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EFFECT OF BIOFERTILIZERS AND DIFFERENT DOSES OF AMMONIUM NITRATE ON VEGETATIVE GROWTH, YIELD , PHYSICAL AND CHEMICAL CHARACTERISTICS OF GRAPEVINES

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ABSTRACT: The present study was conducted during 2006 and 2007 seasons on seven years old "Superior" and "Thompson Seedless" grapevines to study the effect of some biofertilizers (Biogen, Nitrobeine and Rhizobacterine) and ammonium nitrate (33% N) with different doses ranging from zero% up to 100% of the recommended nitrogen dose and their interaction on vegetative growth, yield, physical and chemical characteristics of grapes and leaf mineral content of Superior and Thompson Seedless grapevines. In addition to the aforementioned parameters efficiency of biofertilizers in reducing the application rate of N fertilization without any risk in the yield and bunch quality was also considered.

Results showed that mineral nitrogen at concentratin of 75% in combination with 30 g of Biogen gave the best results in all parameters (vegetative growth , yield , physical & chemical characteristicsof berries .

Treatment (75% nitrogen fertilizer + Biogen) gave the highest values of total chlorophyll in the leaf, N, P, K. However the treatment of zero% nitrogen fertilizer + Rhizobacterine gave the lowest values in both cultivars.

Generally, the results proved that using nitrogen at 45 units for Superior and 60 units for Thompson Seedless plus Biogen resulted in an increase in the yield and improved fruit quality as compared with using 60 units for Superior and 80 units for Thompson Seedless without biofertilizers. Hence, it could be concluded that using biofertilizers can reduce about 25% of the recommended nitrogen dose.

INTRODUCTION

Grape (*Vitis vinifera* L.) is considered to be the first major fruit crop as regards its production all over the world. In Egypt, grape ranks second among fruit crops preceded by citrus. The total acreage of grapevines in Egypt exhibited an obvious increase through the last three decades till it reached 165786 feddans with a production of 1431966 tons according to the latest statistics of Ministry of Agriculture (2007).

Fertilization is one of the most important cultural practices carried out during the growing season, especially nitrogen fertilization. Nitrogen is one of the major plant nutrients, being a part of protein, enzymes, amino acids, polypeptides and many other bio-chemical compounds in plant system. It is required for the survival and growth of each plant cell (Neilsen *et al.*, 2000). Also, N is a constituent of amino acids and proteins, its important effect lies in encouraging cell division and the development of meristematic tissue (Nijjar,1985). On the other hand, Mineral fertilizers and other chemicals commonly used in agricultural production, not only have harmful effects on the environment, but they also can alter the composition of fruits; vegetables and root crops and can decrease their contents of vitamins, minerals and other useful compounds (Bogatyre, 2000). These compounds represent a very great danger due the harmful residues that may remain in the food .

Biofertilizers are commonly called microbial inoculants which are capable of transforming important nutritional elements in the soil from non-usable to usable form by the crop plants through their biological processes El-sayed 1998. During the last decade, biofertilizers have been extensively used as an eco-friendly approach to minimize the use of chemical fertilizers, improve soil fertility status and for the enhancement of crop production by their biological activity in the rhizosphere (Ram Rao *et al.*, 2007).

These micro-organisms have definite beneficial roles in the fertility of soil rhizosphere and the growth of the plants. Biofer-tilizers proved to eliminate the use of pesticides sometimes, and rebalance the ratio between plant nutrients in the soil. They are easy and safe to handle with field applications. They also increase crop yield and decrease the costs of some agricultural practices (Ishac, 1989 and Saber, 1993).

The positive action of biofertoilizers can be interpreted by the results of Rodelas *et al.,* (1999) and Singh and Kapoor, (1999) who suggested that plant hormones released by micro-organisms increase plant root growth causing in turn an increase in the plant root surface which improves nutrient absorption. In this respect, Bhardwi *et al.,* (2000) mentioned that the production of antimicrobial substances is responsible for reducing plant root infection with pathogens which makes the plants more healthy and consequently increases their nutrient uptake.

The beneficial effect of plant growth promoting rhizobacteria have been attributed to biological N2 fixation and production of phytohormones that promote root development and proliferation resulting in more efficient uptake of water and nutrients (Jacoud *et al ., 1999)* . Nitrobeine &Biogen has greater amount of bacteria which were responsible for fixation of nitrogen by atmosphere (El-Desuki *et al.,2006).*

The main objective of this investigation was to study the effect of some biofertilizers (Biogen, Nitrobeine and Rhizobacterine), mineral nitrogen in the form of ammonium nitrate (33% N) with different rates and their influence on vegetative growth, yield, physical and chemical characteristics of grapes and leaf mineral content of Superior and Thompson Seedless grapevines. Moreover, the efficiency of biofertilizers in reducing the application rate of mineral N fertilization without any risk in yield and fruit quality was also considered.

MATERIALS AND METHODS

This experiment was conducted during 2006 and 2007 seasons in a private vineyard situated at 64 kilo-meters from Cairo on the desert road of Cairo- Alexandria on seven years old "Superior" and "Thompson Seedless" grapevines. The vines were chosen as to be similar in growth as possible. Vines were planted in a sandy loam soil (Table, 1) at 1.5 x 3.0 m apart under the drip irrigation system.

The vines were cane pruned with bud load of 72 buds/vine and trellised according to the telephone shape system, And received the same normal cultural practices such as fertilization (except nitrogen) , pest and diseas control.

The recommended doses of nitrogen were 60 units for "Superior" and 80 units for "Thompson Seedless" per feddan. Thus, the experiment was comprised of 13 treatments for both cultivars (4 levels of nitrogen x 3 levels of biofertilizers x4 replicates in addition to the control as shown in (Table, 2).

Table (1): Chemical and mechanical analysis of the vineyard soil at 0-30 and 30-60 cm soil depths.

Sample	Depth (cm)	pH	EC (mmhos/cm)	Cations/100g				Anions/100g			Mechanical analysis (%)			
				Ca^{++}	Mg^{++}	K^{+}	Na^{+}	Hco_3^{-}	Cl^{-}	So_4^{-}	Sand	Silt	Clay	Texture
1	0-30	8.6	0.13	0.15	0.38	0.22	0.20	0.36	0.46	0.32	55.89	21.31	13.20	Sandy loam
2	30-60	8.7	0.15	0.14	0.37	0.21	0.18	0.35	0.44	0.31	56.60	20.70	13.35	Sandy loam

Table (2): The treatments of the experiment for Superior and Thompson Seedless grapevines.

Treatments	
Mineral N doses of the recommended dose (%)	Biofertilizer
0	Biogen
	Nitrobeine
	Rhizobacterine
25	Biogen
	Nitrobeine
	Rhizobacterine
50	Biogen
	Nitrobeine
	Rhizobacterine
75	Biogen
	Nitrobeine
	Rhizobacterine
100	control

The application of nitrogen fertilizer followed the same normal application practices as follows: 15% after bud burst untill flowering, 50% after flowering, and before varison stage and 35% after harvest.

