Response of Flame Seedless Grapes to Sulphur and Different Nitrogen Sources and Application Times under Calcareous Soil and Drainage Irrigation Water II. Maturity, Harvest Spread and Fruit Postharvest Physiochemical Quality

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ABSTRACT

This investigation was carried out during 2001 and 2002 seasons to study the maturity, spread harvest and fruit postharvest physiochemical quality of Flame Seedless grapevines grown in calcareous soil and irrigated with drainage water as influenced by different sources and doses of nitrogen fertilizer and sulphur applications. The obtained results could be summarized as follows:

1. Regardless of the nitrogen application doses and sulphur rates, the urea and ammonium nitrate increased cluster weight and length and berry weight, volume, diameter, length, TSS, reducing sugars and anthocyanin content during both seasons. In the meantime, the urea application increased berries uniformity and maturity in both seasons. The ammonium sulphate application increased berry firmness and harvest spread in both seasons. Both berry acidity and non-reducing sugars were not affected by any of nitrogen fertilizer sources.
2. Regardless of nitrogen sources and sulphur rates, the addition of nitrogen at three equal doses increased cluster weight and length and berry weight, volume, diameter, length, TSS, reducing sugars and anthocyanin and fruit maturity and uniformity in both seasons. The addition of nitrogen at one dose increased berry firmness and harvest spread in both seasons. No differences between the three times on berry acidity and non-reducing sugars.
3. Regardless of nitrogen sources and application times, the soil sulphur application increased cluster weight and length and berry weight, volume and diameter, during the second season, and berries firmness, uniformity, TSS, reducing sugars maturity and harvest spread during both seasons. The berry length, acidity and non-reducing sugars were not affected by the addition of sulphur to the soil.

INTRODUCTION

In Egypt, grapevine (*Vitis vinifera*, L.) is one of the most important fruit crops which consumed fresh. The vines are grown under different environmental conditions and soil types. In addition, one of the important tools in increasing the productivity of grapevines is fertilization, especially nitrogenous fertilization.

The soil pH plays an important role in the uptake of the nitrogen fertilizer form. High pH at 7 is favouring the uptake of NH_4^+ ions and low pH at 5 is convenient for NO_3^- uptake (Abd El-Khalek, 1992). Mills *et al.*(1974) reported that the volatilized ammonia from soil at pH 7.2 was 17% and this percentage during 7 days reached 63% by increasing the pH to 8-8.5. Moreover, the different forms of nitrogen fertilizer applied had an effect on fruit quality of Thompson Seedless grape (Abd El-Khalek, 1992). Harhash and Abd El-Nasser (2000) reported that the nitrogen forms affected physical and chemical properties of Flame Seedless grape fruits. Saleh *et al.*(2000) found that the TSS and TSS/acid ratio were significantly affected by the different nitrogen forms, while the fruit weight, volume, length, firmness and acidity were not affected. Also, the date of nitrogen fertilizer application was reported to affect fruit quality (Abd El-Khalek, 1992 on grapes; Kassem *et al.*, 1995a on citrus and Saleh *et al.*, 2000 on pear).

Moreover, sulphur is a major element needed in relatively large amounts for the metabolic functions in order to obtain the optimal growth. It was used for many years in reclamation and improvement of sodic soils (Stromberg and Tisdale, 1979). Sulphur is oxidized by soil microorganisms to sulfuric acid, which in turn lowers soil pH and improves the availability of most soil nutrients (Hassan and Olsen, 1966). Many investigators reported the importance of sulphur in increasing yield and fruit quality (Abo-Rady *et al.*, 1988, Kassem *et al.*, 1995b and Harhash and Abd El-Nasser, 2000).

The present study was carried out to investigate the combined effect of nitrogen sources and spread number of applications and sulphur rate on the fruit quality, maturity and spread harvest of Flame Seedless grapes grown in calcareous soil and irrigated with drainage water.

