J. Plant Production, Mansoura Univ., Vol. 2 (10): 1271 - 1297, 2011

EFFECT OF NITROGEN SOURCE ON GROWTH AND FRUITING OF SUPERIOR GRAPEVINES UNDER NUBARIA CONDITION

Shoaieb, M. M.; Sawsan A. Bondok and Y. A. Omran
Viticulture Dept., Hort. Res. Inst., Agric. Res. Center, Giza, Egypt.

ABSTRACT

This study was conducted during 2007, 2008 and 2009 seasons on 7-year old Superior grapevines in a private vineyard in Nubaria region at the 90th kilometer of Alexandria Cairo desert Road.

The vines were grown in a sandy soil under the drip irrigation system, planting distance was 2 x 3 meter between the vines and the rows and supported by the Spanish Parron system. Winter pruning was carried out in the third week of December in all seasons of study, 100 buds per vine were left (10 canes each with 10 buds) according to vine vigor. The aim of this investigation was to study the effect of N source: Granular ammonium nitrate, liquid ammonium nitrate, granular calcium nitrate, ammonium sulphate, calcium Cyanamid and vine prunings on growth and fruiting of Superior grapevines, 70 units per Feddan were used annually from each source. The quantity of different sources was divided into three doses:

1- 15 units of N were added during the period from budburst to the beginning of bloom
2- 35 units of N were added during the period from berry set to veraison
3- 20 units of N were added after harvest.

Vine prunings were added once during winter.

The results showed that bud burst started in March ranging between the second and eighth day, end of shoot growth date ranged September 8th to 25th for granular and liquid ammonium nitrate, granular calcium nitrate and calcium Cyanamid. Liquid forms of N had a longer period of days. Ammonium sulphate fertilizer and vine prunings were found to have short periods of growing period in days.

Also, the soluble forms of N gave highest values of average shoot length. As for wood ripening coefficient forms of N which contain calcium element resulted in the highest values of this parameter in comparison with the other forms of N meanwhile vine prunings were found to have the least values. T.S.S % and acidity % were affected by N forms. All chemical N fertilizers increased these values but vine prunings reduced them. As for nitrate and nitrite juice berry content, it was found that vine prunings had the lowest values in this respect as compared with other treatments. The highest values came from liquid N form.

Berry set %, adherence strength and berry firmness were affected with different N forms. The highest values resulted from fertilizers which contain calcium element. Liquid N was found to reduce number of leaves per shoot, shoot thickness and increased weight of prunings/vine. Also, number of clusters per vine, cluster weight, yield per vine and leaf content of N, P, K were affected by N forms. Calcium cyanamid had higher values in this respect in the first season than vine prunings. Organic manure which had the highest values in the second and third seasons. Similar results were noticed on leaf area (cm^2), total leaf area / per vine (m^2) and leaf area (cm^2) per cluster which were increased by the application of granular and liquid ammonium nitrate. Vine prunings as organic manure were found to have the least price for N unit.

INTRODUCTION

Superior Seedless grape is considered as one of the most important table grape cultivars since its grapes are required for export to the Europeans markets. This grape cultivar requires adequate cultural practices and appropriate climatic and soil conditions.

Fertilization is considered the major factor in this respect taking into account the minimizing accumulation of harmful residual substances such as nitrates and nitrites in the edible berries. To achieve success in table grape export good yield and high quality growers need more knowledge, concerning some cultural practices especially fertilizers.

The Egyptian table grape industry has a great potential to become a competitive exporter of grapes. Egypt possesses the natural recourses to produce early ripening grapes. Nitrogen plays an essential role in protein synthesis, constituent of amino acids (protein building blocks), enzymes, nucleic acids structure and chlorophyll. Also, nitrogen in the form chemical greatly lost through leaching in vineyards under surface and drip irrigation systems. This fact is very important from the point of fruit nutrition and is necessary for finding other forms from nitrogen sources which lead to produce a good fruit and reduce loss N through leaching especially in the sandy soil. Old N forms should be replaced by new forms: such as granular calcium nitrate, calcium Cyanamid and organic forms. Therefore the aim of this investigation is to study the effect of some nitrogen sources such as: Granular and liquid ammonium nitrate (33.5 % N), granular calcium nitrate (15.5 %), ammonium sulphate (20.6 % N), calcium Cyanamid (19.8 % N) and organic form of N (vine prunings 2.1 % N). Varying N sources was beneficial in selecting the best source suitable for use in the sandy soil. Soluble forms of N increased vine vigor, shoots tended to have long internodes and often large leaves. Also, wood ripening was delay and became brittle at the early stages of growth, excessive shading occurred from excessive growth and shoot crowding resulting in immature canes, reducing fruit set, maturity will be delayed. Also, the use of chemical fertilizers over the years resulted in serious problems in the soil, not only the salinity, but also and more important the pollution of the under ground water and the accumulation of chemicals in the plant tissue in addition to the disturbance of the natural biological balance in the soil. For abovement reasons were mentioned before we should employment organic N amendments for perceived or real improvement in soil physical, chemical and biological properties but the main benefit appears to be the increase in nutrient availability (Darwish *et al*, 1995). The use of organic materials as N source has been considered as a best management because organic N is released to the vines may gradually then water soluble inorganic N fertilizers (Nijjar, 1985). Also the organic fertilization improved vegetative growth, nutritional status and reduced the residuals of nitrate and nitrite in grape berries and the continuous fertilization with organic fertilizer is promising the long run for grapevines (El-Morsy, 1997, Ragab and Mohamed 1999, Kassem and Marzouk, 2002 and Ghobrial, 2006).

Finally the present study aimed to examine the effect of N source on growth and fruiting of Superior grapevines for gaining the best yield and good quality.

MATERIALS AND METHODS

This investigation was carried out during three consecutive seasons of 2007, 2008 and 2009 on 7- year old Superior Seedless grapevines in a private vineyard (El- Badry) in Noubaria region at the 90th kilometer of Alexandria Cairo desert Road. The vines were grown in a sandy soil under drip irrigation system. The aim of this investigation to study the effect of nitrogen source on growth and fruiting of Superior grapevines, the chosen vines were healthy, and uniform in vigor. This was experimentally proved through some growth parameters (average trunk diameter at one meter from the soil surface and average weight of prunings (kg/vine)). Planting distance was 2 x 3 meters between the vines and the rows; the supporting system was Spanish parron. Winter pruning was done during the third week of December in all seasons of the study and 100 buds per vine were left of each vine (10 canes each with 10 buds), each this load was determined to vine vigor. All vines received the same recommended cultural practices including (150 kg mono calcium super phosphate 15.5% P_2O_2), 50 kg Potassium Sulphate (48% K_2O), 100 gm ammonium sulphate/ vine and 50 kg Magnesium sulphate per feddan during winter. In addition to the other agricultural practices such as hoeing and pest control.

The experiment included 144 vines and was designed according to the completely randomized block design, six treatments were carried out, and each with three replicates (8 vines / replicate). The vines of each treatment were divided into two equal groups. The first group was assigned to study some growth characteristics and vegetative growth cycle. The second group was kept to determine physical and chemical properties of the yield Omar (2004).

Physical and chemical properties of the soil at 0.0 – 90 cm soil depth were determined according to Evenhuis (1978) and the obtained data are given in table (1):

Table (1): Analytical data of the soil under experimental vines

Particle size distribution	
Sand %	88.2
Silt %	8.3
Clay %	3.5
Texture	Sandy
pH (1:2.5 extract)	7.8
E.C (1:2.5 extract)	1.2
O. M. %	0.81
Ca Co_3 %	2.1
Total N %	0.04
P (ppm, Olsen)	8.0
K (ppm)	140.0

The experiment included six sources of N:

Nitrogen sources	Amount of nitrogen	
	per feddan (kg)	per / vine (gm)
Granular ammonium nitrate (33.5%N)	210.0	300.0
Liquid ammonium nitrate (33.5%N)	210.0 liter	300.0 cm^3
Granular calcium nitrate (15.5%N)	450.0	640.0
Ammonium sulphate (20.6%N)	340.0	485.0
Calcium Cyanamid (19.8%N) *	350.0	500.0
Grape Vine prunings (2.1%N)	3333.0	4800.0

*** Calcium Cyanamid (Ca CN_2): its commercial name is Perlka and contains approx 19.8% nitrogen, approx 50% lime (Ca O) and is completely decomposed in the soil and plant tissue within a short period of time to give urea. Thus residual problems are nonexistent. There are no residues to accumulate either in the soil, water or the harvested crop.**

70 units of N per feddan were used from each source, this amount was divided into:

A- 15 units of N were used through the period from budburst to the begining of bloom.

B- 35 units of N were used through the period from fruit set to Veraison.

C- 20 units of N were used after harvest.

Vine prunings were added once during winter in holes at both sides of the vine rows after their preparing through the prunings of the last winter pruning, crash by using a mechanical machine used for making silage and mixing them with 500 gm ammonium sulphate (20.6% N) per 100 kg crashed canes for increasing the rate of tissue analysis then they were covered with a plastic cover until the date of their use.

Table (2): Analytical data of vine prunings:

Total N% Total	2.1
Total P ppm	80
Total K%	5.8
Moisture content %	26.4
Organic carbon %	24.1
Weight of (m^3) =	885.0 kg
Available Fe ppm	1200.0
Available Mn ppm	80.0
Available Zn ppm	320.0

For achieving the objectives of this study, the following measurements were recorded:

Vegetative growth cycle:

Budburst date: Budburst date was recorded when 5 buds per vine were opened. i.e. when green leaves emerged from the buds of each vine.

End of shoot growth date: End of shoot growth date was recorded when the shoot apex becomes straight, internodes become shorter, also, the leaves become small in size and take the yellow color.