Bio-fetilizers, nitorbeine, Rhizobacterine and biogen at the rate of 30 g / vine were mixed with the organic manure and the mixtures were added to the soil before the beginning of bud burst in a circle around each vine at the soil depth of 30 cm then covered with soil and irrigated with water.

The following parameters were adopted to evaluate the tested treatments:

At varison stage, four vines were specified for sampling. A representative sample of 20 berries from the apical, middle and basal portions of the cluster was picked from each vine every week. Samples harvested as TSS of control treatment reached about 16-17% according to Tourky *et al.*, (1995).

Vegetative growth characteristics :

- Trunk diameter was measured 50 cm. above ground by a venire caliper (cm).
- Cane thickness was measured using a venire caliper (cm) started from bud No.2 from the base .
- Average leaf area (cm^2) of the apical 5^{th} and 6^{th} leaves using a CI-203-Laser Area-meter made by CID, Inc., Vancouver, USA.

Yield and its components:

Yield/vine was determined by multiplying average number of clusters/vine by average cluster weight. Representative random samples of six clusters/vine were harvested at maturity stage. Average cluster weight (g) was determined.

Physical characteristics :

Average cluster length (cm), average cluster width (cm), weight of 100 berries (g) and volume of 100 berries per cluster (cm^3) were recorded. Averages of berry dimensions (length and diameter cm) and average berry firmness (g/cm^2) (using Shatilons's instrument) were determined.

Chemical characteristics :

Total soluble solids in berry juice (T.S.S.) (%) were determined by hand refractometer and total titratable acidity as tartaric acid (%) (A.O.A.C. 1985), then TSS /acid ratio was calculated.

-Leaf content of total chlorophyll was measured by using nondestructive Minolta chlorophyll meter SPAD 502 of the apical 5^{th} and the 6^{th} leaves (Wood *et al.,* 1992).

Total nitrogen was determined according to Pregl (1945) in petioles, phosphorus was colorimetrically determined according to Snell and Snell (1967), potassium was Flame photometrically determined by using a bye unican sp 1990 Atomic absorption specterometer according to Jackson (1967).

Statistical analysis:

The complete randomized block design was adopted for the experiment. The statistical analysis of the present data was carried out according to Snedecor and Chocran (1972). Averages were compared using the new L.S.D. values at 5% level. Percentages were transformed by a certain equation prior to the statistical analysis and thereafter percentages were presented with statistical letters.

RESULTS AND DISCUSSION

Effect of nitrogen form on morphological characteristics :

1-Trunk diameter:

It is obvious from Table (3) that no significant differences could be detected between treatments in the first season. However, in the second season, data revealed highly significant differences between these treatments. The highest value of trunk diameter in the second season was given by vines receiving 75% of the recommended nitrogen + Biogen. On other hand, the lowest value of this estimate was obtained with vines receiving zero of the recommended nitrogen + Rhizobacterine.

2-Cane thickness:

As shown in Table (3) it is clear that cane thickness of Superior and Thompson Seedless grapevines was greatly affected by mineral nitrogen or biofertilizers application during 2006 and 2007 seasons. The reduction of mineral nitrogen doses significantly decreased cane thickness as in case of vines receiving zero of the recommended nitrogen + Rhizobacterine, which recorded the lowest values. However, vines fertilized with 75% of the recommended nitrogen + Biogen resulted in the highest values of cane thickness.

3-Average leaf area:

It is apparent from Table (3) that high significant differences could be noticed between different treatments of mineral nitrogen and biofertilizers. The highest value of leaf area of Superior and Thompson Seedless grapevines in both seasons was recorded by the treatment where vines were fertilized with 75% of the recommended nitrogen + Biogen. On other hand, the lowest value of this estimate was obtained with vines receiving zero of the recommended nitrogen + Rhizobacterine. These results are in harmony with those obtained by El-Sayed (2002a) who reperted that 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 meristeniatic tissue can provide a clear explanation for the role of N in activating growth (Nijjar, 1985).

Regarding the important role of biofertilizers in increasing the availability of mineral and organic nutrients to the vines is surely reflected on improving both cell division and cell enlargement (El-Sayed 1998). Consequently a great promotion of vine growth was attained he added that, these bacteria may produce growth promoting substances such as auxins, gibberellins and cytokinins which might improve plant growth and stimulate the microbial development . Similar results were obtained by El-Shammaa and Abd El-Hady (2001).

Table (3): Effect of mineral nitrogen and some biofertilizers on vine trunk diameters (cm), vine cane thickness (cm) and leaf area (cm^2) among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		Vine trunk diameters (cm)				Vine cane thickness (cm)				Leaf area (cm^2)			
Mineral N (%)	Biofertilizer	Superior		Thompson		Superior		Thompson		Superior		Thompson	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
0	Biogen	4.85^{a}	5.22^{hi}	4.13^{a}	4.41^{fg}	1.24^{d}	1.29^{def}	1.16^{cde}	1.17^{fgh}	110.4^{ef}	117.2^{def}	133.8^{cde}	136.7^{cdef}
	Nitrobeine	4.84^{a}	5.19^{hi}	4.09^{a}	4.33^{fg}	1.23^{d}	1.26^{ef}	1.15^{de}	1.16^{gh}	107.1^{fg}	115.3^{ef}	130.1^{ef}	133.8^{ef}
	Rhizobacterine	4.82^{a}	5.14^{i}	4.08^{a}	4.26^{h}	1.18^{e}	1.24^{f}	1.13^{e}	1.14^{h}	103.6^{g}	111.2^{f}	127.7^{f}	131.60^{f}
25	Biogen	4.91^{a}	5.53^{bc}	4.22^{a}	4.83^{c}	1.30^{c}	1.35^{c}	1.20^{bcde}	1.27^{cde}	117.9^{cd}	123.1^{bcd}	137.8^{bc}	140.9^{bc}
	Nitrobeine	4.90^{a}	5.35^{f}	4.17^{a}	4.62^{de}	1.29^{c}	1.31^{cde}	1.20^{bcde}	1.24^{defg}	112.8^{e}	118.8^{cde}	132.8^{cdef}	135.7^{cdef}
	Rhizobacterine	4.88^{a}	5.31^{fg}	4.15^{a}	4.57^{e}	1.21^{de}	1.27^{ef}	1.19^{bcde}	1.23^{efg}	111.8^{e}	117.2^{def}	130.9^{def}	133.8^{ef}
50	Biogen	4.93^{a}	5.57^{b}	4.25^{a}	4.96^{b}	1.38^{b}	1.43^{b}	1.24^{b}	1.37^{ab}	119.7^{bcd}	127.0^{b}	139.60^{b}	142.9^{b}
	Nitrobeine	4.91^{a}	5.35^{f}	4.19^{a}	4.89^{bc}	1.23^{d}	1.29^{def}	1.23^{bc}	1.32^{bcd}	117.3^{d}	122.3^{bcd}	136.0^{bcd}	138.9^{bcde}
	Rhizobacterine	4.91^{a}	5.38^{ef}	4.18^{a}	4.70^{d}	1.31^{c}	1.35^{c}	1.22^{bcd}	1.29^{bcde}	122.1^{ad}	124.9^{b}	133.9^{cde}	135.8^{cdef}
75	Biogen	4.97^{a}	5.69^{a}	4.29^{a}	5.09^{a}	1.45^{a}	1.49^{a}	1.33^{a}	1.45^{a}	123.9^{a}	133.1^{a}	145.8^{a}	148.4^{a}
	Nitrobeine	4.95^{a}	5.44^{de}	4.22^{a}	4.94^{bc}	1.29^{c}	1.34^{cd}	1.25^{b}	1.34^{bc}	18.2^{bcd}	124.2^{bc}	136.9^{bc}	140.8^{bc}
	Rhizobacterine	4.96^{a}	5.47^{cd}	4.20^{a}	4.90^{bc}	1.30^{c}	1.35^{c}	1.22^{bcd}	1.31^{bcde}	121.8^{abc}	125.9^{b}	135.6^{bcd}	139.9^{bcd}
100	control	4.90^{a}	5.23^{gh}	4.16^{a}	4.51^{ef}	1.22^{de}	1.28^{ef}	1.21^{bcd}	1.25^{bcd}	120.2^{abcd}	122.1^{bcd}	133.5^{cde}	135.3^{def}
New L.S.D (0.05%)		N.S	0.09	N.S	0.13	0.05	0.06	0.08	0.09	4.2	6.1	5.3	5.5

