Effect of Organic and / or Mineral Nitrogen Fertilization on the Nutritional Status, Yield and Fruit Quality of Flame Seedless Grapevines Grown in Calcareous Soil

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ABSTRACT

A field study was carried out during 1999 and 2000 seasons on six years old Flame seedless grapevines growing in calcareous loamy sand soil. One level of nitrogen either from ammonium sulphate alone or with three organic manure sources were applied in order to study their effect on the nutritional status, yield and fruit quality. The results revealed that adding organic fertilizers with ammonium sulphate significantly increased leaf mineral contents. Yield, berry and clusters weight were significantly higher with applying cattle and chicken manures combined with ammonium sulphate than manures applied alone. In addition, cattle manure + ammonium sulphate obtained higher effect on yield, berry weight and cluster weight than town and chicken manure + ammonium sulpahte treatments. However, manures applied either alone or with ammonium sulphate did not affect on TSS content.

INTRODUCTION

In the recent years the use of organic fertilizers in place of mineral fertilizers has become potentially attractive because of the harm effect and high costs of mineral fertilizers. Manure and organic fertilization is happen to have a great importance.

In sandy and sandy loam soils, organic fertilization is used to improve soil conditions and as an important source of macro and micro nutrients. Several studies had shown that addition of manure not only increased the organic matter content in soil but also the available P and exchangeable K, Ca and Mg content (Bhangoo *et al.*, 1988).

Previous researches had shown that, organic fertilization increased vegetative growthand nutritional status of several fruit trees (Spiers, 1982; Bhangoo *et al.*, 1988; Villasurda and Baluyut ,1990; EL-Morshedy, 1997_1; EL-Morsy, 1997; JianWin *et al.*, 1999 and Abdel-Nasser and Harhash, 2000).

The present work was undertaken to study the effect of different manure fertilizers as a source of nitrogen alone or in combination with mineral

nitrogen fertilizer on leaf mineral content, yield and fruit quality of Flame seedless grapevines grown in calcareous loamy sand soil.

MATERIALS AND METHODS

The present study was carried out during the two successive growing seasons, 1999 and 2000 on six years old Flame seedless grapevines (*Vitis vinifera*, L.) grown in Mariut district near Alexandria, Egypt. The soil was loamy sand with a pH = 8.2 and $CaCO_3$ = 29.68%. The vines were healthy with no visual nutrients deficiency symptoms, planted at 1.5 x 4 meters apart, spur pruned in December of both seasons at 48 buds and irrigated with Nile water under flood system. In both seasons, 50 Kg per feddan potassium sulphate were added twice in early March and early May. 150 Kg per feddan super phosphate was added with the manure fertilizer in December of both seasons. The chemical characters of the manure fertilizers are shown in Table 1. In addition, all vines received the same nitrogen requirements (200 gm N/vine). This amount was obtained from organic manures, ammonium sulphate (21% N) or equally chared from the organic and mineral nitrogen sources. Ammonium sulphate was applied in three equal doses at the beginning of March, April and May in both seasons. Fertilizers were mixed with the 30 cm surface layer of the soil under the vines foliage, about 0.5 m around the vine trunk.

Seventy grapevines as uniform as possible were selected. Seven fertilizer treatments with five replicates for each were conducted in both seasons. Each replicate consisted of two adjacent vines; i.e. ten vines per treatment The seven orchard treatments were established as follows:

1) Ammonium sulphate alone.
2) Town refuse only.
3) Cattle manure only.
4) Chicken manure only.
5) Ammonium sulphate + town refuse.
6) Ammonium sulphate + cattle manure.
7) Ammonium sulphate + chicken manure.

The experiment treatments were arranged in complete randomize design. (CRD).

In order to study the nutritional status, leaf samples of 20 leaves for each replicate were collected on July, 1st of both seasons. Samples were taken from the first fully mature leaves from the tip of the shoots. Leaf petioles were separated from the blades. Blades were washed with tap water, rinsed three times with distilled water and oven dried at 70°C to a constant weight.

