94	2.22	1.65	1.94	1.87	2.18	1.67	1.91	1.93	2.31	1.70	1.98
2- 75% M + 50 g Bio.	2.00	2.34	1.68	2.01	1.99	2.41	1.70	2.03	2.05	2.35	1.74	2.05
3- 75% M + 50 g Nitro.	1.98	2.20	1.62	1.93	1.96	2.18	1.66	1.93	2.00	2.33	1.70	2.01
4- 50% M + 100g Micro.	2.04	2.36	1.72	2.04	2.01	2.33	1.73	2.02	2.08	2.45	1.82	2.12
5- 50% M + 100g Bio.	2.14	2.80	1.88	2.27	2.10	2.74	1.87	2.24	2.18	2.82	1.96	2.32
6- 50% M + 100g Nitro.	2.05	2.55	1.73	2.11	2.02	2.40	1.72	2.05	2.13	2.50	1.81	2.15
7- 100% M, control	1.77	1.99	1.52	1.76	1.80	2.05	1.56	1.80	1.80	1.99	1.58	1.79
Mean (A)	1.99	2.35	1.68		1.96	2.32	1.70		2.02	2.39	1.76	
L.S.D. 5%	A:0.08	B: 0.08	AB: 0.14		A:0.07	B: 0.10	AB: 0.17		A:0.11	B: 0.12	AB: 0.21	

Table (4): Effect of some biofertilization treatments on the percentage of phosphorus in leaves of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1- 75% M + 50 g Micro.	0.310	0.391	0.239	0.313	0.300	0.386	0.237	0.307	0.307	0.408	0.240	0.318
2- 75% M + 50 g Bio.	0.320	0.414	0.244	0.326	0.314	0.426	0.242	0.327	0.328	0.414	0.247	0.330
3- 75% M + 50 g Nitro.	0.317	0.389	0.232	0.313	0.318	0.386	0.236	0.313	0.316	0.412	0.242	0.323
4- 50% M + 100g Micro.	0.323	0.415	0.243	0.327	0.317	0.410	0.244	0.324	0.331	0.431	0.259	0.340
5- 50% M + 100g Bio.	0.342	0.491	0.267	0.367	0.336	0.484	0.264	0.361	0.344	0.495	0.278	0.372
6- 50% M + 100g Nitro.	0.328	0.452	0.247	0.342	0.320	0.423	0.242	0.328	0.339	0.442	0.257	0.346
7- 100% M, control	0.248	0.310	0.214	0.257	0.252	0.319	0.220	0.264	0.252	0.316	0.223	0.264
Mean (A)	0.313	0.409	0.241		0.308	0.405	0.241		0.317	0.417	0.249	
L.S.D. 5%	A: 0.012	B: 0.013	AB:0.023		A: 0.015	B: 0.012	AB: 0.021		A:0.017	B: 0.020	AB: 0.035	

Table(5): Effect of some biofertilization treatments on the percentage of potassium in the leaves of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ / Treat. (B) ↓ cvs. →(A)	2004 Flame	2004 Thompson	2004 Ruby	2004 Mean (B)	2005 Flame	2005 Thompson	2005 Ruby	2005 Mean (B)	2006 Flame	2006 Thompson	2006 Ruby	2006 Mean (B)
1- 75% M + 50 g Micro.	1.79	1.34	0.91	1.35	1.75	1.32	0.92	1.33	1.80	1.40	0.94	1.38
2- 75% M + 50 g Bio.	1.86	1.43	0.93	1.41	1.83	1.47	0.94	1.41	1.93	1.45	0.98	1.45
3- 75% M + 50 g Nitro.	1.85	1.35	0.90	1.37	1.81	1.33	0.92	1.35	1.86	1.43	0.95	1.41
4- 50% M+ 100g Micro.	1.90	1.43	0.95	1.43	1.87	1.43	0.97	1.42	1.91	1.50	1.02	1.48
5- 50% M + 100g Bio.	1.98	1.71	1.05	1.58	1.98	1.67	1.03	1.56	2.03	1.72	1.08	1.61
6- 50% M + 100g Nitro.	1.92	1.56	0.96	1.48	1.88	1.48	0.98	1.44	1.98	1.53	1.01	1.51
7- 100% M, control	1.65	1.08	0.84	1.19	1.68	1.12	0.86	1.22	1.67	1.10	0.87	1.21
Mean (A)	1.85	1.41	0.93		1.83	1.40	0.94		1.88	1.45	0.98	
L.S.D. 5%	A:0.05	B: 0.07	AB: 0.12		A:0.04	B: 0.08	AB: 0.13		A:0.06	B: 0.06	AB: 0.10	