Effect of nitrogen fertilizers and biofertilizers on yield and its components:

Yield/vine:

Data listed in Table (4) showed that the yield of Superior and Thompson Seedless grapevines was greatly affected by mineral and biofertilizers application in 2006 and 2007 seasons. The highest value of yield was obtained with vines receiving 75% of the recommended nitrogen + Biogen while, the lowest was obtained with vines receiving zero of the recommended nitrogen + Rhizobacterine. Differences among the 75% nitrogen + Biogen and other treatments were significant.

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Number of clusters /vine:

It is obvious from Table (4) that no significant differences were found between treatments in the first season. However, in the second season, data revealed high significant differences between these treatments. The highest value of this estimate was given by vines receiving 75% of the recommended nitrogen + Biogen. On the other hand, the lowest value of number of clusters / vine was obtained with vines receiving zero of the recommended nitrogen + Rhizobacterine.

Average cluster weight:

Data presented in Table (4) show the effect of mineral nitrogen and biofertilizers on average cluster weight of Superior and Thompson Seedless grapevines. The results showed high significant differences among all treatments in 2006 and 2007 seasons. The highest value of cluster weight was obtained with vines receiving 75% of the recommended nitrogen + Biogen, while, the lowest value was given by vines receiving zero of the recommended nitrogen + Rhizobacterine.

This result was in agreement with those obtained by Lovisolo *et al.*, (2000) and El-Sayed (2002a) on grapevines who reported that berry set, yield and cluster weight / vine were significantly increased as N rates increased from 40 to 120g / vine . Ahmed *et al.*, (2003) on Flame seedless grapevines observed that the best results with regard to yield and cluster weight were positively affected with the application of biofertilizer .

Weight and number of clusters / vine were positively affected by combined of N plus biofertilizers than using N alone (El-Shamaa and Abd El-Hady (2001).

Table (4): Effect of mineral nitrogen and some biofertilizers on yield per vine (kg), number of clusters per vine and average weight of cluster (g) among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		**Yield per vine (kg)**				**Number of clusters per ine**				**Average weight of cluster (g)**			
Mineral N (%)	**Biofertilizer**	**Superior**		**Thompson**		**Superior**		**Thompson**		**Superior**		**Thompson**	
		2006	**2007**	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**
	Biogen	12.8^{ef}	13.3^{fg}	12.5^{ef}	12.9^{cd}	24.6^{a}	25.3^{e}	28.2^{a}	28.9^{f}	522.3^{ef}	524.8^{ef}	442.3^{bcde}	447.3^{bcde}
	Nitrobeine	12.5^{ef}	12.9^{g}	11.9^{fg}	12.1^{de}	24.4^{a}	24.9^{e}	27.9^{a}	28.7^{g}	511.7^{ef}	519.3^{ef}	425.3^{def}	422.4^{ef}
0	**Rhizobacterine**	12.2^{f}	12.7^{g}	11.1^{g}	11.3^{e}	24.2^{a}	24.8^{e}	27.8^{a}	28.6^{g}	503.5^{f}	512.1^{f}	398.8^{f}	396.3^{f}
	Biogen	13.6^{cde}	15.3^{de}	12.9^{cdef}	13.3^{bcd}	24.9^{a}	27.8^{d}	29.6^{a}	30.1^{c}	547.9^{cdef}	551.8^{def}	436.3^{bcde}	440.5^{cde}
	Nitrobeine	13.2^{def}	14.7^{ef}	12.6^{def}	12.8^{cd}	24.5^{a}	27.3^{d}	29.4^{a}	29.7^{d}	539.5^{def}	537.8^{def}	429.7^{def}	432.4^{de}
25	**Rhizobacterine**	13.2^{def}	14.7^{ef}	12.3^{efg}	9.7^{f}	24.8^{a}	27.5^{d}	29.1^{a}	29.5^{e}	533.8^{def}	535.6^{def}	423.5^{ef}	427.3^{g}
	Biogen	14.7^{bc}	17.4^{bc}	14.2^{b}	14.4^{b}	24.8^{a}	29.1^{bc}	30.2^{a}	30.4^{b}	592.5^{bc}	597.5^{bc}	469.5^{b}	473.5^{b}
	Nitrobeine	13.5^{cdef}	15.8^{cde}	13.8^{cde}	13.8^{bc}	24.8^{a}	28.7^{c}	30.1^{a}	30.2^{c}	542.8^{def}	549.8^{def}	457.3^{bcd}	456.8^{bcd}
50	**Rhizobacterine**	14.3^{bcd}	16.8^{cd}	13.1^{bcdef}	13.3^{bcd}	24.9^{a}	29.0^{bc}	30.1^{a}	30.1^{c}	573.3^{cd}	578.3^{cd}	436.5^{cd}	440.3^{cde}
	Biogen	16.1^{a}	19.2^{a}	15.5^{a}	15.9^{a}	25.1^{a}	29.8^{a}	30.7^{a}	30.7^{a}	642.5^{a}	643.8^{a}	503.4^{a}	517.3^{a}
	Nitrobeine	14.8^{abc}	17.5^{abc}	14.2^{b}	14.4^{b}	24.9^{a}	29.2^{abc}	30.4^{a}	0.6^{a}	595.3^{abc}	600.3^{abc}	468.1^{bc}	471.8^{bcd}
75	**Rhizobacterine**	15.5^{ab}	18.6^{ab}	14.1^{bc}	14.0^{bc}	24.9^{a}	29.5^{ab}	30.3^{a}	30.4^{b}	623.5^{ab}	629.5^{ab}	465.5^{bc}	461.5^{bc}
100	**control**	13.8^{cde}	16.2^{cde}	13.2^{bcde}	13.4^{bcd}	24.8^{a}	28.9^{bc}	30.1^{a}	30.2^{c}	555.8^{cde}	560.8^{cde}	438.5^{bcde}	443.1^{bcde}
New L.S.D (0.05%)		1.4	1.8	1.3	1.4	N.S	0.7	N.S	0.2	49.3	45.7	33.1	32.7