Growing period in days: Calculated from budburst to the end of growth. At the commencement of the growing season, thirty shoots per each treatment during each season of the study were labeled and measured at the cessation of shoot growth to calculate, average shoot growth length (cm), according to Osman *et al* (1997), number of internodes / shoot, internode length (cm) and number of internodes / meter.

Number of leaves per shoot, shoot thickness and weight of pruning wood (kg)/ vine : Number of leaves of the current season were collected, shoot was counted (mature leaves of 5-7th position from the shoot tip at Veraison stage were collected, leaf area (cm^2) was calculated by using leaf area meter, (Model GL 203, U.S.A.), Then area per vine (m^2), and N, P and K% in leaf petioles were determination according to Pregl (1945), Jackson (1958) and Piper (1950) leaf area (cm^2)/ cluster were calculated. also shoot thickness was estimated by measuring the intermediate diameter of the third basal internode for ten shoots/vine by using a vernier caliper. Also weight of one year – old pruning wood (kg)/ vine was recorded at the pruning time of each season.

Wood ripening: Wood ripening measurements were carried out on the same tagged shoots. The part of the shoot that ripened, i.e., changing its color from greenish to brownish as previously mentioned by Stove (1971) was measured during the period from the beginning until the end of this process in days, then coefficient of wood ripening was calculated by dividing length of the ripened part by the total shoot length according to Bouard (1966).

Berry set percentage: Berry set percentage was estimated by caging five flower clusters on each vine with perforated paper bags before bloom and after berry set. Percentage of berry set was calculated by dividing the number of setting berries / clusters by the total number of flowers per cluster multiplied by 100.

Yield and bunch characteristics:

Harvesting date was recorded when T.S.S. in berry juice reached 16% (Weaver 1976). Yield expressed in weight (kg/vine) and number of clusters/vine were recorded. Five clusters/vine were taken at random for carrying out the following determinations: cluster weight (gm), cluster length (cm), number of berries/ cluster and coefficient of cluster compactness calculated according to the following equation:

$$\text{Compactness coefficient} = \frac{\text{Number of berries / cluster}}{\text{Cluster length}}$$

Also Berry adherence strength (gm) and berry firmness (kg / cm^2) were determined using Push – Pull Pynanometer, Model DT 101.

Dynamics of fruit ripening:

Total soluble solids% and total acidity% of berry juice were determined periodically each five days starting from 25 May till 10th June for all seasons of the study by using a hand refractometer , total acidity% was expressed as gm tartaric acid/ 100 ml juice according to A. O. A. C. (1985).

Nitrate (No_3) and nitrite (No_2) content of berries as (gm / kg berries) fresh weights were determined according to the method of Sen and Donaldson (1978).

Leaf petioles N, P and K content

Leaf content of total nitrogen (%) (Pregl, 1945), phosphorus (%) (Snell and Snell 1967) and potassium (%) (Jackson, 1967).

After the end of the experiment an economical study of the nitrogen sources and average cost (L.E) / ton of fruits was carried out according to nitrogen source and yield / feddan (the data are shown in table 14).

Statistical analysis:

The obtained data were tabulated and statistically analyzed according to Snedecor and Cochran (1972) using the new L.S.D. test for comparing the differences between treatments.

RESULTS AND DISCUSSION

Data in table (1) clearly show that soil of the experiment contains 0.81% organic matter and this percentage is considered very little accordingly this soil was poor in humus. Therefore, the addition of plant residues will be advantageous in improving this soil.

Effect of nitrogen source on:

Vegetative growth cycle

Budburst date:

From table (3) it is clear that budburst occurred nearly during the first week of March in the three seasons of the study, ranging between 2 and 8 March during the investigation, these differences could not be due to the effect of fertilizers since the addition of nitrogen occurred after budburst. It is supposed that these differences in budburst during seasons of the investigation may be ascribed to the effect of both winter chilling degrees and weather temperature before and during bud burst.

Date of shoot growth cessation:

Concerning the effect of nitrogen source on the date of shoot growth contain data in Table (3) show that this date for Superior grapevines was affected by the application of nitrogen sources, the obtained results revealed that this occurred earlier for forms of nitrogen which come from ammonium sulphate (20.6% N) and vine prunings (2.1% N), shoot growth date was August 20 for the two nitrogen forms in the first season (2007). Also, the date of growth ranged between August 20 to 30 in the three seasons of the study for ammonium sulphate: this was conspicuous also for nitrogen coming from vine prunings during 2007 season, this result may be due to the slow dissolution of ammonium sulphate and vine prunings and the slow movement in the soil to come in contact with the roots. Regarding the effect of the other forms of nitrogen such as granular and liquid ammonium nitrate, granular calcium nitrate, calcium Cyanamid on the date of shoot growth cessation, it is obvious that they resulted in prolonging the date of shoot growth cessation (September 15 to 21, 18 to 25, 8 to 20 and 16 to 24 respectively. As for nitrogen from vine prunings the date in the third season was September 26 and their results may be ascribed on the organic nitrogen accumulation from vine prunings and their slow degradation.

Growing periods in days:

Data in table (3) show that the growing period of shoots in days as an average of the three seasons were 198.0 202.7, 193.3, 173.7, 200.3 and 191.1 respectively according to the nitrogen source, it is interesting for notice that fertilizers having soluble nitrogen, ammonium nitrate and calcium and Cynamid are completely decomposed in the soil and plant tissue, within a short periods of time to give urea), and therefore these two forms of nitrogen source arrive at the roots earlier than the other forms and increased chlorophyll which sustained higher rates of photosynthesis thus period of growth was prolonged (Basiouny and Biggs, 1976).

Table (3): Effect of nitrogen source on vegetative growth cycle of Superior grapevines during 2007, 2008 and 2009 seasons.

Treatments	Season	Bud burst date	End of growth date	Growing period in days	average shoot growth/length (cm)
Granular ammonium nitrate (33.5%N)	2007	March 2	September, 15	197.0	180.6
	2008	March 4	September, 20	200.0	186.4
	2009	March 7	September, 21	197.0	188.4
	Average			198.0	185.1
Liquid ammonium nitrate (33.5%N)	2007	March 3	September, 18	199.0	220.4
	2008	March 2	September, 24	206.0	222.4
	2009	March 6	September, 25	203.0	225.6
	Average			202.7	222.8
Granular Calcium nitrate (15.5%N)	2007	March 3	September, 14	194.0	174.2
	2008	March 2	August, 28	190.0	175.8
	2009	March 5	September, 20	196.0	180.4
	Average			193.3	176.8
Ammonium sulphate (20.6%N)	2007	March 4	August, 20	169.0	172.6
	2008	March 3	August, 26	176.0	173.6
	2009	March 7	August, 30	176.0	178.6
	Average			173.7	174.9
Calcium Cyanamid (19.8%N)	2007	March 3	September, 16	197.0	178.1
	2008	March 4	September, 22	202.0	180.0
	2009	March 6	September, 24	202.0	180.2
	Average			200.3	179.4
Vine prunings (2.1%N)	2007	March 4	August, 20	169.0	178.0
	2008	March 6	September, 18	200.0	190.0
	2009	March 8	September, 26	204.0	197.8
	Average				
	Average			191.1	188.6

New L.S.D 5% 2007 28.20
2008 32.10
2009 38.10

Average shoot length (cm):

Table (3) showed that average shoot length (cm) was significant affected by nitrogen forms, using N from liquid ammonium nitrate, vine prunings and granular ammonium nitrate gave the maximum values of average shoot length (cm) as compared with calcium Cyanamid, granular calcium nitrate and ammonium sulphate. Liquid ammonium nitrate had significant values in this respect during all seasons of study. The differences in shoot length due to the nitrogen forms and especially mineral nitrogen fertilizer was more apparent than the organic nitrogen form in the first and second seasons of study, but in the third season nitrogen form coming from vine prunings resulted in high values. The organic form of nitrogen needs more time to show its effect (Ghobrial, S. F.2006), it also contains Z element which is consider a precursor of amino acids.

The findings are in agreement with Wang *et al* (1991) who found that using organic and chemical fertilizers increased shoot length of grapevines. Elmorsy (1997) noticed that adding organic nitrogen fertilizer promoted growth of Banaty grapevines and Killer *et al* (1998) who found that high N availability stimulated shoot growth. H.A.El-Sayed (2002), Kassem and Marzouk (2002) on Flame Seedless and Elgalil *et al*, (2003) on King Ruby grapevines found the same results.

The positive effect of vine prunings as an organic manure on the vegetative characteristics could be attributed to its effect on supplying the vines with their requirements of various nutrients (Z, Fe and Mn) through a relatively long times, in addition to positive effect on lowering soil $_{P}H$ which could aid in facilitating the availability of some nutrients in the soil and improving the physical characters of the soil in favor of root development, Gamal and Ragab (2003). However Abou El-khashab (2002) reported that the enhancement of vine growth due to the inoculation with N- fixing bacteria could be attributed to the capability of these organisms to produce growth regulators such as auxines, cytokinines and gibberellins which promote the production of root biomass and nutrients up take.

On number of internodes/shoot, internode length (cm) and number of internodes/ meter

Data presented in table (4) revealed those varying N sources were resulted in substantial changes in internode number per shoot, internode length (cm) and internodes number / m. The maximum values concerning internodes number per shoot was detected on the vines fertilized with granular calcium nitrate and calcium Cyanamid during seasons of the study.