Table(6): Effect of some biofertilization treatments on number of clusters/vine of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ / Treat. (B) ↓ cvs. →(A)	2004 Flame	2004 Thompson	2004 Ruby	2004 Mean (B)	2005 Flame	2005 Thompson	2005 Ruby	2005 Mean (B)	2006 Flame	2006 Thompson	2006 Ruby	2006 Mean (B)
1- 75% M + 50 g Micro.	25.6	21.0	40.2	28.93	27.6	22.5	40.9	30.33	30.4	24.8	42.1	32.43
2- 75% M + 50 g Bio.	26.8	20.0	35.8	27.53	28.1	23.0	41.0	30.70	31.6	25.3	43.2	33.37
3- 75% M + 50 g Nitro.	27.0	21.4	37.0	28.47	29.0	24.0	41.8	31.60	32.2	26.8	43.8	34.27
4- 50% M+ 100g Micro.	25.4	21.0	36.2	27.53	28.3	24.3	41.2	31.27	33.1	27.4	41.8	34.10
5- 50% M + 100g Bio.	26.1	20.3	38.6	28.33	28.8	25.0	42.0	31.93	33.5	26.5	43.6	34.67
6- 50% M + 100g Nitro.	27.0	21.3	35.2	27.83	29.3	24.8	42.6	32.23	33.8	27.8	44.0	35.07
7- 100% M, control	27.2	19.8	36.6	27.87	26.8	20.3	37.8	28.30	28.6	22.5	38.4	29.83
Mean (A)	26.44	20.69	37.09		28.27	23.41	41.04		31.89	25.87	42.41	
L.S.D. 5%	A:2.12	B: N.S.	AB: 3.66		A:1.88	B: 1.75	AB: 2.02		A:2.81	B: 2.45	AB: 4.24	

and the development of meristematic tissues (Gaur *et al.*, 1980 and Subba Rao, 2984).

As interaction, all combination of Thompson seedless gave the highest values of such growth aspects compared to other studied cultivars. Whereas, all combination of either Ruby seedless or Flame seedless gave similar values. In addition, all cultivars nearly similar in their response to such biofertilizers.

The present results are in harmony with those of Ahmed *et al.* (1997), Mahmoud (1999), Abdel-Hady (2003), El-Akkad (2004), Tawfik (2005), Ibrahim, (2006) and Abbas, *et al.* (2006).

2 – Yield and its components:

Data illustrated in Tables (6-8) evident that fertilizing the vines with recommended dose of N (RDN) *via* mineral combined with biofertilizers was very effective in improving berry set % and number of clusters and yield/vine compared to RDN% mineral (M) alone. Increasing the level of biofertilizers from 50 to 100 g/vine and decreasing the dose of mineral N from 75 to 50% out of the RDN was followed by a gradual promotion on berry set %, yield and number of clusters/vine. Combined application of mineral form at 50% plus 100 g of nitrobein, biogen and microbien gave the maximum values compared to using 75% plus 50 g of these biofertilizers. The differences between the two rates of each biofertilizer had significantly effect on berry set and yield/vine, whereas, had insignificant effect on number of cluster/vine. Also, insignificant differences were noticed among these biofertilizers.