MATERIALS AND METHODS

The present study was carried out during 2001 and 2002 growing seasons on 8-year old Flame Seedless grapes (*Vitis vinifera*, L.) grown at Mariut region near Alexandria, Egypt. Vines were grown in calcareous soil under flooding irrigation method with drainage water. The analysis of orchard soil and irrigation water is presented in Table (1). Trees were planted at 1x4 m spacing and pruned by retaining a maximum of 35-40 nodes/vine. Vines were trained to the quadrilateral cordon system, trellised on two story cross arm system and pruned to approximately 2-3 nodes/fruiting spur. In both seasons, 250 kg superphosphate per feddan were added with 15 m^3 organic manure in December. Potassium sulphate was added to all vines at a rate of 150 kg/fed. at two equal doses in March and May in both seasons. The organic manure samples were taken yearly, dried and chemically analyzed. Average N, P, K, Ca and Mg contents of the manure were 1.78-1.86, 0.73-0.77, 0.81-0.85, 2.86-2.93 and 1.26-1.32%, respectively, on dry weight basis, of both seasons. The corresponding values of Fe, Mn, Zn and Cu were 540-548, 28-32, 120-126 and 46-50 ppm, respectively in both seasons.

Seventy two trees, as uniform as possible, were chosen for the present study. Three sources of nitrogen fertilizer (urea, ammonium sulphate and ammonium nitrate) were applied at the rate of 150 g N/tree and three nitrogen applications were applied; i.e., one dose at March, two equal doses at March and April and three equal doses at March, April and May during both seasons. Two rates of elemental sulphur were used; i.e., zero and 250 g/vine in December with organic manure in both seasons. Elemental sulphur was mixed with the organic manure and superphosphate then mixed with the 30 cm surface layer of soil under the vines foliage, about 0.5 m around the vine trunk. Eighteen fertilization treatments, representing all the possible combinations of three sources of nitrogen fertilizer, three nitrogen applications and two levels of elemental sulphur, were used in the present study (3x3x2 = 18 treatments). Each particular fertilization treatment was repeated on the same trees in the two experimental seasons. The treatments were arranged in a randomized complete block design with four replicates for each treatment, using one tree as a single replicate (18 treatments x 4 replicates = 72 trees).

Table 1.
(a) Physical and chemical properties of experimental orchard soil samples.

Properties	Soil depth (cm)	
	0 - 30	30 - 60
$CaCO_3$, %	28.92	31.22
EC, dS/m	4.3	5.3
pH	8.3	7.7
Texture	sandy clay loam	sandy clay loam
Ca^{++}, meq/L	20	24
Mg^{++}, meq/L	8	10
Na^{+}, meq/L	12.7	17.5
K^{+}, meq/L	2.3	1.3
CO_3^{2-}, meq/L	0.0	0.0
HCO_3^{-}, meq/L	10	10
Cl^{-}, meq/L	19	17.5

(b) Chemical analysis of irrigation water.

EC dS/m	pH	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}
		meq/L						
3.7	7.7	14	7.1	15	1.4	0.0	10	16.5

At harvest time (early July) of both seasons, the percentage of early maturity [(kg yield per tree at first harvest / kg total yield per tree) / 100] and harvest spread (number of days from the beginning to the final harvest) were recorded. For fruit quality determinations, fruits of the whole bunch were evaluated for their colour uniformity according to an established colour (0-25%, >25-<50%, >50-<75%, >75-<100% and 100%). Colouration was rated as 1, 2, 3, 4 and 5, respectively. Cluster weight and length and berry length, diameter, weight and volume were recorded during both seasons. In berry juice, total soluble solids (TSS) were determined using a hand refractometer. Acidity was determined according to A.O.A.C (1984). Anthocyanin was measured colourimetrically in the separated berry skin extract at 530 nm (Rabino *et al.*, 1977). Firmness was determined using a grapes pressure tester and sugars content was determined according to the procedure outlined by Loomis and Shull (1937) and Malik and Singh (1980).