The dried material was ground and digested with H_2O_2 and H_2SO_4 according to Evinhuis and Dewaard (1980). Suitable amounts from the extraction of each sample were undertaken for mineral determination. Nitrogen and phosphorus were determined colorimetrically as described by Evinhuis (1976) and Murphy and Riley (1962), respectively. Potassium was determined by a flame photometer. Ca, Mg, Fe, Mn and Zn were determined using an atomic absorption spectrophotometer.

At harvest time; i.e. 20th of July in both seasons, the number and weight of clusters per vine were recorded. For fruit quality determinations, samples of 100 berries were taken from randomly selected clusters of each vine. Berries were blended for 15 seconds and squeezed through sheet cloth to obtain 100mL of juice. Total soluble solids were recorded by a refractometer. Acidity was determined by titration with 0.1N NaOH (AOAC, 1980). Anthocyanin was measured colorimetrically in the berry skin extract at 530 nm (Sastry and Tischer, 1952). The data were statistically analyzed using the completely randomized design (Steel and Torrie, 1980).

Table (1): Some chemical characteristics of the organic manures used in the present experiment.

Parameter		Town refuse		Cattle manure		Chicken manure	
		1999	2000	1999	2000	1999	20
Moisture content	%	20.20	18.00	12.80	14.60	8.60	9.
Organic carbon	%	31.20	30.80	22.80	23.60	18.60	20.
Total nitrogen	%	1.35	1.40	1.96	2.15	3.26	3.
Organic matter	%	51.90	50.20	40.20	43.70	35.70	38.
Total macronutrients	%						
P		0.41	0.46	0.93	0.98	1.16	1.
K		0.70	0.78	1.22	1.11	1.28	1.
Ca		0.65	0.60	1.76	1.82	1.95	1.
Mg		0.20	0.18	0.90	0.96	0.96	1.
Total micronutrients	ppm						
Fe		900	1000	1500	12720	2600	24
Mn		200	198	420	436	476	4
Zn		260	230	80	68	120	1

RESULTS AND DISCUSSION

Leaf mineral contents

Leaf nitrogen content was significantly increased in both seasons with all treatments except for town refuse alone in the first season when compared with ammonium sulphate alone (Table2). Cattle manure and chicken manure significantly increased leaf phosphorus content in the first season as compared with ammonium sulphate only. However, all treatments, except for town refuse + ammonium sulphate treatment increased leaf phosphorus content in the second season when compared with mineral fertilizer alone (Table2). In the first season, all treatments increased leaf potassium content as compared with ammonium sulphate treatment (Ttable2). Leaf Ca, Mg, Fe, Zn and Mn contents were significantly increased, in both seasons, with all treatments when compared with ammonium sulphate alone (Table2).

With regard to manure fertilizer treatments alone, no significant differences in leaf N, P, Zn, Fe and Mn contents were obtained in both seasons (Table 2). In addition, cattle manure significantly increased leaf K and Ca contents as compared with the town refuse treatment. On the other hand, chicken manure treatment significantly increased leaf Mg content in both seasons (Table 2).

With regard to the application of manure with mineral fertilizer, leaf nitrogen content was significantly increased by the combination of the three manures with ammonium sulphate in both seasons as compared with the organic fertilizers alone. However, in both seasons, no differences were obtained in phosphorus content by adding the three manures alone or in combinations with ammonium sulphate (Table2). Potassium was significantly increased by adding town refuse with mineral fertilizer when compared with town refuse alone in the first season. In contrast, adding the town refuse alone gave a significant higher potassium content in the second season (Table 2). No significant differences in leaf Ca, Mg, Fe, Zn and Mn contents were found when organic fertilizers were added alone or with mineral fertilizer (Table2).

From the above results it might be concluded that organic manure is an important source of macro and micro nutrients. These results agreed with those of Yagodin, 1984, Bhangoo *et al.*, 1988, El-Morshedy, 1997_1 and 1997_2 and El-Kobbia, 1999. Increasing leaf minerals content by adding organic manure might be due to the availability of nutrients in the soil. These findings are in agreement with those of Abdel-Nasser and Harhash, 2000. They reported that available soil nutrients were increased due to organic manure application. According to Asker *et al.*, 1994 organic manure improve soil porosity, infiltration rate and soil water retention. Sandy loam soils , may with time become

Table 2. Effect of applying different sources of nitrogen fertilizer on leaf mineral contents (on dry weight basis) of Flame Seedless grapevine in 1999 and 2000 seasons.