This result may be due to that these two forms of N had the least values of internode length as compared with the other treatments resulting in increasing internodes number / shoot. Calcium element is known to reduce growth and therefore when we want to reduce growth rate for increasing early shoot ripening we should increase fertilizing with calcium element. On the other hand lower values in internode length resulted on vines treated with granular calcium nitrate and calcium cyanamid. This was true in all seasons of study. As for the effect of granular and liquid ammonium nitrate on internode number per shoot data showed that these two forms of N had medium values in this respect. It is worthy to not that these two forms (nitrogen have a higher degree of solubility in water) leading to an increase of shoot length table (3) which increased also internode length, also these forms increased leaf area and vine vigor which increased shading and reduced photosynthesis and therefore internode length was increased. Concerning the effect of ammonium sulphate and vine prunings on internode number/shoot data revealed that these two forms of N had the least values in this respect. Table (3) showed that ammonium sulphate had small values of average shoot length. This can be explained by the slow release in water and the long of time it takes to reach the root. Ammonium sulphate was shown to have medium values of internode length.

The enhancement in internode length was noticed on vine, treated with vine prunings (organic manure) during this study. this may be due to that vine prunings supplies the vines with their requirements of various nutrients through a relatively long time, besides its effect on lowering soil pH which could aid in increasing the availability of nutrients in the soil and improving physical characters of the soil in favor of root development, Gamal and Ragab (2003). However Abou El-khashab (2002) reported that, the enhancement of plant growth due to the inoculation with N-fixing bacteria could be attributed to the capability of these organisms to produce growth regulators such as auxins, cytokinines and gibberellins which affect positively the production of root biomass and nutrient uptake. Length of internode can be taken as an indicator of high and low nitrogen fertilizer amounts.

The findings are in accordance with those obtained by Abed El-Naby and Gomaa (2000), Maksoud (2000), El-Sayed, A.H. (2002) and Megawer, Abd El-Naby *et al* (2005), Ghobrial, S.F (2006), Hegazi *et al* (2007), Abdelwadoud, Z.M. A.M. (2009).

On number of leaves/shoot, shoot thickness (cm) and weight of prunings (kg/vine):

It can be seen from the data in table (5) that application of calcium cyanamid and granular calcium nitrate for Superior grapevines was remarkably effective in increasing number of leaves/shoot than the use of either liquid and granular ammonium nitrate, ammonium sulphate or vine prunings. The highest significant results were obtained on vines supplied with calcium cyanamid and granular calcium nitrate. This may be due to the fact that these forms of nitrogen remain in the soil for a long time and nitrogen losses by leaching are minimized, also these two forms of N were found to reduce length of the internodes which caused an increase in number of internodes / shoot. Soluble and granular N fertilizers had medium values in this respect. This may be attributed to losses of N by leaching. Ammonium sulphate and vine prunings recorded the least number of leaves / shoot. Since, these forms of N need a long period to become available. Ghorbial, S.F (2006), and Rizk *et al* (2006).

Concerning the effect of N sources on shoot thickness (cm) data in table (5) indicated that calcium cyanamid and granular calcium nitrate had the highest values of shoot thickness. This result may be due to their effect on shoot growth rate. On the contrary, liquid and granular ammonium nitrate were found to increase shoot growth rate which the result of carbohydrates produced by leaves were consumed in favor of shoot growth and therefore these two forms of nitrogen had intermediate values in this respect. The lowest values of this parameter on vines fertilized with vine prunings and ammonium sulphate, because these forms need more time to show their effect.

4-5

Weight of prunings (kg) / vine:

Data shown in table (5) revealed that fertilizing the vines with the three forms of N: liquid and granular ammonium nitrate and calcium cyanamid resulted in the maximum values of weight of prunings (kg)/vine, they were followed by granular calcium nitrate, ammonium sulphate and vine prunings.

The positive effect of vine prunings might be attributed to their effect on supplying the vines with their requirements from various elements and improving physical and chemical properties of the soil (Nijjar, 1985). The highest significant values given by liquid and granular nitrate and vine prunings especially in the third season, as regards weight of prunings (kg)/vine can be reorganized as a total effect of shoot length, number of leaves / shoot, shoot thickness and vine leaf area. The results are in agreement with those obtained by El-sayed, H.A (2002) on Flame Seedless, Ahmed *et al* (2003) on Flame Seedless grapevines, and Megawer, M.M (2009) on Superior grapevines.

On leaf area (cm^2), total leaf area (m^2) / vine and leaf area (cm^2) / cluster.

As shown in table (6) leaf area and total leaf area / vine were positively affected by application of N in the forms: liquid as granular ammonium nitrate as compared with the other forms of N. This result may be due to the solubility of liquid and granular ammonium nitrate as they become completely decomposed in soils and arrive to the plant tissue within short periods of time to give urea. Moderate values of leaf area and leaf area / vine resulted from fertilizing Superior grapevines with calcium cyanamid and granular calcium nitrate. The other treatments such as ammonium sulphate and vine prunings recorded lower insignificant values. It can be also the minimum values recorded by ammonium sulphate may be ascribed to that N source from ammonium sulphate is not adequate and slowly degredate in the soil. These results were true for all seasons of the study.

It is worthy to observe a positive effect of vine prunings on total leaf area m^2 / vine in the third season (20.6 m^2/vine), this could be attributed to their effect on supplying the vines with their requirements of various nutrients (Zn, Fe and Mg) through relatively long times, in addition to their effect on lowering soil pH which increase the availability of some nutrients in the soil and improve physical characters of the soil in favor of root development (Gamal and Ragab 2003).

As for leaf area per cluster, data revealed significant differences between treatments. The maximum values of leaf area per cluster were recorded on vines receiving liquid and granular ammonium nitrate, followed in a descending order by granular calcium nitrate and ammonium sulphate; calcium cyanamid and vine prunings had lower values of (leaf area cm^2/cluster) in the first season then increased in the third season due to the organic matter needs more time to show its effect. The differences between treatments concerning leaf area/cluster due to different number of cluster / vine table (7), and the degree of element solubility in water could explain their effect on this parameter. It is obvious that increasing leaf area cm^2 produced high cluster weight (gm). These results are in agreement with those of Winkler (1969) who found that decreasing critical leaf area / cluster less than 3244 and 2280 cm^2 / cluster for Malage and Muscat of Alex. Grapes reduced berry growth. Also Weaver (1971) mentioned that reducing leaf area / pound of berries less than 4540.0 cm^2 caused a reduction in cluster maturation Abdelwadodoud, Z.M (2003), Ghobrial, S.F. (2006) on Flame Seedless grapevines and Megawer, A.M. (2009) on Superior grapevines found similar result.

On wood ripening.

It is clear from the data obtained in Table (7) that the beginning of wood ripening occurred during June, July and August according to the source of nitrogen in the three seasons of study. The most effective source which caused advancing of wood ripening were granular calcium nitrate and calcium cyanamid and the average period in days for wood ripening was (59 and 63.3 days) for the same treatments. The advancement in the beginning and the short period in days of wood ripening may be due to calcium element with increased cell wall in addition to that these two forms of N remain in the soil for a long time, N losses by leaching are minimized. Also both forms of N have shorter shoot length table (3) and therefore the shoot growth reduced and the organic foods which are consumed in growth are reserved in the shoots as a result of which the ripening of the shoots occurred earlier.

Also using ammonium sulphate fertilizer enhanced wood repining although the beginning of wood repining was somewhat late, because of the slow dissolution of this fertilizer takes a long time to reach the roots and therefore it had a shorter shoot length table (3) and took 60.3 days for wood repining period Rizk *et al* (2006) on Thompson Seedless grapevines. On the other hand granular and liquid ammonium nitrate fertilizers were shown to delay the beginning of wood repining and prolonged wood repining period in days (70.3 and 63.7 days) in comparison with other treatments. Table (3) showed that these two forms of N source had longer shoots and higher values of leaf area table (6). These increments of growth could have resulted in depletion in most mineral and organic foods thus delaying wood repining. This was true for all seasons of study.

As for vine prunings (organic source), data from table (7) revealed that wood ripening started on August 4, 6 and 2. Also average wood ripening period in days was 70.0 days. From these values it noticed that the addition of vine prunings as an organic fertilizer delayed the beginning of wood ripening and prolonged wood ripening period in days as compared with other forms of nitrogen (mineral source). The possible interpretation for these results may be the slow decomposition organic material and therefore it needs more time to show its effect are long time to change the organic matter to mineral form of nitrogen may have caused delaying in the beginning of wood ripening and prolonged the period of ripening.

Concerning wood ripening coefficient, data presented in table (7) showed significant differences were found between various N sources.

The maximum values of average wood ripening coefficient were recorded on vines receiving granular calcium nitrate, calcium cyanamid followed by ammonium sulphate, granular and liquid ammonium nitrate and vine prunings which gave the lowest values during seasons of the study. The increase of wood ripening coefficient observed in case of using calcium cyanamid and granular calcium nitrate as N source may be attributed to the moderate shoot growth which resulted in a great accumulation of organic and mineral foods.

On other hand using N source from liquid and granular nitrate fertilizers were shown to increase shoot growth length, therefore for most of organic and mineral foods were depleted in the rapid growth as a result of which wood ripening coefficient was reduced.

Regarding the effect of ammonium sulphate and vine prunings on average wood ripening coefficient, it is obvious that these two forms of N source had small values in the three seasons of study. Minimum values of ripening could be explained to the difficult movement of ammonium sulphate in the soil to reach the roots and N from vine prunings as an organic fertilizer needs more time to show its effect. These results are in harmony with those obtained by Nijjar. G. S. (1985), Elmogy *et al* (2004), Elshennawy and Fayed (2005a) who reported that vegetative growth was significantly increased with chemical fertilizers and that the organic fertilizer (Compost) was effective in the third year of application. Ghobrial, S. F. (2006) on Flame Seedless grapevines found the same results.

Physical properties of yield:

On number of clusters / vine, cluster weight (gm) and yield / vine (kg).

Data shown in table (8) revealed no significant differences between treatments concerning number of clusters / vine. It is well-known that number of clusters has previously been determined in the preceding season (Abdelwadoud, Z.M 2003). This result was true for all seasons of study.