Effect of nitrogen fertilizers and biofertilizers on physical characteristics of clusters and berries:

Cluster length:

As shown in Table (5) the results revealed significant differences between treatments in 2006 and 2007 seasons concerning cluster length and this effect was more pronounced in the treatment where the vines were fertilized with 75% of recommended nitrogen + Biogen. On other hand, the lowest value of cluster length was obtained with vines receiving zero of the recommended nitrogen + Rhizobacterine.

Cluster width:

Data presented in Table (5), revealed high significant differences between vines receiving mineral nitrogen and biofertilizers on cluster width of Superior and Thompson Seedless grapevines in 2006 and 2007 seasons. The highest value of cluster width was recorded by vines receiving 75% of the recommended nitrogen + Biogen, while, the lowest value was given by vines receiving zero of the recommended nitrogen + Rhizobacterine

Weight of 100 berries:

As shown in Table (6), significant differences among nitrogen doses applied to Superior and Thompson Seedless vines were noticed as concerns weight of 100 berries during 2006 and 2007 seasons. The highest weight of 100 berries was obtained by vines receiving 75% of the recommended nitrogen + Biogen. On the other hand, the lowest value was given by vines fertilized with zero of the recommended nitrogen + Rhizobacterine.

Volume of 100 berries:

The effect of different doses of mineral nitrogen in combination with biofertilizers on 100 berries volume of Superior and Thompson Seedless grapes during 2006 and 2007 seasons is given in Table (6). The highest value of this estimate was recorded by vines receiving 75% of the recommended nitrogen + Biogen, while, the lowest value was obtained with vines receiving zero of the recommended nitrogen + Rhizobacterine.

Table (5): Effect of mineral nitrogen and some biofertilizers on average length of cluster (cm) and average cluster width (cm) among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		Average length of cluster (cm)				average cluster width (cm)			
Mineral N (%)	Biofertilizer	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007
0	Biogen	20.5^{abc}	20.8^{ab}	22.5^{bcd}	23.5^{bc}	11.9^{ef}	12.5^{fg}	11.6^{bcd}	11.7^{cd}
	Nitrobeine	19.5^{bc}	19.7^{bc}	22.4^{cd}	22.3^{c}	11.3^{fg}	11.6^{gh}	11.2^{cd}	11.4^{cd}
	Rhizobacterine	19.5^{bc}	19.5^{c}	22.3^{d}	22.2^{c}	10.6^{g}	10.9^{h}	10.9^{d}	10.8^{d}
25	Biogen	20.8^{abc}	21.3^{a}	23.4^{abcd}	24.5^{ab}	12.7^{cde}	13.1^{def}	11.9^{abcd}	12.1^{abcd}
	Nitrobeine	20.5^{abc}	20.8^{ab}	23.1^{abcd}	24.0^{ab}	12.1^{def}	12.6^{ef}	11.7^{abcd}	11.9^{abcd}
	Rhizobacterine	19.3^{c}	19.7^{bc}	22.9^{abcd}	23.9^{ab}	11.8^{ef}	12.5^{fg}	11.5^{bcd}	11.7^{bcd}
50	Biogen	21.5^{a}	21.8^{a}	23.7^{abcd}	24.7^{ab}	13.8^{ab}	14.2^{abc}	12.3^{abc}	12.5^{abc}
	Nitrobeine	20.5^{abc}	20.9^{ab}	23.6^{abcd}	24.5^{ab}	13.0^{bcd}	13.5^{cde}	12.1^{abcd}	12.3^{abc}
	Rhizobacterine	20.8^{ab}	21.3^{a}	23.0^{abcd}	24.1^{ab}	13.3^{abc}	13.9^{bcd}	11.9^{abcd}	12.2^{abc}
75	Biogen	21.5^{a}	21.9^{a}	24.2^{a}	25.2^{a}	14.2^{a}	14.9^{a}	12.9^{a}	12.9^{a}
	Nitrobeine	20.5^{abc}	20.9^{ab}	24.0^{ab}	25.0^{a}	13.5^{abc}	14.1^{abc}	12.7^{ab}	12.8^{ab}
	Rhizobacterine	20.8^{ab}	21.4^{a}	23.9^{abc}	24.7^{ab}	13.9^{ab}	14.6^{ab}	12.6^{ab}	12.5^{abc}
100	control	19.5^{bc}	19.8^{bc}	23.0^{abcd}	23.9^{ab}	13.2^{abc}	13.9^{bcd}	11.9^{abcd}	12.2^{abc}
New L.S.D (0.05%)		1.4	1.3	1.6	1.5	1.1	1.0	1.4	1.2

Berry length:

Data in Table (6) show the effect of mineral nitrogen and biofertilizers on berry length of Superior and Thompson Seedless grapes during 2006 and 2007 seasons. The highest value of berry length was recorded by vines receiving 75% of the recommended nitrogen + Biogen. On the other hand, the lowest value of berry length was obtained with vines fertilized with zero of the recommended nitrogen + Rhizobacterine