The promotion in berry set and number of clusters as a result of using combination biofertilizer plus mineral-N might be mainly attributed to their positive effect on improving vigour and nutritional status of vines, as well as their important action in maintaining a good balance between total carbohydrates and N in favour as improving bud burst and fertility coefficient that lead to increases the cluster number per vine and berry set %. In addition, increasing of. yield/vine was mainly due to increasing the number of cluster and heavy cluster weight as a result of more berry setting. This gave good evidence for the importance of using N-biofertilizers with the mineral-N source for increasing the efficiency of N use and for controlling the release of N to the vines consequently the maximum yield was produced.

The results of Akl *et al.* (1997), Mahmoud (1999), Abdel-Hamid (2002), Abdel-Hady (2003), El-Akkad (2004), Tawfik (2005), Ibrahim (2006) and

Table(7): Effect of some biofertilization treatments on berry set percentage of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1- 75% M + 50 g Micro.	22.00	26.15	17.25	21.80	13.80	21.90	19.15	18.28	17.80	23.32	15.96	19.03
2- 75% M + 50 g Bio.	22.18	26.28	17.18	22.06	14.10	22.13	19.30	18.51	18.81	22.61	16.88	19.43
3- 75% M + 50 g Nitro.	22.65	27.11	17.80	22.52	14.18	21.70	19.65	18.51	18.00	23.54	17.35	19.63
4- 50% M + 100g Micro.	23.90	28.67	18.15	23.34	14.85	22.92	20.20	19.32	20.79	23.38	16.33	20.17
5- 50% M + 100g Bio.	23.18	28.30	18.65	23.38	15.13	23.16	20.65	19.65	19.32	24.05	17.17	20.18
6- 50% M + 100g Nitro.	23.80	27.90	19.00	23.57	15.65	23.23	21.10	19.99	19.68	23.82	19.20	20.90
7- 100% M, control	21.95	26.30	16.80	21.68	13.83	19.80	18.70	17.44	18.78	22.95	14.04	18.59
Mean (A)	22.70	27.32	17.83		14.51	22.12	19.82		18.63	23.00	16.31	
L.S.D. 5%	A: 0.89	B: 0.92	AB: 1.59		A:0.75	B: 1.12	AB: 1.93		A:0.94	B: 1.25	AB: 2.13	

Table(8): Effect of some biofertilization treatments on yield/vine (kg) of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1- 75% M + 50 g Micro.	9.50	6.62	16.00	10.71	11.58	6.45	18.36	12.13	13.50	7.85	18.40	13.25
2- 75% M + 50 g Bio.	10.10	6.50	17.43	11.34	11.88	6.88	18.95	12.57	14.35	8.45	19.60	14.13
3- 75% M + 50 g Nitro.	9.85	6.64	17.50	11.33	12.06	6.79	18.60	12.48	14.30	8.60	18.74	13.88
4- 50% M + 100g Micro.	9.60	6.75	17.30	11.22	12.58	7.37	19.90	13.28	15.70	9.00	19.50	14.73
5- 50% M + 100g Bio.	10.40	6.65	19.30	12.12	13.00	7.87	21.05	13.97	16.43	9.43	21.52	15.79
6- 50% M + 100g Nitro.	10.55	7.20	17.60	11.78	12.70	7.31	19.70	13.24	15.86	9.20	20.00	15.02
7- 100% M, control	9.10	5.38	15.10	9.86	10.20	5.25	15.80	10.42	11.65	6.50	15.32	11.16
Mean (A)	9.87	6.53	17.19		12.00	6.85	18.91		14.54	8.43	19.01	
L.S.D. 5%	A: 0.87	B: 0.78	AB: 1.39		A: 1.02	B: 1.08	AB: 1.87		A:0.98	B: 1.20	AB: 2.08	

Abbas *et al.* (2006) who worked on Red Roomy, Thompson seedless, Flame seedless and Ruby seedless grapevines supported the beneficial effects of biofertilizers on berry set, number of cluster and yield/vine. They concluded that using biofertilziers, i.e. Rhizobacterine, Nitrobein, biogen and microbien can reduce about 20% of N fertilizer dose.