It can also be observed that no significant differences could be detected between granular, liquid ammonium nitrate and granular calcium nitrate regarding number of clusters / vine and cluster weight.

As for cluster weight, it is apparent that granular and liquid ammonium nitrate had high values but without any significant differences between them, substantial increase in cluster resulted from vine prunins in the second and third seasons of the study. The positive increase in number of clusters per vine were shown by vine prunins fertilizer (organic manure) in the second and third seasons could be due to the inoculation with N – fixing bacteria which has the capability to produce growth regulators such as auxins, cytokinines and gibberellins which affect the production of root biomass and nutrients up take. Also cytokinines were found to increase bud fertility (Abou El-khashab 2002). Organic matter also needs more time to show its effect.

Data in table (8) show that calcium cyanamid had high significant values in this respect (26.0 and 27.0 cluster / vine in the first and third seasons of study, this increment may be ascribed to that calcium cyanamid activates beneficial soil organisms increases the fertility of the soil and can be used as a highly efficient compost accelerator, also Ca element increase cell division.Concerning the effect of nitrogen source on yield per vines of Superior grapevines, data revealed significant increase in yield per vine in case of using calcium cyanamid and vine prunings. This increase is due to the increase in number of clusters per vine and cluster weight.

6-7-8

Granular and liquid ammonium nitrates were found to increase vine vigor and decrease in number of clusters / vine and cluster weight. This may be due to the competition between growth and fruit set Cook (1956) found that high rates of N reduced the yield. Also, data showed the importance of using organic matter in fertilizing. These results are in agreement with those reported by Abou El-khashab, A.M (2002), disagreement El-sayed, A.H. (2002) Gamal, A.M. and M.A. Ragab (2003), and Ghobrial, S. F. (2006) on Flame Seedless grapevines.

On cluster length (cm), number of berries/cluster and coefficient of cluster compactness:

Data presented in table (9) revealed that the treatments which resulted in the highest cluster length (cm) of Superior grapevines in the three seasons of study were liquid ammonium nitrate, calcium cyanamid and granular ammonium nitrate as compared with granular calcium nitrate, ammonium sulphate and vine prunings. Also liquid ammonium nitrate and calcium cyanamid were shown to have significant values in this respect, which can be ascribed to the rapid decomposition and absorption of these forms of nitrogen within a very short lime. On the other hand, in the form of vine prunings resulted in the least values in the first season, while in the second and the third seasons, they showed a substantial increase because this form of nitrogen fertilizer (vine prunings) needs a long time to show its effect in addition to its cumulative effect.

Concerning the effect of nitrogen source on number of berries/cluster data of table (9) indicated that fertilizing Superior grapevines with calcium cyanamid and granular calcium nitrate gave the maximum number of berries per cluster. Whereas, vine prunings occupied the second rank, this may be due you to the long time they need to show their effect, granular ammonium nitrate and ammonium sulphate had the least values in this respect (Cook 1956 mentioned that high N rates decreased fruit set).

The best results with regard to number of berries per cluster were obtained from vines fertilized with calcium cyanamid in the three seasons of study. Nitrogen source from vine prunings gave the lowest value of this parameter in the first season. However, an increase was observed in the third season. Using fertilizers which contain calcium element was found to increase berry set (data of table 10) because calcium element increased thickness cell wall and prevented formation of the abscission layer. Also using calcium cyanamid rapidly metabolizes making use of its nitrogen content for the synthesis of amino acids. The continuous addition of organic matter in the form vine prunings increased the synthesis of amino acids, increased rates of photosynthesis and sustained berries and prevented their fails (Basiouny and Biggs, 1976), and Ghobrial, (2006) found that fertilizing Flame Seedless grapevines with organic matter increased cluster weight.

Concerning the effect of nitrogen sources on coefficient of cluster compactness data in table (9) showed that the treatments which decreased number of berries per cluster and increased cluster length such as liquid and granular ammonium nitrate had the least value of cluster compactness in comparison with the other treatments.

9-10

This was valid for all seasons of study. It is known that soluble and granular nitrogen form increase vine vigor and encouraged the competition between vegetative growth and fruit set. Generally, increasing the dose of N for grape varieties produced loose clusters because N element makes natural thinning of the clusters.

These results are in coincidence with those obtained by Abdelwadoud, (2003), who found that 100 units of nitrogen / Feddan produced less compacted clusters than 80, 60, and 40 units and this was mainly due to the reduction in number of berries / cluster. Girgis *et al* (1998), mentioned that cluster dimensions appeared to have insignificant response to N rates.

Fertilizing Superior grapevines with granular calcium nitrate, ammonium sulphate, calcium cyanamid and vine prunings resulted in the highest values of cluster compactness without significant differences between them.

On the other hand, addition of calcium cyanamid and vine prunings for Superior grapevines gave the highest significant values of cluster compactness, also ammonium showed significant values in the third season in comparison with the other treatments such as liquid ammonium nitrate which had the minimum values. The results in this concern are similar to El-sayed, (2002) who found that fertilizing Flame Seedless grapevines with 80 units of ammonium sulphate ensured a balance between growth and fruiting. Also ammonium sulphate amends the vine with nitrogen for longer periods during its development and reduces losses of N through leaching and other ways.

On berry set% adherence strength (g) and firmness (kg/cm^2):

It can be shown from the data in table (10) that application of different nitrogen forms to Superior grapevines resulted in different effects on berry set%. Calcium cyanamid and granular calcium nitrate were remarkably effective in increasing fruit set% in comparison with the other treatments. Granular and liquid ammonium nitrate were have found to lowest values in this respect for all seasons of study. Ammonium sulphate gave the smallest values. As for use effect of N from vine prunings, data showed that the values of this estimate were in between in this respect. It can be observed that the forms of nitrogen which contain calcium element had the highest significant values of fruit set % this may be due to the increase in cell wall thickness and prevent absasion layer to completion.

Also using soluble forms of nitrogen in fertilizing increase vine growth and increase the competition between growth and fruit set, the result of which fruit set is decreased.

The improving effect of calcium cyanamid and granular calcium nitrate is supported by the results of Rizk *et al* (2006) who found that treated Thompson Seedless grapevines with Mg-EDTA at 0.3% followed by Ca-EDTA at 0.3% in the two seasons of study enhanced number of berries / cluster. Also Ahmed (2000) found the same results on Flame Seedless grapevines.

In addition Ahmed *et al* (2003) found that fertilizing Flame Seedless grapevines with ammonium sulphate at 486 g/vine resulted in the least value

(9.2%) of berry set % and that the highest value was obtained from fertilizing the vine with organic (75%N) and mineral nitrogen (25% N) sources.

Regarding adherence strength (g) and firmness (kg/cm^2) the data in table (10) revealed that all vines treated with calcium cyanamid and granular calcium nitrate had the highest values. Liquid and granular ammonium nitrate treatments came next in this respect, while, vine prunings and ammonium sulphate treatments ranked third giving the lowest values.

It can also be observed that the use of vine prunings as a nitrogen organic source in fertilizing Superior grapevines increased the adherence strength and firmness of berries only in the third season, indicating that organic fertilization needs more time to show its effect. Also these positive results due to organic fertilization activate the biosynthesis of plant growth promoters which increased adherence strength and berry firmness.

As shown in table (10) no significant differences were detected between liquid and granular ammonium nitrate on berry firmness.

No significant differences could be detected between ammonium sulphate and vine prunings in the first and second seasons, but in the third season significant differences were noticed between these fertilizers in favor of vine prunings and ammonium sulphate. This was true because organic N form (vine prunings) needs a long period to show its effect. It can also be observed that fertilizing Superior grapevines with calcium cyanamid and granular calcium nitrate resulted in the highest significant value of berry firmness in comparison with the other treatments. This may be due to the role of calcium element in increasing cell wall thickness and building calcium pectate between the cells which increased the berry firmness which is suitable for grapes prepared for export. The importance of calcium in increasing the fruit firmness and adherence was mentioned by Chang and Kliewer (1991), Ahmed (2000), on grapes. Liquid and granular ammonium nitrate resulted in berries more soft berries which had the least values of firmness and adherence. Elshenawy and Fayed (2005 b) reported that berry firmness was increased due to the application of organic manures and bio-fertilizers to Crimson Seedless grapevines.

Chemical properties of berries:

Dynamics of berry ripening:

Total soluble solids % and total acidity % were determined periodically each five days starting from May 25 till June 10 and harvesting date was recorded when T.S.S % reached 16.0 % for each treatment during the three seasons of study (Weaver, 1976).

Data in table (11) clearly show that total soluble solids % increased gradually from May 25 till June 10 and that source of granular calcium nitrate and calcium cyanamid were found to have higher values as compared with the other treatments.

Ammonium sulphate, granular ammonium nitrate and liquid ammonium nitrate came second in this respect, but without significant differences between them; liquid ammonium nitrate had the least value of TSS which could be due to that liquid ammonium nitrate increased vine vigor (average shoot growth and leaf area table 3 and 6) as a result of which berry ripening was retarded. On the other hand, nitrogen source from vine prunings gave the least values in the first season but this value was enhanced in the second an third seasons owing to the slow degradation of tissues of vine prunings. However, the continuous application of organic fertilizers enhanced of photosynthesis activity and hence increased T.S.S. %.