Table (6): Effect of mineral nitrogen and some biofertilizers on average weight of 100 berries (g), average volume of 100 berries (cm^3) and average length of berry (cm) among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		Aaverage weight of 100 berries (g)				Average volume of 100 berries (cm^3)				Aaverage length of berry (cm)			
Mineral N (%)	Biofertilizer	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007
0	Biogen	406.3^{ef}	411.5^{fgh}	136.8^{de}	140.8^{f}	401.3^{fgh}	400.3^{fg}	124.4^{efg}	129.8^{def}	1.99^{de}	2.00^{c}	1.40^{de}	1.42^{def}
	Nitrobeine	402.8^{f}	406.7^{gh}	133.3^{e}	130.3^{g}	395.5^{gh}	398.2^{g}	121.6^{fg}	121.3^{f}	1.84^{f}	1.90^{de}	1.37^{ef}	1.38^{fg}
	Rhizobacterine	399.8^{f}	404.8^{h}	129.3^{e}	130.2^{g}	393.8^{h}	394.8^{g}	117.3^{g}	120.8^{f}	1.81^{f}	1.87^{e}	1.34^{f}	1.36^{g}
25	Biogen	436.8^{cd}	438.3^{cde}	144.5^{cd}	147.4^{def}	425.3^{cdef}	430.3^{cde}	133.5^{cde}	133.8^{cde}	2.04^{cde}	2.04^{c}	1.42^{cde}	1.44^{cde}
	Nitrobeine	428.3^{cde}	432.8^{def}	137.8^{de}	142.5^{ef}	418.5^{defg}	426.4^{de}	129.3^{def}	127.8^{def}	2.02^{de}	2.02^{c}	1.40^{de}	1.42^{def}
	Rhizobacterine	420.5^{def}	426.5^{efg}	137.7^{de}	142.3^{f}	413.6^{efgh}	421.8^{ef}	126.3^{efg}	126.5^{ef}	1.96^{e}	1.98^{cd}	1.38^{ef}	1.41^{ef}
50	Biogen	446.3^{bc}	450.3^{bcd}	154.3^{bc}	159.5^{b}	440.5^{bcd}	444.3^{bcd}	142.8^{bc}	146.5^{b}	2.13^{abc}	2.17^{b}	1.45^{bcd}	1.48^{bc}
	Nitrobeine	436.8^{cd}	440.4^{cdee}	148.8^{bc}	152.5^{bcde}	430.3^{bcde}	429.7^{cde}	138.3^{bcd}	141.3^{bc}	2.04^{cde}	2.06^{c}	1.42^{cde}	1.48^{bc}
	Rhizobacterine	441.5^{bcd}	444.8^{bcd}	145.4^{cd}	149.3^{cdef}	436.8^{bcde}	438.8^{bcde}	134,1^{cde}	136.8^{bcd}	2.09^{bcd}	2.07^{c}	1.40^{de}	1.46^{cd}
75	Biogen	470.3^{a}	472.5^{a}	164.7^{a}	170.1^{a}	464.8^{a}	466.3^{a}	153.3^{a}	157.8^{a}	2.23^{a}	2.27^{a}	1.51^{a}	1.56^{a}
	Nitrobeine	451.8^{abc}	455.3^{abc}	156.8^{ab}	158.3^{bc}	446.7^{abc}	448.5^{abc}	146.5^{ab}	145.5^{b}	2.15^{ab}	2.18^{ab}	1.49^{ab}	1.53^{a}
	Rhizobacterine	460.7^{ab}	463.8^{ab}	150.4^{bc}	154.4^{bcd}	454.3^{ab}	452.3^{ab}	139.3^{bcd}	141.7^{bc}	2.16^{ab}	2.19^{ab}	1.47^{abc}	1.52^{ab}
100	control	443.5^{bcd}	443.2^{bcde}	145.8^{cd}	150.3^{bcdef}	439.5^{bcd}	434.5^{bcde}	134.3^{cde}	136.3^{bcde}	2.06^{bcde}	2.07^{c}	1.41^{de}	1.47^{c}
New L.S.D (0.05%)		23.7	21.6	10.3	10.1	24.2	21.9	10.4	10.3	0.11	0.10	0.06	0.05

Berry diameter:

Data presented in Table (7) illustrate the effect of mineral nitrogen and biofertilizers on berry diameter of Superior and Thompson Seedless grapes during 2006 and 2007 seasons. The highest value of berry diameter was obtained from vines receiving 75% of the recommended nitrogen + Biogen, while, the lowest value was given by vines receiving zero of the recommended nitrogen + Rhizobacterine.

Abou-Sayed *et al.*, (2000) on Thompson seedless grapevines and El-Sayed (2002a) on flam seedless grapevines showed that cluster length, weight and size of barriers were increased as N level was increased.

Coefficient of berry elongation (L/D ratio):

Data of Table (7) show the effect of mineral nitrogen and biofertilizers application on coefficient of berry elongation of Superior and Thompson Seedless grapes during 2006 and 2007 seasons. It is obvious that no significant differences were found between treatments in both seasons.

Akl *et al.*, (1997) worked on red roomy grapevines and demonstrated that , the positive effect of biofertilizers could be due to , they activate the photosynthesis process and both cell division and cell enlargement .

Berry firmness:

The effect of different doses of mineral nitrogen in combination with biofertilizers on berry firmness of Superior and Thompson Seedless grapes during 2006 and 2007 seasons is given in Table (8). The highest value of this estimate was recorded by vines receiving 75% of the recommended nitrogen + Biogen, while, the lowest value was given by vines receiving zero of the recommended nitrogen + Rhizobacterine.

These findings could be attributed to the effect of nitrogen on stimulating vegetative growth which increased carbohydrate formation in addition to its direct effect on stimulating fruit growth. These results are in agreement with those of Eid (1978) on White Banaty Seedless grapevines.

Table (7): Effect of mineral nitrogen and some biofertilizers on average diameter of berry (cm) and coefficient of berry elongation (L/D ratio) among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		Average diameter of berry (cm)				Coefficient of berry elongation (L/D ratio)			
Mineral N (%)	Biofertilizer	Superior 2006 2007		Thompson 2006 2007		Superior 2006 2007		Thompson 2006 2007	
0	Biogen	1.63^{e}	1.69^{f}	0.85^{fg}	0.87^{f}	1.22^{a}	1.18^{a}	1.65^{a}	1.63^{a}
	Nitrobeine	1.54^{f}	1.57^{g}	0.83^{g}	0.85^{g}	1.19^{a}	1.21^{a}	1.65^{a}	1.62^{a}
	Rhizobacterine	1.51^{f}	1.56^{g}	0.80^{h}	0.82^{h}	1.20^{a}	1.20^{a}	1.68^{a}	1.66^{a}
25	Biogen	1.71^{cd}	1.72^{def}	0.90^{e}	0.93^{d}	1.19^{a}	1.19^{a}	1.58^{a}	1.55^{a}
	Nitrobeine	1.69^{def}	1.71^{ef}	0.87^{f}	0.90^{e}	1.20^{a}	1.18^{a}	1.61^{a}	1.58^{a}
	Rhizobacterine	1.64^{e}	1.69^{f}	0.83^{g}	0.86^{fg}	1.20^{a}	1.17^{a}	1.66^{a}	1.64^{a}
50	Biogen	1.77^{bc}	1.80^{bc}	0.94^{bc}	0.97^{b}	1.20^{a}	1.21^{a}	1.54^{a}	1.53^{a}
	Nitrobeine	1.71^{cd}	1.75^{cde}	0.92^{cde}	0.95^{c}	1.19^{a}	1.18^{a}	1.54^{a}	1.56^{a}
	Rhizobacterine	1.73^{cd}	1.77^{cd}	0.90^{e}	0.93^{d}	1.21^{a}	1.17^{a}	1.56^{a}	1.57^{a}
75	Biogen	1.85^{a}	1.88^{a}	0.98^{a}	0.99^{a}	1.21^{a}	1.21^{a}	1.54^{a}	1.58^{a}
	Nitrobeine	1.80^{ab}	1.84^{ab}	0.95^{b}	0.97^{b}	1.19^{a}	1.18^{a}	1.57^{a}	1.58^{a}
	Rhizobacterine	1.82^{ab}	1.85^{ab}	0.93^{bcd}	0.94^{cd}	1.19^{a}	1.18^{a}	1.58^{a}	1.62^{a}
100	control	1.72^{cd}	1.76^{cde}	0.91^{de}	0.93^{d}	1.20^{a}	1.18^{a}	1.55^{a}	1.58^{a}
New L.S.D (0.05%)		0.07	0.06	0.03	0.02	N.S	N.S	N.S	N.S