Regarding, the effect of fertilization treatments, it could be mentioned from Tables (6, 7 & 8) that number of clusters/vine, berry set percentage and yield/vine significantly varied according to the cultivar. Ruby Seedless cultivar had the highest number of cluster per vine consequently gave the highest yield (kg per vine) compared to the other studied grapevine cultivars. Contrarily, Thompson Seedless owing the minimum number of cluster as well as yield (kg)/vine.

As, the interaction between the two studied factors, data show that Ruby Seedless grapevine fertilized at different treatments gave the highest number of cluster as well as heavy yield than analogous one resulted from the combination of Flame Seedless and Thompson Seedless grape cultivars.

Contrarily, all combinations of Thompson Seedless recorded minimum number of cluster and yield per vine than analogous ones resulted from combination of other studied grapevine cultivars.

Also, all combinations of Thompson Seedless cultivar gave the highest berry set percentage than analogous ones resulted from the combinations of Flame seedless and Ruby Seedless cultivars.

3 – Cluster and berry characteristic:

Tables (9-14) revealed that application of the RDN *via* mineral plus bio-form improving the cluster and berry attributes compared to using RDN *via* mineral form alone. The promotion of such traits were associated with increasing the proportion of biofertilizers and decreasing the applied rate of mineral form. The best results with regard to quality of the. berries were obtained on vines fertilized with N at RDN as 50% *via* mineral plus 100 g biogen/vine.

These findings could be related to the effect of biofertilizers on activating the synthesis of total carbohydrates and proteins which enhances cell division and enlargement leading to increase berry weight and size, consequently hastened the maturation of berries. These results are nearly in the same line with these obtained by Mahmoud (1999), Abdel-Hamid (2002), Abdel-Hady (2003), El-Akkad

Table(9): Effect of some biofertilization treatments on cluster weight (g) of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1- 75% M + 50 g Micro.	386.0	315.0	476.8	392.6	420.5	317.2	449.0	395.6	440.0	320.8	448.2	403.0
2- 75% M + 50 g Bio.	392.0	323.0	488.3	401.1	423.0	330.0	462.3	405.1	446.3	334.0	466.3	415.5
3- 75% M + 50 g Nitro.	378.5	310.0	480.0	389.5	416.0	315.0	445.8	392.3	438.0	321.4	446.0	401.8
4-50% M + 100g Micro.	409.0	325.0	496.0	410.0	445.0	336.2	483.0	421.4	466.0	342.0	480.8	429.6
5- 50% M + 100g Bio.	413.7	325.0	518.6	419.1	452.0	358.0	502.6	437.5	481.5	358.3	501.0	446.9
6- 50% M + 100g Nitro.	405.5	338.0	503.0	415.5	435.0	355.8	469.8	420.2	468.0	341.8	470.4	426.7
7- 100% M, control	346.0	270.5	435.0	350.5	380.0	286.0	418.0	361.3	398.3	288.3	412.8	366.5
Mean (A)	390.1	315.2	485.4		424.5	316.9	461.5		448.3	329.5	460.8	
L.S.D. 5%	A: 23.62	B: 15.68	AB: 27.10		A:19.8	B: 13.5	AB: 23.40		A: 10.50	B: 9.53	AB: 16.47	