As for acidity %, data in table (11) show that decreased in acidity % from May 25 to June 10 due to the consumption organic acids in respiration. Significant differences were noticed between nitrogen forms. Data also revealed that all forms of nitrogen which contain calcium element and nitrogen organic form vine prunings gave the least values of acidity in seasons of this study, this may be due to that organic fertilization increased the exchangeable calcium, potassium and magnesium (Elnaggar *et al*., 2004) and decreased acidity by forming potassium tartrate which is relatively insoluble (Phillip and Kuykendall, 1973), also vine prunings contain Zn element which play a vital role in many important systems, exerts an effect on carbohydrate metabolism through its role in photosynthesis and sugar transformation. Raven *et al* 1999 reported that organic fertilizers increased Co_2 in the farm which enhanced photosynthesis. The results are in harmony with El-Morsy (1997), El- Shenawy and Fayed (2005 d) and Elshenawy and Fayed (2005 b). Also Zakaria, (2003) found that treated Thompson Seedless grapevines with a higher dose of nitrogen decreased T.S.S % and increased acidity %. Also, Ghobrial (2006) noticed that fertilizing Flame Seedless grapevines with organic material increased T.S.S % and decreased acidity %.

On nitrate and nitrite content of berry (mg/kg fresh weight):

It is evident from the data in table (12) that application of different forms of nitrogen to Superior grapevines resulted in positive and negative effects on nitrate and nitrite content of berries. The maximum nitrate and nitrite values were given by vines fertilized with mineral nitrogen forms and liquid ammonium nitrate was found to have the highest significant values in this respect followed in a descending order by calcium cyanamid, granular calcium nitrate, ammonium sulphate, this result may be due to the high solubility of nitrogen form in water. On the other hand fertilizing Superior grapevines with organic matters in the form of vine prunings produced berries with significant lower nitrate and nitrite values. Also, application organic fertilizers indicated the importance of this form in reducing berry nitrate and nitrite content. The addition of organic fertilizers is promising in the production of healthy table grapes suitable for export (Ghobrial, 2006).

These findings are in accordance with Ghobrial, (2006) who found that treated Flame Seedless grapevines with mineral fertilization resulted in the highest values of nitrate and nitrite berry content. On the other hand, he found that organic fertilizer had the lowest values in this respect. Similar results were found by Eman *et al* (2008) on Thompson Seedless and Megawer, (2009) on Superior grapevines.

Abdelwadoud, (2003) found that increasing doses of nitrogen fertilization from 40 to 100 units/Fadden) had a bad effect on berry quality of Thompson Seedless where a remarkable increase in nitrate and nitrite content was noticed.

11-12

Mineral nitrogen fertilization easily forms nitrate, whereas organic fertilizers slowly form nitrate (Ibraheem, 1994). The upper limit of nitrate and nitrite which the man can consume in a day is 5 mg per kg and 0.07 mg per kg respectively of his weight (Abdelhameed, 1999). It's clear that, the use of organic fertilizer produced Superior berries with low or very low values of nitrate and nitrite. This is an indication that the addition of organic fertilizers seems to the promising in the production healthy table grapes suitable for export.

On leaf petioles N, P and K content:

Data in table (13) clearly reveal that varying N source applied caused great differences in the percentages of N in the leave petiole. Using forms of N from liquid and granular ammonium nitrate significantly maximized N% comparison with other forms of N especially in the first season. This may be due to these two forms of N have high solubility in water than other forms of N sources.

N from organic form (vine prunings) ranged the third value in the first season then occupied the first significant values lastly. This may be due to organic matter need more time to become laxity and it's improve soil physical. On the other hand calcium cyanamid and ammonium sulphate have moderate values and least values come from granular calcium nitrate in this respect because its have a slow release in the soil which need along time to show its effect. These results are agree with obtained by El-Sayed, H.A (2002), Elshenawy and Fayed (2005 a) and Ghobrial, (2006).

As for phosphorus and potassium leaf petiole content data in table (13) indicated that mineral N sources significantly increased P and K specially in primary season then organic N source (vine prunings) recorded higher significant values in the second and third seasons of study its due to organic N needs more time to show its effective and its contain P and K table (2).

Economical justification of the different treatments:-

Table (14): Revealed that treated Superior Seedless grapevines with different nitrogen forms: Chemical and organic forms such as vine prunings resulted in substantial differences in average cost (L.E) of ton fruits according to N source. The highest total grape cost resulted from the application of granular calcium nitrate fertilizer (116.6 L.E) / ton fruit followed in a descending order by N from vine prunings (70.0 L.E) / ton fruit, then ammonium sulphate and granular ammonium nitrate which recorded (67.9 and 53.6 L.E) / ton grape fruit respectively. On the other hand the lowest values (46.7 and 53.6 L.E) / ton fruit came from granular and liquid ammonium nitrate. This may be due to the role played by calcium cyanamid in the activation of beneficial soil organisms which increase the fertility of the soils and can be used as a highly efficient compost accelerator.

Vine prunings (organic manure) supplies the vines with their requirements of various nutrients for relatively long times, as well as, their effects on lowering soil $_{P}H$ which could aid in increasing the availability of some nutrients in the soil and improving the physical characters of soil in favor of root development. (Gamal and Ragab 2003).

13-14

Also, these two forms of N were found to increase total average yield per feddan (ton) (9.0 and 8.4 ton / feddan). Moreover N from vine prunings produced healthy grapes and had the least prices of unit fertilizer (50 kg = 6.2 L. E.).

From the results in this investigation, it can be concluded that the best results with regard to high yield, fruit quality, minimized berry juice content of nitrate and nitrite, improvement in berry firmness, good berry adherence and producing of a crop suitable for local and foreign markets and at the same time reducing the soil and water pollution were obtained from fertilizing with N forms of calcium nitrate, calcium Cyanamid and vine prunings (organic manure). The N forms (ammonium nitrate and ammonium sulphate) should be resulted by other forms such as calcium Cyanamid, calcium nitrate and organic matter.

The multiple N forms offer the farmers a wide range to select the best source from N which is suitable for his orchard and with the lowest possible cost.

REFERENCES

Abd El – Naby, S. K. M. and M. R. El-Sonbaty (2005): Effect of partial replacement of chemical fertilizers by organic manures on banana production and fruit quality. Assuit J. Agric. Sci., 36: 107 – 122.

Abd El-Naby, S. K. M. and A. M. Gomaa (2000): Growth nutritional status, yield and fruit quality of Maghrabi banana as affected by some organic manures and biofertilizers. Minufiya J. Agric. Res., 25(4): 1113 – 1129.

Abd El-Ghany, A.A. and Merwad, I.A. (2001): Effect of trellis system shape on Thompson Seedless grapevine productivity. J. Agric. Sci. Mansoura Univ., 26(3): 1649 – 1654.

Abdelhameed, Z. H. (1999): Food Toxicity and chemical pollution. Eldar Elarabia for Publishing and Distribution. Cairo, Egypt. (In Arabic).

Ahmed, A. M.; H. A. El – Sayed and M. M. Shoeib (2003): Effect of bio and organic source of N as a partial substitute for chemical fertilizer on bud behaviour, growth and fruiting of Flame Seedless grapevines. Viticulture Dep. Hort. Res. Inst., Agric. Res. Center, Giza, Egypt.

Omar, A. H. (2000): Effect of mineral or chelated calcium and magnesium on growth and fruiting of Flame Seedless grapevines in the sandy soil. M.Sc. Thesis, Cairo Univ.

Abou El-khashab, A.M., (2002): Growth and chemical constituents of some olive cultivars as affected by biofertilizers and different water regimes. Egypt. J. Agric. Res., NRC. 1: 243 – 265.

A. O. A. C. (1985): Association of Official Agricultural Chemists Official methods for Analysis. 12th Ed Washington D. C USA.

Basiouny, F. M. and R. H. Biggs (1976): Rates of photosynthesis and the Hill Reaction in Citrus Seedlings affected by Fe, Mn, and Zn nutrition. J. Amer. Soc. Hort. Sci., 101(3): 193 – 196.

Bouard, J. (1966): Researches physiologiques sur la vigne et en particulier sur l'aoutments des serments. Thesis Sc. Nat. Bordeaux (France. PP. 34).

Chang S.S.; and M. W. Keliewer (1991): Effect of N forms and rates, shading and presence and absence of Ca on the growth, tissue N composition and fruit quality of grapevines. Nitrogen forms. 228 – 238.

Cook, J. A. (1956): Petiole nitrate analysis as a criterion of nitrogen needs in California vineyards. Pro. Amer. Soc. Hort. Sci., 131 – 140.

Darwish, O.H., Persound, M. and Martens, D.C. (1995): Effect of long – term application of animal manure on physical properties of three soils. Plant and soil, 176: 289 – 295.

Elgalil, H. A. A; Eldsouky, M. M.; Elwasfy, M. M. (2003): Effect of some cultural practices on king Ruby grapevine production under Assiut conditions A- Effect of organic manure and yeast application on growth and nutrient status as well as yield and berry quality. Assiut – Journal – of Agric. Sci. 34(6): 173 – 192.

El–Mogy, M. M. ; M. M. shoeib and H. Abd Ella.(2004): Bud fertility, growth, yield and fruit quality of Thompson Seedless grapevines as affected by some field practices. J. Agric. Sci. Mansoura Univ., 29(3): 1395 – 1406, 2004.

El-nagger, A. M. A. (2004): Effect of organic farming on drip irrigated grapevines and soil chemical properties. Proceedings of the 2nd International Conf. Organic Agric. Nasr city, Cairo, Egypt. PP 117 – 128.

El–Sayed, H.A. (2002): Selecting the best sources and levels of N applied via fertigation for Flame Seedless grapevines. Proc. Minia 1st Conf. for Agric. and Environ. Sci., Minia, Egypt, March 25 – 28, 2002.

El-Shenawy, I.E. and T.A. Fayed (2005 a): Evaluation of the Conventional to organic and bio – fertilizers on Crimson Seedless grapevines in comparison with chemical fertilization. I-Vegetative growth and nutritional status. Egypt. J. Appl. Sci. 20(1): 192 – 211.

El-Shenawy, I.E. and T.A. Fayed (2005 b): Evaluation of the Conventional to organic and bio – fertilizers on Crimson Seedless grapevines in comparison with chemical fertilization. 2- yield and fruit quality. Egypt. J. Appl. Sci. 20 (1): 212 – 225.