The data were statistically analyzed using the analysis of variance method (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

1. Cluster weight and length

1.1. Effect of nitrogen sources

Regarding the effect of nitrogen sources; i.e., urea, ammonium sulphate and ammonium nitrate on cluster weight and length of Flame Seedless grapes grown in calcareous soil, it is clear from data in Tables (2 and 3) that addition of nitrogen as urea or ammonium nitrate increased cluster weight and length as compared with ammonium sulphate. These results are true in both seasons. The increase in cluster weight due to urea or ammonium nitrate could be attributed to positive effect of urea or ammonium nitrate on berry weight and volume (Tables 2 and 3). These results are in agreement with those obtained by Abd El-Khalek (1992), who found that urea and ammonium nitrate applied to grapes increased cluster weight and volume. Additionally, Mansour (1998) on grapes and Saleh *et al.*(2000) on pears found that the coated urea increased cluster or fruit weight.

1.2. Effect of nitrogen application times

Regardless of nitrogen sources and sulphur application rates, data in Tables (2 and 3) indicated that the addition of nitrogen at three equal doses to the Flame Seedless grapes grown in calcareous soil increased both weight and length of cluster during both seasons. The increase in the cluster weight resulting from adding nitrogen fertilizer at three equal doses could be attributed to increasing berry weight by adding nitrogen at three equal doses (Tables 2 and 3). Kassem *et al.*(1995a) and Saleh *et al.*(2000), however, found no differences between the three times of nitrogen application on the fruit weight.

1.3. Effect of sulphur

With regard to the effect of sulphur application on cluster weight and length of Flame Seedless grapes, the obtained results in Tables (2 and 3) revealed that the elemental sulphur increased weight and length of cluster, in the second season only. These results are in line with those reported by Kassem *et al.*(1995b) on guava and Harhash and Abd El-Nasser (2000) on Flame Seedless grapes. They found that sulphur increased cluster or fruit weight.

Table 2. Effect of nitrogen sources and application times and sulphur rates fertilization on the physical parameters and maturity of Flame Seedless grapes during 2001 season.

Treatments		Cluster weight (g)	Cluster length (cm)	Berry weight (g)	Berry volume (ml)	Berry diameter (cm)	Berry length (cm)	Berry firmness (g/cm^2)	Uniformity score	Early maturity (%)	Harvest spread (days)
Nitrogen sources (N)	Urea	449	22.8	2.98	2.80	1.80	1.79	518	4.6	36	30
	Am. sulphate	419	18.4	2.67	2.46	1.52	1.50	548	3.7	29	42
	Am. nitrate	447	21.6	2.91	2.78	1.68	1.67	526	4.0	31	33
	$L.S.D_{0.05}$	26	2.0	0.23	0.29	0.13	0.15	17	0.4	3	8
Nitrogen application times (T)	T_1	425	19.3	2.67	2.45	1.54	1.52	562	3.8	29	40
	T_2	401	20.5	2.80	2.60	1.64	1.63	523	4.0	30	35
	T_3	496	23.0	3.05	2.99	1.81	1.79	507	4.4	37	30
	$L.S.D_{0.05}$	26	2.0	0.23	0.29	0.13	0.15	17	0.4	3	8
Sulphur rates (S)	S_0	429	20.3	2.78	2.60	1.65	1.63	522	3.9	31	30
	S_1	448	21.6	2.94	2.76	1.69	1.67	540	4.3	33	40
	$L.S.D_{0.05}$	NS	NS	NS	NS	NS	NS	14	0.3	NS	7
$L.S.D_{0.05}$											
	N x T	*	*	*	*	*	*	*	*	*	*
	N x S	*	*	*	*	*	*	*	*	*	*
	T x S	NS	NS	NS	NS	NS	NS	*	*	NS	*
	N x T x S	*	*	*	*	*	*	*	*	*	*

Am. = Ammonium. * = Significant. NS = Not significant.

Table 3. Effect of nitrogen sources and application times and sulphur rates fertilization on the physical parameters and maturity of Flame Seedless grapes during 2002 season.