Table (10): Effect of some biofertilization treatments on compactness coefficient of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1-75% M + 50 g Micro.	6.43	9.72	7.51	7.89	6.50	8.94	7.20	7.55	7.83	10.31	8.05	8.73
2- 75% M + 50 g Bio.	6.37	9.67	7.33	7.79	6.57	8.95	7.12	7.55	8.09	9.92	7.93	8.65
3- 75% M + 50 g Nitro.	6.13	9.59	7.77	7.83	6.55	8.66	7.18	7.46	7.65	9.85	7.82	8.44
4-50% M+ 100g Micro.	6.53	10.05	7.76	8.11	6.77	8.98	7.23	7.66	8.51	10.01	7.98	8.83
5- 50% M + 100g Bio.	6.33	10.09	7.66	8.03	6.88	8.70	7.20	7.59	7.45	9.47	7.80	8.27
6- 50% M + 100g Nitro.	6.25	9.88	7.49	7.87	6.63	8.59	6.88	7.37	7.33	9.48	7.80	8.20
7- 100% M, control	6.46	9.98	7.51	7.98	6.82	8.50	7.23	7.52	7.62	9.90	7.96	8.49
Mean (A)	6.36	9.85	7.58		6.67	8.76	7.15		7.78	9.85	7.92	
L.S.D. 5%	A: 0.58	B: N.S.	AB: 0.99		A: 0.36	B: N.S.	AB: 0.79		A:0.63	B: N.S.	AB: 1.31	

Table(11): Effect of some biofertilization treatments on 50 berry weights (g) of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ / Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1-75% M+ 50 g Micro.	124.35	70.09	118.56	104.33	123.78	66.78	120.68	103.75	116.80	67.95	109.50	98.08
2- 75% M + 50 g Bio.	125.60	72.10	121.65	106.45	124.40	68.16	121.51	104.69	123.00	68.80	112.00	101.27
3-75% M + 50 g Nitro.	119.50	68.04	115.96	101.17	118.72	67.16	114.10	99.99	120.80	64.50	104.80	96.70
4-50% M+100g Micro.	124.46	67.18	118.82	103.49	122.08	67.27	120.00	103.12	117.40	65.80	111.30	98.17
5- 50% M + 100g Bio.	127.60	69.02	122.60	106.41	120.03	75.18	123.50	106.24	125.60	71.28	113.80	103.50
6-50% M+ 100g Nitro.	124.30	70.21	119.12	104.54	116.67	73.36	114.90	101.64	122.80	66.91	106.98	98.90
7- 100% M, control	112.48	61.49	111.10	95.02	110.61	63.95	110.50	95.02	116.60	62.81	104.80	94.74
Mean (A)	122.61	68.30	118.25		119.47	68.84	117.88		120.43	66.86	109.03	
L.S.D. 5%	A:1.13	B: 2.25	AB: 3.89		A:2.40	B: 2.81	AB: 4.80		A:1.76	B: 2.95	AB: 5.11	

Table (12): Effect of some biofertilization treatments on total soluble solids percentage of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→ / Treat. (B) ↓ cvs. →(A)	2004				2005				2006			
	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1-75% M+ 50 g Micro.	17.40	21.00	19.00	19.13	17.30	20.55	19.20	19.02	16.30	20.60	16.67	17.86
2- 75% M + 50 g Bio.	17.52	21.40	19.30	19.41	17.30	20.90	18.80	19.00	17.20	21.17	17.80	18.72
3-75% M + 50 g Nitro.	17.35	21.35	18.80	19.17	17.10	20.80	18.80	18.90	16.80	20.98	17.30	18.36
4-50% M+100g Micro.	18.15	21.50	20.0	19.88	17.60	21.50	19.70	19.70	17.00	21.70	17.50	18.73
5- 50% M + 100g Bio.	18.40	22.00	20.50	20.30	18.20	21.90	20.00	20.03	17.80	22.00	18.40	19.40
6-50% M+ 100g Nitro.	18.10	21.50	20.00	19.87	17.65	21.60	19.80	19.68	17.35	21.80	17.80	18.98
7- 100% M, control	16.40	20.60	18.10	18.37	16.80	20.30	17.80	18.30	15.80	19.80	16.40	17.33
Mean (A)	17.62	21.34	19.39		17.42	21.08	19.16		16.89	21.15	17.41	
L.S.D. 5%	A:0.28	B: 0.49	AB: 0.84		A:0.32	B: 0.56	AB: 0.97		A:0.18	B: 0.39	AB: 0.67	