Eman, A.A. Abd El – Monem, M. M. S. Saleh and Mostafa, E. A. M. (2008): Minimizing the quantity of mineral nitrogen fertilizers on grapevine by using humic acid, organic and biofertilizers. Research Jou. Of Agric. And Biolog. Sci., 4(1): 46 – 50. 2008.

Evenhuis, B. (1978): Simplified Methods for foliar Analysis. Koninklijk Institual Voorde Tropem Amesterdam PP. 1-78.

Farag, G. G., Hafez, A. E. and El-karim, M. A. (2008): Organic Agric. In grape No. 1129 (2008).

Gamal, A. M. and M. A. Ragab (2003): Effect of organic manures source and its rate on growth, nutritional status of the trees and productivity of balady mandarin trees. Assiut J. Agric. Sci., 4: 253 – 264.

Girgis, V. H.; S. I. El-Shenawy and M, M. El-Mogy (1998): Studies on the optimum N: K ratio required for Thompson Seedless grapevines. J. Agric. Sci. Mansoura Univ., 23(12): 5633 – 5640.

Gobrial, S.F., (2006): Minimizing mineral fertilizers in vineyards to reduce the chemical residues in grapes. M. Se. Thesis, Institute of Environmental studies and Research, Ain Shams Univ., Egypt, pp: 67.

Hegazi, E. S., M. R. El – Sonbaty, M. A. Eissa, D. M. Ahmed (2007): Effect of organic and biofertilization on vegetative growth and flowering of Picual olive trees. World J. Agric. Sci., 3(2): 210 – 217.

Ibraheem, T. (1994): Water pollution. Part 1 . Science and life series. Egyptian Organization for Books, Cairo Egypt. P. P. 58 – 61 (In Arabic).

Jackson, N. L. (1958): soil chemical analysis. Constable. Ltd. Co, London PP. 498.

Jackson, M.L. (1967): Soil Chemical Analysis. Printice-Hall Inc. Englewood Cliffs-N.S.

Kassem, H. A. and H. A. Marzouk. (2002): Effect of organic and / or mineral nitrogen fertilization on the nutritional status, yield and fruit quality of Flame Seedless grapevines grown in calcareous soils. J. Adv. Res., 7(3): 117 – 126.

Keller, M.; Arnink, K.J. and G. Hrazdina (1998): Interaction of nitrogen availability during bloom and light intensity during veraison. 1 Effect on grapevine growth, fruit development, and ripening. Amer. J. of Enol. And vitic. 49 (3) 333 – 340 (En, 31 ref).

Maksoud, M. A. (2000) : Response of growth and flowering of manzanillo olive trees to different sources of nutrients. Egypt J. Hort., 27: 513 – 523.

Megawer, M. A. (2009): Reducing the amount of inorganic N fertilizers in Superior grape vineyard by using organic and biofertilizers and humic acid. Viticulture Dept., Hort-Res. Instit. ARC, Giza, Egypt.

Mohamed, A. Z. (2003): Residual effect of nitrogen fertilizer on yield and leaves of Thompson Seedless grapevines. M. Sc. Thesis Fac. Agric. Ain Shams Univ.

Nijjar, G. S., (1985): Nutrition of fruit trees. Mrs Usha Raj kumar for kalyani. Publishers, New Delhi India, pp: 10 - 52.

Omar, A. H. (2004): Summer pruning and foliar application with Fe, Zn, and Mn for Thompson Seedless grapevines. J. Agric. Sci. Mansoura Univ., 29(12): 7177 – 7189, 2004.

Osman, M. H.; Fouad Fawzi and Victor Habib (1997): Vegetative growth cycle and wood ripening of some Seedless grape cultivars. Facu.of Agric. (SABA – BASHA) P.O. Vol. 2 Number 1 July 1997.

Philip, L. and J. R. Kuykend all (1973): Changes in titratable acidity Brix and potassium content malate, and tartrate during berry development of Thomson Seedless grapes. J. lood Sci, 38: 874 – 876.

Piper, C. S. (1950) : soil and plant Analysis. Inter. Sci., Pulb, New Yourk, PP. 368.

Pregl, F. (1945): Quantitative organic micro analysis. 4th Ed. J. A. Chw chill Ltd., London.

Raven JA; Evans MCW and Korb R (1999): The role of trace metal in photosynthetic electron tranport in – evolving organism. Phtosynth Res 60 : 111 – 149.

Rizk – Alla, Mervat S., V.H. Girgis and Abd El-Ghany, A.A. (2006): Effect of foliar application of mineral or chelated calium and magnesium on Thompson Seedless grapevines grown in a sandy soil. J. Agric. Sci. Mansoura Univ., 31 (5): 3079 – 3088.

Ragab, M.A. and Mohamed, G.A. (1999): Effect of some organic and mineral nitrogen fertilization treatments on Flame Seedless grapevines, Minia .J. Agric. Res., Develop. Vol. 19, pp. 27-43.
Sen, N.P. and Donaldson, B. (1978): Improved clorimetric Method for Determining Nitrate and nitrite in food. J. Assoc. OFF. ANAL, CHEM. 61, 6, 1389 – 1395.
Snedecor, G.W. and Cochran, W.G. (1972): Statistical Methods. Iowa State Univ. press Ames Iowa, USA.
Snell, F.D. and Snell, C.T. (1967): Colorimeteric Method of Analysis. D. van Nestrant Company Inc., P. 551-552.
Stove, K. (1971): Physiological bases of viticulture (section 1) in Russian. Publishing house. Bulgarian Academic Science – Sofia.
Wang, C. T.; H. T. Chan and F. J. Lay (1991): Effects of organic manures on the yield quality of grapes. Bulletin of Taicihung District Agric. Improve. Station, 32: 41-48.
Weaver, R. (1976): Grape growing. Dep. Of visit. And Eno. Univ. California Davis.
Weaver R. J. and Pool R. M. (1971): Relation of Seedless and ringing to gibberellin-like activity in berries of vitis vinifera. Plant physiology, 40 : 770 – 776.
Winkler, A, J. (1969): Effect of vine spacing in an unirrigated vineyard on vine physiology, production and wine quality. Amer. J. Enol. Vitic., 20: 7 – 15.

تأثير مصدر الأزوت علي نمو و إثمار كرمات العنب السوبيريور تحت ظروف منطقة النوباريه

مسعد محمد شعيب ، سوسن عبدالوهاب بندق و ياسر أنورعمران
قسم العنب – معهد بحوث البساتين – مركز البحوث الزراعية – الجيزه – مصر.

أجري هذا البحث خلال مواسم ٢٠٠٧ ، ٢٠٠٨ ، ٢٠٠٩ علي كرمات عنب سوبيريور نامية في أرض رملية في منطقة النوباريه لدراسه تأثير مصادر الأزوت المختلفة من خلال مياه الري بالتنقيط حيث أضيفت ٧٠ وحده أزوت من كل :

(١) نترات أمونيوم محببه ٣٣.٥% N
(٢) نترات أمونيوم سائله ٣٣.٥% N
(٣) نترات كالسيوم محببه ١٥.٥% N
(٤) سلفات أمونيوم ٢٠.٦% N
(٥) سيناميد كالسيوم ١٩.٨% N
(٦) نواتج التقليم الشتوي للعنب بعد إعدادها مسبقا لتصبح كالكمويست العضوي و تحتوي علي (٢.١% N) تم اضافتها مره واحده للتربه أثناء الخدمة الشتويه.

وكان الغرض من الدراسه هو دراسه تأثير مصادر الأزوت المختلفة علي نمو الكرمات و خصائص الثمار الطبيعية و الكيماويه و كذلك الجدوي الاقتصادية من كل مصدر أزوت و محاوله الاستفاده من ٢٥ مليون طن منتجة سنويا كمخلفات زراعية بطريقة آمنة دون إحداث تلوث للبيئه نتيجه حرقها و كذلك تقليل الأثر المتبقي للسماد بالثمار و إنتاج ثمار آمنه صالحه للتصدير. بالاضافة إلى إيجاد مخرج آمن و الحد من استخدام الأسمده الكيماويه التي ارتفع سعرها بدرجة مبالغ فيها في الأونه الأخيرة.

أشارت نتائج الدراسه إلى أن استخدام مصادر الأزوت المختلفة كان له أثرا واضحا علي معدل نمو المجموع الخضري للكرمه (مساحة الورقة - المسطح الخضري للكرمه - طول الفرخ الخضري – نضج الخشب بالأيام – وزن قصاصة التقليم وعدد و طول سلاميات الفرخ و كذلك عدد السلايمات لكل متر وعدد الاوراق علي كل فرخ – نهايه نمو الفرخ – فتره نمو الفرخ بالايام و سمك الفرخ و المسطح الخضري لكل عنقود.

كذلك كان هناك تأثير بالنسبه لمصادر الأزوت المختلفه علي محتوي الثمار من المواد الصلبه الذائبه والحموضة وميعاد نضج الثمار و محتواها من النترات و النيتريت. وأيضا تأثر طول العنقود – ونسبه العقد ومعامل التزاحم بالعنقود وصلابه الثمار ومدي التصاق الحبات بالعنقود وعدد العناقيد / كرمه ووزن العنقود وبالتالي محصول الكرمه بالكيلوجرام.