Treatments		Cluster weight (g)	Cluster length (cm)	Berry weight (g)	Berry volume (ml)	Berry diameter (cm)	Berry length (cm)	Berry firmness (g/cm^2)	Uniformity score	Early maturity (%)	Harvest spread (days)
Nitrogen sources (N)	Urea	480	21.2	2.98	2.86	1.83	1.82	528	4.4	33	30
	Am. sulphate	431	17.3	2.85	2.63	1.63	1.62	570	3.7	24	38
	Am. nitrate	497	19.6	3.04	2.89	1.78	1.77	530	4.0	26	30
L.S.D$_{0.05}$		32	1.6	0.12	0.14	0.08	0.10	32	0.5	5	7
Nitrogen application times (T)	T_1	452	17.5	2.90	2.75	1.70	1.70	586	3.6	22	37
	T_2	469	18.7	2.92	2.72	1.71	1.69	542	4.0	28	31
	T_3	487	22.0	3.05	2.93	1.83	1.81	500	4.5	33	30
L.S.D$_{0.05}$		32	1.6	0.12	0.14	0.08	0.10	32	0.5	5	7
Sulphur rates (S)	S_0	453	18.6	2.90	2.71	1.70	1.72	528	3.7	25	29
	S_1	489	20.2	3.02	2.89	1.80	1.75	558	4.4	31	36
L.S.D$_{0.05}$		28	1.3	0.10	0.11	0.07	NS	26	0.4	4	6
L.S.D$_{0.05}$											
N x T		*	*	*	*	*	*	*	*	*	*
N x S		*	*	*	*	*	*	*	*	*	*
T x S		*	*	*	*	*	NS	*	*	*	*
N x T x S		*	*	*	*	*	*	*	*	*	*

Am. = Ammonium. * = Significant. NS = Not significant.

2. Berry weight, volume, diameter and length

2.1. Effect of nitrogen sources

Concerning the effect of nitrogen sources on berry weight, volume, diameter and length, the data in Tables (2 and 3) indicated that, regardless of nitrogen application times and sulphur rates, the highest berry weight, volume, diameter and length of Flame Seedless grapes were obtained from trees fertilized with urea or ammonium nitrate as compared with ammonium sulphate, in both seasons. These results could be supported by the findings of Abd El-Khalek (1992), who reported that urea and ammonium nitrate increased berry weight and volume as compared with ammonium sulphate. Harhash and Abd El-Nasser and Saleh *et al.*(2000) reported that the different nitrogen sources affected fruit weight, volume, diameter and length. Moreover, Mortvedt *et al.*(1991) and Khattari and Shatat (1993) reported that increasing the fruit physical properties as a result of different nitrogen sources may be due to its effect on improving nutrients uptake which enhanced the formation of carbohydrates and cell enlargement.

2.2. Effect of nitrogen application times

Regardless of nitrogen sources and sulphur rates, the data in Tables (2 and 3) indicated that the addition of nitrogen at three equal doses increased berry weight, volume, diameter and length, in both seasons. Increasing the values of fruit weight, volume, diameter and length as a result of applied nitrogen at three equal doses may be due to its effect on improving nutrients uptake which enhanced fruit weight and volume. Abd El-Khalek (1992) reported that addition of nitrogen soil application at three equal doses increased berry weight and volume. Meanwhile, Saleh *et al.*(2000), on pears, did not find differences between the three times of application effect on fruit weight, volume, length and width.

2.3. Effect of sulphur

With regard to the effect of sulphur, the data in Tables (2 and 3) showed that sulphur increased berry weight, volume and diameter, in the second season only, but did not affect berry length, in both seasons. Such results are in harmony with those obtained by Harhash and Abd El-Nasser (2000) on Flame Seedless grapes. They found that the sulphur application increased berry weight, volume and diameter.

3. Berry firmness

3.1. Effect of nitrogen sources

The data in Tables (2 and 3) showed that, regardless of nitrogen application times and sulphur rates, the ammonium sulphate applied to the soil significantly increased berry firmness, in both seasons, as compared with urea or ammonium nitrate. These results are not in line with those obtained by Gobara (1998) and Saleh *et al.*(2000) on pears.