Treatments	1999								2000							
	N	P	K	Ca	Mg	Fe	Zn	Mn	N	P	K	Ca	Mg	Fe	Zn	Mn
	%					ppm			%					ppm		
Ammonium sulphate	1.89	0.16	1.64	1.76	0.46	94	30	28	1.93	0.18	1.77	1.62	0.41	98	33	30
Town refuse	1.96	0.20	1.72	2.06	0.51	120	46	36	2.10	0.21	1.86	1.86	0.50	123	45	38
Cattle manure	2.00	0.21	1.88	2.12	0.52	126	50	40	2.10	0.21	1.80	2.01	0.56	130	48	40
Chicken manure	2.01	0.22	1.92	2.10	0.62	122	43	41	2.12	0.23	1.88	1.96	0.58	120	42	41
Ammonium sulphate + Town refuse	2.10	0.19	1.80	1.96	0.49	118	44	34	2.28	0.20	1.72	1.88	0.51	120	44	40
Ammonium sulphate + Cattle manure	2.21	0.19	1.90	2.00	0.52	126	46	41	2.30	0.22	1.80	1.82	0.50	128	48	46
Ammonium sulphate Chicken manure	2.16	0.20	1.92	2.07	0.51	120	43	36	2.26	0.23	1.82	2.00	0.56	121	46	43
$L.S.D_{0.05}$	0.11	0.05	0.08	0.17	0.04	13	10	5	0.14	0.03	0.10	0.12	0.07	14	7	4

deficient in N, K, Zn, B and P applications (Christensen *et al.*, 1978). Thus, adding manure fertilizer helps in overcoming nutrients deficient in these kinds of soils.

Yield, clusters number, berry and cluster weight

In both seasons, the treatments; cattle manure only and the three manures applied with ammonium sulphate significantly increased yield per vine as compared with ammonium sulphate treatment (Table 3). However, no significant differences were obtained among treatments in number of clusters per vine in both seasons (Table3). On the other hand, all organic fertilizers alone or combined wioth ammonium sulphate significantly increased berry weight when compared with ammonium sulphate alone in both seasons (Table3). Cluster weight was increased by all treatments in both seasons except for chicken manure alone in the first season and town refuse alone in the second season when compared with ammonium sulphate treatment (Table 3).

Yield, berry and cluster weight were significantly higher with applying cattle and chicken manures combined with ammonium sulphate than manures applied alone in the first season(Table 3).
In addition, Cattle manure + ammonium sulphate gave higher effect on yield, berry weight and cluster weight than town refuse and chicken manures + ammonium sulpahte treatments (Table 3).

Total soluble solids , acidity and anthocyanin contents

TSS content was significantly increased in the first season by application of chicken manure either alone or combined with mineral fertilizer (Table 3). In contrast, organic fertilizers alone or with ammonium sulphate treatments increased TSS content when compared with ammonium sulphate treatment in the second season. No significant differences were obtained among manures applied either alone or with ammonium sulphate.

Acidity was significantly increased by all treatments as compared with ammonium sulphate alone in the first season only (Table3). Cattle manure + ammonium sulphate had higher effect than cattle manure alone in both seasons (Table 3).

All treatments, except for town refuse + ammonium sulphate in the second season, increased anthocyanin content in both seasons when compared with ammonium sulphate treatment (Table 3). In addition, chicken manure alone in both seasons gave significantly higher anthocyanin content than applying chicken manure + ammonium sulphate (Table 3).

Table 3. Effect of organic manure fertilizers on yield and fruit quality of Flame Seedless grapevines in 1999 and 2000 seasons.