كانت أفضل النتائج المتحصل عليها هي : كان أفضل المعاملات هى التي تحتوي علي الصوره السائله للأزوت و كذلك السهله الذوبان في الماء و التي تتحول بعد الإضافة إلي يوريا مثل نترات الامونيوم السائله و سيناميد الكالسيوم و نترات الأمونيوم المحببة تليها الصوره العضويه (نواتج التقليم) حيث احتلت المرتبة الأولى من حيث متوسط طول الفرخ عمر سنه وفترة النمو الخضري. أما بالنسبه لمعامل نضج الخشب فقد احتلت المعاملات المحتويه علي الكالسيوم مثل سيناميد الكالسيوم و نيترات الكالسيوم المحببة علي أعلى القيم في هذا المجال وينطبق هذا أيضا علي محتوي الثمار من المواد الصلبه الذائبة والعكس هذه من النيتروجين والمحتويه علي كالسيوم أدت المعامله بها إلي انخفاض محتوي الثمار من الحموضه الكليه كما أدت هذه إلي تبكير نضج الثمار وقد احتلت المعامله بالنيتروجين العضوي (نواتج التقليم) إلي تقدم نضج الثمار و خاصة في الموسم الثالث و ذلك لاحتياجها إلي فتره أطول لحدوث التأثير و كذلك تأثيرها علي خواص التربه الطبيعية وينطق ذلك أيضا علي محتوي الثمار من النترات و النيتريت .

فيما يتعلق بعدد الثمار فى العنقود ومعامل التزاحم بالعنقود وأبعاد الحبات فقد احتلت معاملات الصور المعدنية مثل النترات السائله و المحببة وسيناميد الكالسيوم أكبر القيم في هذا المجال و تفوق عليها المعامله بقصاصة التقليم في الموسم التالى وزاد بدرجة كبيرة في الموسم الثالث.

أما بالنسبه للعقد وقوة الشد وصلابه الثمار فقد احتلت صور السماد المحتويه علي الكالسيوم يليها المعامله بنواتج التقليم أكبر القيم، كما أدت هذه المعاملات إلي زيادة ملحوظة في عدد الأوراق علي الفرخ الخضري عمر سنه و سمك الفرخ عمر سنه وتقليل عدد الأوراق وزياده وزن نواتج التقليم الشتوي، كما أدت هذه الصورة إلى زيادة مساحه الورقة والمسطح الخضري للكرمة وللعنقود.

فيما يتعلق بمتوسط عدد العناقيد لكل شجرة ووزن العنقود ومحصول الكرمه بالكيلو جرام فقد اتضح من الدراسه أن عدد العناقيد لم يتأثر معنويا لأن عدد العناقيد قد تحدد من الموسم السابق للنمو أما فى المواسم التالية فقد احتلت المعاملة بسيناميد الكالسيوم المرتبة الأولى.

بالنسبه لمحصول الكرمة فقد تلاحظ أن أعلى القيم قد نتجت من المعامله بسيناميد الكالسيوم وقد تفوق عليها المعامله بالصوره العضويه (نواتج التقليم) في السنوات التاليه.

فيما يتعلق بمحتوى الأوراق من عناصر النيتروجين والفوسفور والبوتاسيوم فقد اتضح من الدراسه أن المعامله بسيناميد الكالسيوم وقد تفوق عليها المعامله بالصوره العضويه (نواتج التقليم) في السنوات التاليه.

يمكن التوصيه بالاتي تحت ظروف هذه المنطقة و الظروف المماثله لها :

- استخدام صور الأزوت الكيماويه من مصادر نترات الكالسيوم ١٥.٥ % N و سيناميد الكالسيوم ١٩.٨ % N و استخدام مخلفات المزارع بعد إعدادها لتكون صالحة للاستفادة منها للمحافظه علي نظافة البيئه و إنتاج محاصيل أمنه صحيا علي الإنسان و الحيوان و الحد من استخدام الأسمده الكيماويه لتقليل الانفاق في مجال التسميد وزيادة دخل المزارع و ذلك بمعدل ٧٠ وحدة أزوت للفدان بالنسبة العنب السوبيريور.

قام بتحكيم البحث

أ.د / عبد العال حجازى حسن	**كلية الزراعة – جامعة المنصورة**
أ.د / فؤاد فوزى حسن	**مركز البحوث الزراعية**

Table (4): Effect of nitrogen source on number of internodes / shoot, internode number / meter and internode length of Superior grapevines during 2007, 2008 and 2009 seasons.

Nitrogen source	2007			2008			2009		
	Internodes number/ shoot	Internodes length (cm)	Number of internodes/ m	Internodes number/ shoot	Internodes length (cm)	Number of internodes/ m	Internodes number/ shoot	Internodes length (cm)	Number of internodes/ m
Granular ammonium nitrate (33.5%N)	17.4	10.3	17.5	16.8	10.9	17.5	16.8	11.2	16.8
Liquid ammonium nitrate (33.5%N)	17.7	12.4	18.8	17.2	12.8	17.4	17.1	13.2	17.1
Granular Calcium nitrate (15.5%N)	19.2	9.1	19.1	18.8	9.4	18.7	18.6	9.8	18.4
Ammonium sulphate (20.6%N)	16.4	10.4	16.6	16.1	10.7	16.2	15.9	11.2	15.9
Calcium Cyanamid (19.8%N)	19.6	9.0	19.8	19.1	9.4	19.1	18.7	9.6	18.8
Vine prunings (2.1%N)	16.3	10.9	16.3	16.6	11.3	16.8	17.1	11.6	17.1
New L.S.D at 5%	3.1	2.5	2.7	2.8	3.1	2.2	2.7	3.4	2.6

Table (5): Effect of nitrogen source on number of leaves/shoot, shoot thickness (cm) and weight of prunings vine (kg).

Nitrogen source	2007			2008			2009		
	No. of leaves/ shoot	Shoot thickness (cm)	Weight of pruning wood/ vine(kg)	No. of leaves /shoot	Shoot thickness (cm)	Weight of pruning wood/ vine(kg)	No. of leaves/ shoot	Shoot thickness (cm)	Weight of pruning wood/ vine(kg)
Granular ammonium nitrate (33.5%N)	17.6	1.4	3.9	17.1	1.20	3.6	16.8	1.20	3.5
Liquid ammonium nitrate (33.5%N)	17.8	1.3	4.1	17.4	1.20	3.9	17.1	1.30	3.8
Granular Calcium nitrate (15.5%N)	19.2	1.7	3.2	18.8	1.60	3.1	18.5	1.70	2.9
Ammonium sulphate (20.6%N)	16.6	1.0	2.8	16.3	1.10	2.5	16.0	1.10	2.5
Calcium Cyanamid (19.8%N)	19.8	1.8	3.4	19.2	1.70	3.3	18.8	1.90	3.4
Vine prunings (2.1%N)	16.4	1.0	2.6	16.8	1.10	2.9	17.0	1.30	3.2
New L.S.D at 5%	2.4	0.20	1.2	2.1	0.30	0.7	2.2	0.50	0.5

Table (6): Effect of nitrogen source on leaf area (cm^2), leaf area/vine (m^2) and leaf area (cm^2) / cluster

Nitrogen source	2007			2008			2009		
	Leaf area (cm^2)	Total leaf area(m^2) / vine	leaf area (cm^2) /cluster	Leaf area (cm^2)	Total leaf area(m^2) / vine	leaf area (cm^2) /cluster	Leaf area (cm^2)	Total leaf area(m^2) / vine	leaf area (cm^2) /cluster
Granular ammonium nitrate (33.5%N)	178.0	22.2	10571.0	178.1	23.4	11700.0	179.8	23.8	10818.0
Liquid ammonium nitrate (33.5%N)	182.1	26.4	12000.0	184.0	28.1	13381.0	184.2	28.6	12435.0
Granular Calcium nitrate (15.5%N)	176.2	21.1	9590.0	176.0	22.2	11100.0	177.1	22.8	9913.0
Ammonium sulphate (20.6%N)	170.0	18.8	8174.0	171.0	19.7	8955.0	173.2	20.4	9714.0
Calcium Cyanamid (19.8%N)	175.1	19.2	7385.0	176.3	19.8	7920.0	176.1	21.6	8000.0
Vine prunings (2.1%N)	152.8	16.6	7217.0	160.4	18.2	7000.0	173.0	20.6	8240.0
New L.S.D at 5%	4.1	30.0	75.6	5.1	45.0	78.5	5.2	48.0	84.4

Table (7): Effect of nitrogen source on wood ripening of Superior grape vines during 2007, 2008 and 2009 seasons.

Nitrogen source	Wood ripening										
	Commencement			Period in days				Coefficient			
	2007	2008	2009	2007	2008	2009	Average	2007	2008	2009	Average
Granular ammonium nitrate (33.5%N)	July 17	July 22	July 22	67.0	64.0	60.0	63.7	0.76	0.77	0.74	0.77
Liquid ammonium nitrate (33.5%N)	July 20	July 27	July 26	68.0	69.0	74.0	70.3	0.72	0.70	0.71	0.71
Granular Calcium nitrate (15.5%N)	June 22	June 24	June 20	60.0	61.0	56.0	59.0	0.90	0.87	0.91	0.89
Ammonium sulphate (20.6%N)	July 24	July 27	July 25	60.0	61.0	60.0	60.3	0.80	0.79	0.77	0.79
Calcium Cyanamid (19.8%N)	June 21	June 25	June 18	66.0	64.0	60.0	63.3	0.88	0.90	0.87	0.88
Vine prunings (2.1%N)	August 4	August 6	August 2	63.0	69.0	78.0	70.0	0.68	0.65	0.66	0.66
New L.S.D 5%								0.16	0.20	0.22	

Table (8): Effect of nitrogen source on number of clusters/vine, cluster weight (gm) and yield /vine (kg) of superior grapevines during 2007, 2008 and 2009 seasons