3.2. Effect of nitrogen application times

With regard to the effect of nitrogen application times on berry firmness of Flame Seedless grapes, the obtained data in Tables (2 and 3) showed that, regardless of nitrogen sources and sulphur rates, the addition of nitrogen fertilizer at one dose, in the first season, and at one dose or two equal doses, in the second season, increased berry firmness. These results disagreed with those obtained by Saleh *et al.*(2000) on pear. They found that the application of nitrogen fertilizer at one dose, two equal doses or three equal doses did not affect fruit firmness.

3.3. Effect of sulphur

Data presented in Tables (2 and 3) showed that, regardless of nitrogen sources and application times, the sulphur applied to the soil increased the berry firmness, in both seasons. Such increase may be explained on the basis that sulphur applied increased the uptake of some elements such as Ca (Harhash and Abd El-Nasser, 2000). Fruit firmness was positively correlated with leaf Ca content (Kassem, 1991).

4. Berries uniformity score

4.1. Effect of nitrogen sources

The tabulated results in Tables (2 and 3) clearly indicated that, regardless of nitrogen aplication times and sulphur rates, the berries from trees fertilized with urea had higher uniformity score as compared with ammonium sulphate, in both seasons and ammonium nitrate, in the first season only. No differences were found between the effect of ammonium sulphate and ammonium nitrate on berries uniformity, in both seasons. The study of Ghobrial (1991) on Thompson Seedless grown in calcareous soil, greatly strengthened the present results. He found that nitrogen applied to grapevines in the urea form was superior over the ammonium sulphate or ammonium nitrate to develop berry quality.

4.2. Effect of nitrogen application times

The results in Tables (2 and 3) showed that, regardless of nitrogen sources and sulphur rates, the addition of nitrogen at three equal doses increased berries uniformity as compared with one dose or two equal doses, in both seasons. The increase in cluster uniformity from trees fertilized with nitrogen at three equal doses could be attributed to the positive effect of nitrogen addition at three equal doses on berry sugars content (Table 4) which enhanced berry red colour.

4.3. Effect of sulphur

As regard to the effect of sulphur application, the data revealed that the berries uniformity score was significantly increased by sulphur application, in both seasons (Tables 2 and 3). Such increase may be explained on the basis that sulphur applied increased the uptake of N, Mg, K, Zn, Mn and Fe (Harhash and Abd El-Nasser, 2000), and these elements have close association with chlorophyll biosynthesis and increasing of photosynthesis rate (Hall and Rao, 1996). These results are in line with those obtained by Harhash and Abd El-Nasser (2000), who found that sulphur increased berry anthocyanin content.

5. Percentage of early maturity

5.1. Effect of nitrogen sources

Tables (2 and 3) show the effect of nitrogen sources, regardless of nitrogen application times and sulphur rates, on percentage of early maturity in both seasons. The trees fertilized with urea had higher percentage of early maturity as compared with ammonium sulphate or ammonium nitrate, in both seasons. No differences were obtained between ammonium sulphate and ammonium nitrate. These results may be due to the effect of urea on increasing uniformity and anthocyanin of berries. Abd El-Khalek (1992) reported that ammonium sulphate as well as urea were the effective forms for early ripening of berries.

5.2. Effect of nitrogen application times

Data in Tables (2 and 3) indicated that, regardless of nitrogen sources and sulphur rates, the addition of nitrogen fertilizer at three equal doses increased the percentage of early maturity, in both seasons, as compared with one dose or two equal doses.

5.3. Effect of sulphur

With regard to the effect of sulphur on percentage of early maturity, the data in Tables (2 and 3) indicated that sulphur application increased the percentage of early maturity. This increment was significant, in the second season only.

6. Harvest spread

6.1. Effect of nitrogen sources

With regard to the effect of nitrogen sources on harvest spread, the data in Tables (2 and 3) showed that, regardless of nitrogen application times and sulphur rates, ammonium sulphate application had the highest harvest spread as compared with urea or ammonium nitrate. No differences were found between ammonium nitrate and urea in their harvest spread, in both seasons.