Table (13): Effect of some biofertilization treatments on titratable acidity percentage of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→	2004				2005				2006			
Treat. (B) ↓ cvs. →(A)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1-75% M+ 50 g Micro.	0.604	0.533	0.428	0.522	0.590	0.525	0.410	0.512	0.487	0.470	0.450	0.469
2- 75% M + 50 g Bio.	0.584	0.505	0.403	0.497	0.575	0.518	0.397	0.497	0.477	0.450	0.430	0.452
3-75% M + 50 g Nitro.	0.563	0.470	0.386	0.473	0.556	0.488	0.375	0.473	0.453	0.430	0.390	0.424
4-50% M+100g Micro.	0.590	0.505	0.400	0.498	0.570	0.520	0.405	0.498	0.460	0.450	0.415	0.442
5- 50% M + 100g Bio.	0.575	0.492	0.360	0.476	0.548	0.492	0.310	0.450	0.442	0.420	0.370	0.411
6-50% M+ 100g Nitro.	0.556	0.463	0.338	0.452	0.535	0.460	0.293	0.429	0.423	0.390	0.330	0.381
7- 100% M, control	0.638	0.555	0.445	0.546	0.608	0.555	0.430	0.531	0.523	0.477	0.460	0.487
Mean (A)	0.587	0.503	0.394		0.569	0.510	0.374		0.466	0.441	0.406	
L.S.D. 5%	A: 0.021	B: 0.024	AB: 0.041		A: 0.015	B: 0.018	AB: 0.031		A: 0.019	B: 0.023	AB: 0.039	

Table(14): Effect of some biofertilization treatments on reducing sugars percentage of some seedless grape cultivars during 2004, 2005 and 2006 seasons.

Season→	2004				2005				2006			
Treat. (B) ↓ cvs. →(A)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)	Flame	Thompson	Ruby	Mean (B)
1-75% M + 50 g Micro.	12.15	15.35	13.61	13.70	12.08	15.23	13.43	13.58	12.10	14.82	12.81	13.24
2- 75% M + 50 g Bio.	12.30	15.50	13.75	13.85	12.25	15.30	13.50	13.68	12.36	14.95	12.90	13.40
3- 75% M + 50 g Nitro.	12.93	15.58	13.82	14.11	12.70	15.64	13.60	13.98	12.78	15.80	12.95	13.68
4-50% M+ 100g Micro.	12.55	15.45	13.70	13.90	12.15	15.30	13.52	13.66	12.31	15.10	12.78	13.40
5- 50% M + 100g Bio.	12.80	15.83	13.91	14.18	12.53	15.58	13.70	13.94	12.73	15.48	13.25	13.82
6-50% M + 100g Nitro.	13.21	16.05	14.10	14.45	12.71	15.86	13.85	14.14	12.61	15.30	13.09	13.67
7- 100% M, control	12.10	15.18	13.30	13.53	11.80	14.80	12.93	13.18	11.93	14.33	12.47	12.91
Mean (A)	12.58	15.56	13.74		12.32	15.39	13.50		12.40	15.04	12.89	
L.S.D. 5%	A:0.28	B: 0.47	AB: 0.80		A:0.34	B: 0.33	AB: 0.57		A:0.21	B: 0.38	AB: 0.65	

(2004), Tawfik (2005), Ibrahim (2006) and Abbas *et al.* (2006). They concluded from their studies on different grape cultivars that combined application of N *via* mineral and bioform improved the quality of berries. As well as the best fruit quality of Flame seedless and Ruby seedless grapes were obtained as result of biofertilizing with 40 g biogen plus mineral N at 40 g/vine.