The improvement occurring in growth and nutritional status of vines was reflected on increasing yield as well as number of clusters / vine and cluster weight. The positive role of N can be ascribed to its beneficial effect in raising the number of reproductive shoots and berry set .% The present results are in agreement with those obtained by (Gobara, 1999).

The effect of biofertilizers was studied by **Akl *et al.*,(1997)** who worked on Nitrobeine. They reported that the positive action of Nitrobeine in improving vine productivity may be attributed to reducing plant requirements of N, improving the availability of various nutrients, beside reducing the pollution induced by the application of chemical fertilizers.

Table (8): Effect of mineral nitrogen and some biofertilizers on average berry firmness (g/cm^2) among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		Average berry firmness (g/cm^2)			
Mineral N (%)	Biofertilizer	Superior		Thompson	
		2006	2007	2006	2007
0	Biogen	204.3^{f}	209.8^{ef}	115.9^{gh}	117.6^{de}
	Nitrobeine	198.7^{f}	202.5^{ef}	114.5^{gh}	115.8^{e}
	Rhizobacterine	180.4^{g}	185.9^{f}	112.8^{h}	114.7^{e}
25	Biogen	264.5^{cde}	272.4^{cd}	121.4^{efg}	125.6^{cd}
	Nitrobeine	261.9^{de}	260.7^{d}	119.8^{fgh}	123.4^{de}
	Rhizobacterine	254.6^{e}	256.3^{d}	117.3^{gh}	120.9^{de}
50	Biogen	276.3^{bcd}	283.4^{bc}	132.4^{bcd}	136.7^{b}
	Nitrobeine	266.1^{cde}	271.9^{cd}	130.5^{cd}	135.1^{b}
	Rhizobacterine	267.8^{cde}	272.5^{cd}	128.7^{de}	134.8^{b}
75	Biogen	296.4^{a}	300.7^{a}	142.3^{a}	145.7^{a}
	Nitrobeine	280.1^{abc}	286.4^{abc}	139.5^{ab}	142.2^{ab}
	Rhizobacterine	292.7^{ab}	296.3^{ab}	138.4^{abc}	139.5^{ab}
100	control	267.3^{cde}	272.4^{cd}	127.9^{def}	133.5^{bc}
New L.S.D (0.05%)		16.8	17.1	8.3	8.9

Effect of nitrogen fertilizers and biofertilizers on chemical characteristics of berries:

Total Soluble Solids (T.S.S):

Data presented in Table (9) clearly showed that mineral N at 75% + Biogen gave the best results followed descendingly by mineral N at 50% + Biogen , control treatment and N at 25% + Biogen while the lowest results were obtained at 0% mineral N + Rhizobacterine (Abd El-Hady 2003) .

Titratable acidity:

As shown in Table (9), nitrogen fertilizer and biofertilizers significantly decreased titratable acidity of Superior and Thompson Seedless grapes during 2006 and 2007 seasons. The lowest percentage of titratable acidity was obtained by vines receiving 75% of the recommended nitrogen + Biogen. However, the highest percentage of titratable acidity was shown by vines receiving zero of the recommended nitrogen + Rhizobacterine.

T.S.S / acid ratio:

Data presented in Table (9), revealed that T.S.S / acid ratio of Superior and Thompson Seedless grapes during 2006 and 2007 seasons was found to be significantly increased as nitrogen doses were increased and when biofertilizers were applied. The highest T.S.S / acid ratio was recorded by vines receiving 75% of the recommended nitrogen + Biogen, while, the lowest was given by vines fertilized with zero of the recommended nitrogen + Rhizobacterine.

The positive action of biofertilizers on the quality of the berries could be ascribed to their effect on increasing carbohydrates and accelerating cluster ripening. These results coincided with those obtained by El-Sayed (2002b) on the organic form of N. Abd El-Hady (2003) found that, the combination between biofertilizers and N application of any Biogen and Rhizobacterine with 40 to 70 g of mineral N / vine significantly increased T.S.S, total sugars and reduced total acidity.

Effect of nitrogen and biofertilizers on chemical characteristics of vegetative growth:

Total chlorophyll:

Data presented in Table (10), revealed that leaf total chlorophyll content of Superior and Thompson Seedless grapevines during 2006 and 2007 seasons was found to be significantly increased as nitrogen doses were increased and where biofertilizers were applied. The highest value of total chlorophyll was recorded by vines receiving 75% of the recommended nitrogen + Biogen, while, the lowest percentage of total chlorophyll was obtained with vines fertilized with zero of the recommended nitrogen + Rhizobacterine.