Treatments	1999							2000						
	Yield (kg/vine)	Number of clusters / vine	Cluster weight (g)	Berry weight	T.S.S (%)	Acidity (mg/100 ml juice)	Anthocyanine (ml/100 g fresh weight)	Yield (kg/vine)	Number of clusters / vine	Cluster weight (g)	Berry weight	T.S.S (%)	Acidity (ml/100 ml juice)	Anthocyanine (mg/100 g fresh weight)
Ammonium sulphate	10.72	29.6	1.76	362	13.6	0.72	6.89	12.60	31.7	1.98	397	14.4	0.87	7.62
Town refuse	11.61	30.3	2.03	383	15.2	0.87	8.37	13.26	33.5	2.13	396	16.0	0.80	9.72
Cattle manure	11.96	30.2	2.12	396	15.0	0.78	7.81	14.52	30.0	2.18	484	15.8	0.72	9.60
Chicken manure	11.37	31.6	1.88	360	16.4	0.92	9.56	13.25	29.8	2.20	445	16.2	0.85	10.87
Ammonium sulphate + Town refuse	12.07	28.4	2.30	425	14.6	0.86	8.51	15.60	31.5	2.20	495	15.8	0.86	7.96
Ammonium sulphate + Cattle manure	14.88	32.2	2.48	462	15.0	0.88	7.92	15.02	31.4	2.26	478	16.3	0.87	8.80
Ammonium sulphate Chicken manure	12.86	30.7	2.21	419	15.4	0.80	7.86	15.00	32.6	2.30	460	15.8	0.82	8.00
$L.S.D_{0.05}$	1.02	N.S	0.11	16	1.8	0.02	0.73	1.12	N.S	0.09	21	1.10	0.03	1.04

From the previous results it is concluded that application of manure fertilizer increased yield and berries quality in this study. This is due to the improvement of soil chemical and physical properties after manure application. These results are in line with those of Bhangoo *et al.*, 1988. They reported that poultry manure increased fruit yield and quality of Thompson seedless grapes. Same results were obtained by El-Morshedy (1997_2), JianWin (1999) and Harhash and Abdel-nasser (2000).

Finally in most cases manures gave better effect on leaf mineral contents, yield and fruit quality when applied with ammonium sulphate. Same results were obtained by EL-Morsy (1997). He found that applying filter mud and sludge fertilizers with ammonium sulphate gave best results on the growth and nutritional status of Banaty grapevines. Same results were obtauned by Chaudhury *et al.* (1975) and Villasurda and Baluyut (1990) on guava.

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الملخص العربي

تأثير التسميد الآزوتي العضوي و/أو المعدني على الحالة الغذائية والمحصول وجودة ثمار العنب فليم سيدلس النامى فى أرض جيرية

حسن على قاسم ، هند على مرزوق

قسم الفاكهة – كلية الزراعة (الشاطبى) – جامعة الاسكندرية

أجريت هذه الدراسة الحقلية خلال موسمى ١٩٩٩ و ٢٠٠٠ على شجيرات العنب فليم سيدلس عمر ٦ سنوات نامية فى أرض طميية رملية وذلك لدراسة أثر مستوى واحد من النيتروجين مضافاً فى صورة كبريتات الامونيوم فقط أو بالإضافة الى ثلاثة مصادر من السماد العضوى على المحتوى المعدنى والمحصول وجودة ثمار العنب النامى فى الأراضى الجيرية. ويمكن تلخيص النتائج فيما يلي:١- أدى التسميد العضوى الى زيادة المحتوى المعدنى فى الأوراق. ٢- إضافة سماد الماشية أو الدواجن مع كبريتات الأمونيوم أدى الى زيادة معنوية لكل من المحصول ووزن الحبة والعنقود بالمقارنة بإضافة السماد العضوى وحده. كما كان تأثير المعاملة: سماد ماشية + كبريتات الأمونيوم على المحصول ووزن الحبة والعنقود أكبر عن كل من المعاملتين: سماد الدواجن أو مخلفات المدن + كبريتات الأمونيوم. ٣- لم توجد إختلافات بين معاملات التسميد العضوى فقط أو بالإضافة إلى كبريتات الأمونيوم فى المحتوى من المواد الصلبة الكلية.