In a general view Thompson Seedless grapes surpassed Ruby Seedless and Flame Seedless grapes in its quality from the chemical properties stand point, since it contain higher total soluble solids and reducing sugars percentage. These results are in agreement with those of Ahmed (1993), Abdel-Fattah and Kasstor (1993), Haggag *et al.* (1996) and Ahmed *et al.* (2001).

All combinations significantly improved the cluster and berry attributes physical properties of Thompson Seedless grapes were batter response to the biofertilization than Flame Seedless and Ruby Seedless grapes that were nearly similar in their responses to such biofertilization. Whereas, the chemical properties of Ruby Seedless grapes were batter response to such biofertilization than Flame Seedless and Thompson Seedless grapes that were nearly similar in their responses.

It is evident from the foregoing results that biofertilizer plus ½ recommended dose of nitrogen was sufficient to get good nutritional status, healthy and productivity of Flame Seedless, Thompson Seedless and Ruby Seedless grapevines.

Finally, it could be recommended that 100 g of biofertilizer plus $^1/_2$ RDN was sufficient to get the high yield with good quality and very useful in saving N fertilization cost and reducing nitrate pollution.

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تأثير التسميد الحيوى على النمو والمحصول وخصائص الحبات فى بعض أصناف العنب اللابذرية.*

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أجريت هذه الدراسة خلال ثلاثة مواسم متتالية ٢٠٠٤ ، ٢٠٠٥ ، ٢٠٠٦م لدراسة تأثير إضافة الأسمدة الحيوية على النمو الخضرى والحالة الغذائية والاثمار فى بعض أصناف العنب اللابذرية (الفليم – الطومسون – الروبى) بمزرعة كلية الزراعة جامعة أسيوط – مصر . حيث تم استخدام الأسمدة الحيوية بمعدل ٥٠ أو ١٠٠ جم (نيتروين ، بيوجين ، ميكروبين) بالإضافة إلى ٦٠ أو ٤٠ جم نيتروجين فى صورة معدنية / شجيرة .

ويمكن تلخيص النتائج فيما يلى :

- أدى استخدام التسميد الحيوى (نيتروبين ، بيوجين ، ميكروبين) إلى زيادة جوهرية فى وزن خشب التقليم ومساحة الأوراق ومحتواها من العناصر الغذائية وقد ارتبطت الزيادة بزيادة جرعة السماد الحيوى المستخدمة وقلة السماد المعدنى .

- أوضحت النتائج أن احلال ٥٠% من الجرعة السمادية من النيتروجين بالأسمدة الحيوية يؤدى إلى زيادة المحصول / شجيرة .

- أظهرت نتائج التفاعل بين الأصناف والتسميد أن شجيرات العنب الروبى عديم البذور أعطت أعلى القيم من حيث عدد العناقيد ووزن المحصول مع أى مستوى سمادى بينما سجلت شجيرات العنب الطومسون القيم الأقل .

- أدى استخدام التسميد النيتروجينى من خلال الأسمدة المعدنية والحيوية إلى تحسين خصائص العناقيد والحبات مقارنة باستخدام التسميد المعدنى فقط .

- تفوقت حبات العنب الطومسون من حيث الخصائص الكيميائية من زيادة نسبة المواد الصلبة الذائبة الكلية والسكريات المختزلة .

من نتائج هذه الدراسة يمكن التوصية بإحلال ٥٠% من الجرعة السمادية من النيتروجين بالأسمدة الحيوية للأصناف تحت الدراسة حيث يؤدى ذلك إلى شجيرات قوية سليمة تعطى محصول مرتفع ذو خصائص ثمرية جيدة وخالية من آثار التلوث النتراتى وكذلك تقليل تكلفة السماد ومشاكل تلوث البيئة .

* بحث مقدم إلى المؤتمر العلمي الثاني لشباب الباحثين بكلية الزراعة جامعة أسيوط، ٦ مايو ٢٠٠٨.