Table (9): Effect of mineral nitrogen and some biofertilizers on percentages of TSS of berry, total acidity of berry juice and TSS/ acid ratio among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		TSS of berry %				Total acidity %				TSS/acid ratio			
Mineral N (%)	Biofertilizer	Superior		Thompson		Superior		Thompson		Superior		Thompson	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
0	Biogen	15.8^{fg}	16.0^{gh}	14.9^{j}	15.5^{f}	0.83^{b}	0.82^{b}	0.69^{abcd}	0.66^{bc}	19.0^{def}	19.5^{fg}	21.6^{fgh}	23.5^{ghi}
	Nitrobeine	15.5^{i}	15.8^{h}	14.6^{j}	15.3^{g}	0.89^{a}	0.86^{a}	0.70^{abc}	0.68^{ab}	17.4^{fg}	18.4^{gh}	20.9^{gh}	22.5^{hi}
	Rhizobacterine	14.9^{j}	15.3^{i}	14.4^{kl}	15.2^{g}	0.90^{a}	0.88^{a}	0.72^{a}	0.69^{a}	16.6^{g}	17.4^{h}	20.0^{h}	22.0^{i}
25	Biogen	15.9^{ef}	16.5^{def}	15.6^{f}	16.1^{cd}	0.78^{cd}	0.76^{cd}	0.67^{cd}	0.63^{de}	20.4^{cde}	21.7^{de}	23.3^{ef}	25.6^{defg}
	Nitrobeine	15.7^{gh}	16.3^{efg}	15.4^{g}	16.0^{d}	0.80^{bc}	0.78^{c}	0.68^{bcd}	0.64^{cd}	19.6^{de}	20.9^{def}	22.6^{efg}	25.0^{efghi}
	Rhizobacterine	15.6^{hi}	16.2^{fgh}	15.3^{h}	15.8^{e}	0.84^{b}	0.79^{bc}	0.71^{ab}	0.66^{bc}	18.6^{ef}	20.5^{ef}	21.5^{fgh}	23.9^{fghi}
50	Biogen	16.2^{bc}	16.9^{bcd}	16.4^{b}	16.5^{b}	0.70^{fg}	0.67^{fg}	0.63^{ef}	0.58^{gh}	23.1^{b}	25.2^{b}	26.0^{bcd}	28.4^{bcd}
	Nitrobeine	16.1^{cd}	16.6^{def}	16.3^{c}	16.4^{b}	0.77^{cde}	0.73^{de}	0.66^{de}	0.60^{fg}	20.9^{cd}	22.7^{cd}	24.7^{cde}	27.3^{cde}
	Rhizobacterine	16.2^{bc}	16.7^{cde}	16.1^{e}	16.2^{c}	0.74^{def}	0.69^{f}	0.67^{cd}	0.61^{ef}	21.9^{bc}	24.2^{bc}	24.0^{de}	26.6^{cdef}
75	Biogen	16.4^{a}	17.5^{a}	16.5^{a}	16.7^{a}	0.65^{h}	0.64^{g}	0.58^{g}	0.53^{j}	25.2^{a}	27.3^{a}	28.4^{a}	31.5^{a}
	Nitrobeine	16.3^{ab}	17.1^{abc}	16.4^{b}	16.5^{b}	0.73^{efg}	0.70^{ef}	0.60^{fg}	0.54^{ij}	22.3^{bc}	24.4^{bc}	27.3^{ab}	30.6^{ab}
	Rhizobacterine	16.3^{ab}	17.2^{ab}	16.2^{d}	16.4^{b}	0.69^{gh}	0.67^{fg}	0.61^{fg}	0.56^{hi}	23.6^{ab}	25.7^{ab}	26.6^{abc}	29.3^{abc}
100	control	16.0^{de}	16.4^{efg}	16.1^{e}	16.2^{c}	0.81^{bc}	0.78^{c}	0.71^{ab}	0.64^{cd}	19.8^{de}	21.0^{def}	22.7^{efg}	25.3^{efgh}
New L.S.D (0.05%)		0.2	0.5	0.1	0.2	0.05	0.04	0.04	0.03	2.0	2.1	2.4	3.1

Generally, the results proved that using nitrogen at 45 units for Superior and 60 units for Thompson Seedless plus Biogen resulted in an increase in the yield and improved fruit quality as compared with using 60 units for Superior and 80 units for Thompson Seedless without biofertilizers. Hence, it could be concluded that using biofertilizers can reduce about 25% of the recommended nitrogen dose. El-Shammaa and Abd El-Hady (2001) found that leaf total chlorophyll was increased by using biofertlization.

Akl *et al.*, (1997) found that, biofertilizers activate the photosynthesis process.

Nitrogen:

Data in Table (11) showed that raising the level of nitrogen and biofertilizers application significantly affected leaf N content. The highest value of N leaf content was recorded at 75% of the recommended nitrogen + Biogen. On other hand, the lowest values was obtained at zero of the recommended nitrogen + Rhizobacterine.

Table (10): Effect of mineral nitrogen and some biofertilizers on chlorophyll content among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		Chlorophyll content			
Mineral N (%)	Biofertilizer	Superior		Thompson	
		2006	2007	2006	2007
0	Biogen	29.7^{gh}	29.9^{fgh}	29.7^{fg}	30.3^{fg}
	Nitrobeine	29.5^{h}	29.8^{fg}	29.6^{fg}	29.8^{g}
	Rhizobacterine	29.4^{h}	29.6^{h}	29.3^{g}	29.7^{gg}
25	Biogen	30.3^{de}	30.6^{efg}	30.8^{de}	31.4^{def}
	Nitrobeine	30.1^{ef}	30.3^{efgh}	30.3^{ef}	30.9^{efg}
	Rhizobacterine	29.9^{fg}	30.0^{fgh}	29.8^{fg}	30.5^{fg}
50	Biogen	30.8^{bc}	31.5^{bcd}	31.7^{bcd}	32.6^{bcd}
	Nitrobeine	30.5^{cd}	30.7^{def}	31.2^{cde}	31.8^{cde}
	Rhizobacterine	30.5^{cd}	30.9^{cde}	30.9^{cde}	31.5^{def}
75	Biogen	31.2^{a}	32.4^{a}	32.7^{a}	33.9^{a}
	Nitrobeine	30.9^{ab}	31.6^{abc}	32.3^{ab}	33.1^{ab}
	Rhizobacterine	31.0^{ab}	31.9^{ab}	31.8^{abc}	32.8^{abc}
100	control	30.4^{de}	30.6^{efg}	30.9^{cde}	31.3^{ef}
New L.S.D (0.05%)		0.4	0.9	1.0	1.3

These results are in agreement with those obtained by Capps and Wolf (2000); Shaker (2001) and El-Sayed (2002b) who mentioned that, increasing the rate of nitrogen fertilization caused a direct increase in the leaf nitrogen percentage. Differences among N rates will found to be significant.

Regarding the effect of biofertilizers, data in Table (11) showed that all biofertilizer treatments significantly increased leaf N content as compared to the untreated vines. This increase may be due to the action of biofertilizers which are manifested in converting the gaseous atmospheric nitrogen to the available form for plants.

The highest value of leaf N content was recorded by Biogen followed in a descending order by Rhizobacterine and Nitrobeine. The positive effect of biofertilizers in increasing nitrogen content was observed by

Ahmed *et al.*, (2003); El-Shamaa and Abd El-Hady (2001) and Abd El-Hady (2003).

Phosphorus:

The effect of different doses of mineral nitrogen in combination with biofertilizers on leaf P content of Superior and Thompson Seedless grapes during 2006 and 2007 seasons is shown in Table (11). The highest value of this estimate was recorded by vines receiving 75% of the recommended-ded nitrogen + Biogen, while, the lowest value of leaf P content was obtained with vines fertilized with zero of the recommended nitrogen + Rhizobacterine.

Potassium:

Data in Table (11) illustrated that high significant differences could be noticed between vines receiving mineral nitrogen and biofertilizers application. The highest value of leaf K content of Superior and Thompson Seedless grapevines in both seasons was obtained by 75% of the recommended nitrogen + Biogen. On the other hand, the lowest value of leaf K content was obtained at zero nitrogen + Rhizobacterine.