Nitrogen source	2007			2008			2009		
	No. of cluster/ vine	Cluster weight (g)	Yield/ vine (kg)	No. of cluster/ vine	Cluster weight (g)	Yield/ vine (kg)	No. of cluster/ vine	Cluster weight (g)	Yield/ vine (kg)
Granular ammonium nitrate (33.5%N)	22.0	495.0	10.90	20.0	510.0	10.2	22.0	508.0	11.2
Liquid ammonium nitrate (33.5%N)	22.0	490.0	10.80	21.0	500.0	10.5	23.0	501.0	11.5
Granular Calcium nitrate (15.5%N)	22.0	485.0	10.70	20.0	488.0	9.8	23.0	486.0	11.2
Ammonium sulphate (20.6%N)	23.0	500.0	11.50	22.0	508.0	11.2	21.0	506.0	10.6
Calcium Cyanamid (19.8%N)	22.0	490.0	10.80	25.0	502.0	12.6	27.0	500.0	13.5
Vine prunings (2.1%N)	23.0	420.0	9.70	26.0	512.0	13.3	25.0	525.0	13.1
New L.S.D at 5%	N.S	20.0	0.7	1.1	25.0	0.8	1.5	25.0	1.00

Table (9): Effect of nitrogen source on cluster length (cm), number of berries/cluster and coefficient of cluster compactness of superior grapevines during 2007, 2008, and 2009 seasons

Nitrogen source	2007			2008			2009		
	Cluster length (cm)	Number of berries/ cluster	Coe. of bunch compac.	Cluster length (cm)	Number of berries/ cluster	Coe. of bunch compac.	Cluster length (cm)	Number of berries/ cluster	Coe. of bunch compac.
Granular ammonium nitrate (33.5%N)	25.0	186.0	7.4	24.8	198.0	8.0	23.9	196.0	8.2
Liquid ammonium nitrate (33.5%N)	26.2	192.0	7.3	26.4	205.0	7.8	25.8	198.0	7.7
Granular Calcium nitrate (15.5%N)	24.6	196.0	8.0	24.7	208.0	8.4	23.8	200.0	8.4
Ammonium sulphate (20.6%N)	22.1	180.0	8.1	22.6	192.0	8.5	21.8	188.0	8.6
Calcium Cyanamid (19.8%N)	25.3	210.0	8.3	25.8	224.0	8.7	25.6	218.0	8.5
Vine prunings (2.1%N)	21.4	187.0	8.7	22.5	198.0	8.8	24.1	212.0	8.8
New L.S.D at 5%	3.8	26.0	0.8	3.6	28.0	0.6	2.8	18.0	0.5
Coe. = Coefficient	Compac. = Compactness								

Table (10): Effect of nitrogen source on berry set %, berry adherence strength (g) and berry firmness (kg/cm^2) of Superior grapevines during 2007, 2008, 2009 seasons

Nitrogen source	2007			2008			2009		
	Beery Set%	Adhe. Stre.(g)	Firm. Kg/cm^2	Beery Set%	Adhe. Stre.(g)	Firm. Kg/cm^2	Beery Set%	Adhe. Stre.(g)	Firm. Kg/cm^2
Granular ammonium nitrate (33.5%N)	11.6	810.0	0.915	12.2	812.0	0.912	12.3	810.0	0.910
Liquid ammonium nitrate (33.5%N)	11.1	815.0	0.925	11.0	820.0	0.918	12.1	815.0	0.911
Granular Calcium nitrate (15.5%N)	13.0	870.0	0.985	13.8	888.0	0.982	13.5	890.0	0.976
Ammonium sulphate (20.6%N)	9.4	780.0	0.820	10.6	782.0	0.795	10.0	781.0	0.788
Calcium Cyanamid (19.8%N)	13.3	880.0	0.996	14.2	910.0	0.988	13.9	908.0	0.980
Vine prunings (2.1%N)	11.8	790.0	0.810	12.0	798.0	0.815	12.4	806.0	0.860
New L.S.D at 5%	0.8	70.1	0.061	1.2	71.5	0.051	1.1	70.0	0.055
Ade., Stre. = Adherence strength	Firm. = Firmness								

Table (11): Effect of nitrogen source on dynamics of cluster ripening of Superior grapevines during 2007, 2008 and 2009 seasons.

Nitrogen source	2007				2008				2009			
	T.S.S. %				T.S.S. %				T.S.S. %			
	25/5	30/5	5/6	10/6	25/5	30/5	5/6	10/6	25/5	30/5	5/6	10/6
Granular ammonium nitrate (33.5%N)	14.5	15.6	16.4	17.2	14.9	15.6	16.2	17.1	14.1	15.6	16.2	17.0
Liquid ammonium nitrate (33.5%N)	14.2	15.9	16.0	16.8	14.8	15.0	16.0	17.0	14.0	15.2	16.0	16.7
Granular Calcium nitrate (15.5%N)	14.8	15.9	16.4	17.5	15.0	16.1	16.3	17.6	15.0	16.0	16.8	17.4
Ammonium sulphate (20.6%N)	14.5	15.3	16.1	16.9	14.3	15.4	16.1	17.2	14.1	15.7	16.1	16.8
Calcium Cyanamid (19.8%N)	15.0	16.1	16.4	17.6	15.1	16.1	16.5	17.5	15.1	16.0	16.6	17.4
Canes pruning (2.1%N)	13.8	14.5	15.3	16.1	13.9	15.7	16.1	16.8	14.8	16.3	16.8	17.9
New L.S.D 5%	0.8	1.1	1.0	1.3	0.7	0.9	0.4	0.7	0.9	0.9	0.7	0.9
Nitrogen source	Acidity %				Acidity %				Acidity %			
Granular ammonium nitrate (33.5%N)	0.80	0.79	0.74	0.70	0.83	0.78	0.73	0.68	0.85	0.81	0.77	0.70
Liquid ammonium nitrate (33.5%N)	0.79	0.75	0.70	0.66	0.81	0.77	0.72	0.64	0.80	0.77	0.79	0.67
Granular Calcium nitrate (15.5%N)	0.79	0.72	0.64	0.64	0.79	0.75	0.65	0.61	0.78	0.73	0.63	0.62
Ammonium sulphate (20.6%N)	0.88	0.80	0.76	0.72	0.86	0.81	0.76	0.70	0.85	0.81	0.75	0.70
Calcium Cyanamid (19.8%N)	0.78	0.63	0.68	0.62	0.79	0.64	0.62	0.61	0.75	0.66	0.63	0.61
Vine prunings (2.1%N)	0.81	0.77	0.72	0.64	0.84	0.80	0.73	0.64	0.80	0.74	0.70	0.62
New L.S.D 5%	0.06	0.06	0.05	0.04	0.04	0.11	0.07	0.05	0.06	0.15	0.11	0.06

Table (12): Effect of nitrogen source on nitrate and nitrite content of berries (mg/kg berries fresh weight)

Nitrogen source	2007		2008		2009	
	Na No3 mg/kg	Na No2 mg/kg	Na No3 mg/kg	Na No2 mg/kg	Na No3 mg/kg	Na No2 mg/kg
Granular ammonium nitrate (33.5%N)	22.10	0.80	23.20	0.76	24.0	0.78
Liquid ammonium nitrate (33.5%N)	26.10	0.84	25.8	0.82	27.0	0.80
Granular Calcium nitrate (15.5%N)	24.40	0.64	24.8	0.60	26.0	0.62
Ammonium sulphate (20.6%N)	20.80	0.36	21.6	0.30	23.1	0.32
Calcium Cyanamid (19.8%N)	25.1	0.50	25.6	0.54	25.4	0.60
Vine prunings (2.1%N)	11.1	0.24	6.40	0.12	2.2	0.02
New L.S.D at 5%	7.20	0.40	6.20	0.60	4.4	0.60

Table (13): Effect of nitrogen source on leaf petioles N, P and K content of Superior grapevines

Nitrogen source	2007			2008			2009		
	N %	P%	K%	N %	P%	K%	N %	P%	K%

Granular ammonium nitrate (33.5%N)	2.00	0.30	1.71	2.10	0.32	1.62	2.01	0.31	1.60
Liquid ammonium nitrate (33.5%N)	2.20	0.28	1.64	2.34	0.30	1.60	2.22	0.30	1.58
Granular Calcium nitrate (15.5%N)	1.62	0.21	1.60	1.72	0.20	1.58	1.60	0.20	1.56
Ammonium sulphate (20.6%N)	1.80	0.22	1.75	1.88	0.23	1.78	1.92	0.23	1.74
Calcium Cyanamid (19.8%N)	1.88	0.22	1.86	1.90	0.24	1.84	1.88	0.24	1.76
Vine prunings (2.1%N)	1.98	0.24	1.51	2.38	0.47	1.73	2.28	0.48	1.84
New L.S.D at 5%	0.12	0.02	0.08	0.18	0.03	0.07	0.20	0.06	0.07

Table (14): Economical justification of nitrogen sources

Treatments	Price of the fertilizers(L.E)		Trans-port cost (L.E)	Labor cost (L.E)	Total cost (L.E)	Average yield during three seasons		Average cost production of ton fruit during three seasons (L.E)
	Unite (50 kg)	Total				Per vine (kg)	Per fed (ton)	
Granular ammonium nitrate (33.5%N)	71.8	301.6	20.0	75.0	396.6	10.8	7.6	52.2
Liquid ammonium nitrate (33.5%N),(L)	66.7	280.1	25.0	75.0	380.1	10.9	7.6	46.7
Granular Calcium nitrate (15.5%N)	82.5	742.5	45.0	75.5	862.5	10.6	7.4	116.6
Ammonium sulphate (20.6%N)	61.7	419.6	35.0	75.0	529.6	11.1	7.8	67.9
Calcium Cyanamid (19.8%N)	56.3	394.1	35.0	75.0	504.1	12.3	8.6	58.6
Vine prunings (2.1%N)	6.2	413.3	75.0	100.0	588.3	12.0	8.4	70.0

*** Average sale price of ton fruits for the three seasons is 2100.0 L.E.**

*** Average price of 50 kg fertilizer according to Agriculture Bank development.**

Notice: Total cost include only price of fertilizers / fed.