Abd El-Hady (2003) on Flam seedless grapvines revealed that the combined application of the biofertilizer with mineral N caused a significant increase in the percentage of N, P and K in the leaves in comparison to the addition of mineral N only.

The positive effect of biofertilizers on nutritional status of the trees may be due to the activate of the photosynthesis process, they encourage the uptake of various elements and they control the incidence of pests and diseases (Akl *et al.*, 1997) .

Table (11): Effect of mineral nitrogen and some biofertilizers on N%, P% and K% of leaves among Superior and Thompson Seedless in 2006 and 2007 seasons.

Treatments		N%				P%				K%			
Mineral N (%)	Biofertilizer	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007	Superior 2006	Superior 2007	Thompson 2006	Thompson 2007
0	Biogen	1.33^{f}	1.37^{ghi}	1.41^{g}	1.45^{e}	0.17^{fg}	0.18^{ef}	0.17^{de}	0.19^{fg}	1.15^{efg}	1.17^{fgh}	1.18^{fg}	1.20^{fg}
	Nitrobeine	1.32^{fg}	1.35^{hi}	1.38^{h}	1.41^{f}	0.15^{g}	0.17^{f}	0.16^{e}	0.18^{gh}	1.13^{fg}	1.15^{gh}	1.17^{gh}	1.18^{g}
	Rhizobacterine	1.29^{g}	1.33^{i}	1.37^{h}	1.40^{f}	0.12^{h}	0.15^{f}	0.14^{f}	0.16^{h}	1.12^{g}	1.14^{h}	1.15^{h}	1.17^{g}
25	Biogen	1.37^{de}	1.42^{def}	1.47^{e}	1.53^{c}	0.21^{de}	0.23^{cd}	0.19^{bc}	0.23^{de}	1.18^{de}	1.22^{cdef}	1.22^{de}	1.25^{cde}
	Nitrobeine	1.35^{def}	1.40^{efg}	1.44^{f}	1.48^{d}	0.20^{de}	0.21^{de}	0.17^{de}	0.21^{ef}	1.17^{de}	1.20^{defg}	1.21^{de}	1.24^{de}
	Rhizobacterine	1.34^{ef}	1.38^{fgh}	1.42^{g}	1.46^{de}	0.19^{ef}	0.21^{de}	0.16^{e}	0.19^{fg}	1.15^{efg}	1.19^{efgh}	1.20^{ef}	1.22^{ef}
50	Biogen	1.41^{bc}	1.46^{bcd}	1.52^{c}	1.60^{b}	0.24^{bc}	0.25^{bc}	0.20^{b}	0.26^{bc}	1.23^{bc}	1.27^{abc}	1.25^{bc}	1.28^{abc}
	Nitrobeine	1.38^{cd}	1.43^{cde}	1.49^{d}	1.55^{c}	0.21^{de}	0.23^{cd}	0.19^{bc}	0.25^{cd}	1.20^{cd}	1.24^{bcde}	1.23^{cd}	1.26^{bcd}
	Rhizobacterine	1.38^{cd}	1.44^{bcde}	1.48^{de}	1.54^{c}	0.22^{cd}	0.24^{bcd}	0.17^{de}	0.23^{de}	1.21^{cd}	1.25^{bcd}	1.22^{de}	1.24^{de}
75	Biogen	1.47^{a}	1.51^{a}	1.59^{a}	1.64^{a}	0.28^{a}	0.29^{a}	0.22^{a}	0.30^{a}	1.29^{a}	1.31^{a}	1.28^{a}	1.31^{a}
	Nitrobeine	1.42^{b}	1.47^{abc}	1.55^{b}	1.62^{ab}	0.26^{ab}	0.27^{ab}	0.20^{b}	0.28^{ab}	1.27^{ab}	1.28^{ab}	1.27^{ab}	1.29^{ab}
	Rhizobacterine	1.43^{b}	1.48^{ab}	1.53^{c}	1.61^{b}	0.27^{a}	0.27^{ab}	0.19^{bc}	0.27^{bc}	1.28^{a}	1.29^{ab}	1.25^{bc}	1.28^{abc}
100	Control	1.37^{de}	1.43^{cde}	1.47^{e}	1.53^{c}	0.22^{cd}	0.23^{cd}	0.18^{cd}	0.22^{e}	1.20^{cd}	1.24^{bcde}	1.21^{de}	1.23^{def}
New L.S.D (0.05%)		0.04	0.05	0.02	0.03	0.03	0.04	0.02	0.03	0.05	0.06	0.03	0.04

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الملخص العربى

تأثير التسميد الحيوى والتسميد بجرعات مختلفة من نترات الأمونيوم على النمو الخضرى والمحصول والخصائص الطبيعية والكيماوية فى العنب

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الملخص العربى

أجرى هذا البحث خلال موسمى ٢٠٠٦ ، ٢٠٠٧ على كرمات عنب صنفى (السوبيريور والطومسون عديم البذور) عمرها سبعة سنوات بهدف دراسة تأثير إستخدام ثلاثة أنواع من الأسمدة الحيوية وهى البيوجين والنتروبين والريزوباكتيرين مع جرعات مختلفة من السماد المعدنى الأزوتى (نترات الأمونيوم ٣٣%) بمعدلات: صفر ، ٢٥%، ٥٠% ، ٧٥% من الكمية الموصى بها بالاضافة إلى الكنترول (١٠٠% من الكمية الموصى بها من التسميد النيتروجينى) وذلك على المحصول والصفات الطبيعية والكيماوية للحبات بالاضافة إلى المحتوى الكلوروفيلى والمعدنى للأوراق بالاضافة إلى معرفة مدى كفاءة إحلال الأسمدة الحيوية كبديل جزئى للسماد النيتروجينى دون حدوث أى تدهور فى المحصول أو إنخفاض فى جودة الثمار.

وتوضح النتائج أن التسميد الأزوتي المعدني بتركيز ٧٥% بالاضافة الى ٣٠ جم بيوجين أعطت أفضل النتائج من ناحية (قياسات النمو الخضري ، المحصول ، الصفات الطبيعية والكيماوية للحبات وأعلى تركيز للكلوروفيل ومحتوى أعناق الأوراق من الأزوت والفوسفور والبوتاسيوم) .

وبصفة عامة فقد أوضحت النتائج أن استخدام النيتروجين بمعدل ٤٥ وحدة للسوبيريور، ٦٠ وحدة للطومسون مع ٣٠ جم بيوجين قد تفوقت على باقى المعاملات بالنسبة لزيادة المحصول وتحسين صفات الجودة للثمارمقارنة باستخدام ٦٠ وحدة للسوبيريور، ٨٠ وحدة للطومسون بدون استخدام السماد الحيوى وهذا يوضح أن استخدام التسميد الحيوى يمكن أن يوفر حوالى ٢٥% من كمية السماد النيتروجينى الموصى بها.