6.2. Effect of nitrogen application times

Data in Tables (2 and 3) indicated that the addition of nitrogen fertilizer at one dose increased harvest spread as compared with three equal doses, in both seasons and two equal doses, in the first season only. These results may be due to the effect of nitrogen at one dose on decreased uniformity of berries.

6.3. Effect of sulphur

Regardless of nitrogen sources and application times, the data in Tables (2 and 3) indicated that sulphur application increased harvest spread, in both seasons. This increase may be due to the role of sulphur in increasing the nutrients uptake, which play an important role in producing favourable balance between growth and fruit production (Harhash and Abd El-Nasser, 2000).

7. Total soluble solids (TSS)

7.1. Effect of nitrogen sources

The tabulated results in Table (4) clearly indicated that, regardless of nitrogen application times and sulphur rates, the berries from grapevines under urea or ammonium nitrate fertilization had the highest TSS, in both seasons. These results are in line with those of Ghobrial (1991) on Thompson Seedless grapevines. He found that urea and ammonium nitrate were highly efficient to produce the highest berry quality. Saleh *et al.*(2000), on pear, found that the application of bentonite-coated urea resulted in the highest TSS content.

7.2. Effect of nitrogen application times

With regard to the effect of nitrogen application times, data in Table (4) indicated that the addition of nitrogen at three equal doses increased the berries TSS, in both seasons. These results disagreed with those obtained by Kassem *et al.*(1995a) on citrus and Saleh *et al.*(2000) on pear. They found that the fruit TSS did not significantly differ with applying the different nitrogen application times.

7.3. Effect of sulphur

Regardless of nitrogen sources and application times, data in Table (4) indicated that sulphur application increased the TSS content, in both seasons. These results are in agreement with those obtained by Kassem *et al.*(1995b). Meanwhile, Harhash and Abd El-Nasser (2000), on Flame Seedless grapes, found that the berries TSS were not affected by sulphur application.

8. Acidity

8.1. Effect of nitrogen sources and application times

Data in Table (4) indicated that the berries acidity was not affected by any of nitrogen sources and application times, in both seasons. These results are in line with those obtained by Kassem *et al.*(1995a).

8.2. Effect of sulphur

Data in Table (4) showed that sulphur rate did not affect berries acidity, in both seasons. These results are in line with those obtained by Harhash and Abd El-Nasser (2000) on Flame Seedless grapes.

Table 4. Effect of nitrogen sources and application times and sulphur rates fertilization on fruit quality parameters of Flame Seedless grapes during 2001 and 2002 season.

Treatments		2001 season					2002 season				
		TSS (%)	Acidity (%)	Reducing sugars (%)	Non-reducing sugars (%)	Anthocyanin (mg/100 g fruit)	TSS (%)	Acidity (%)	Reducing sugars (%)	Non-reducing sugars (%)	Anthocyanin (mg/100 g fruit)
Nitrogen sources (N)	Urea	14.60	0.89	10.86	1.46	8.60	14.86	0.96	11.08	1.62	9.72
	Am. sulphate	13.22	0.90	10.10	1.69	7.00	13.32	0.90	10.28	1.56	7.31
	Am. nitrate	14.38	0.94	10.54	1.43	8.39	14.79	0.92	11.12	1.50	9.30
$L.S.D_{0.05}$		1.07	NS	0.22	NS	1.16	1.26	NS	0.71	NS	1.09
Nitrogen application times (T)	T_1	13.63	0.86	10.30	1.70	7.16	13.69	0.90	10.41	1.62	8.20
	T_2	13.70	0.95	10.18	1.46	8.10	14.00	0.92	10.79	1.56	8.60
	T_3	14.88	0.92	11.00	1.42	8.72	15.28	0.97	11.31	1.50	9.53
$L.S.D_{0.05}$		1.07	NS	0.22	NS	1.16	1.26	NS	0.71	NS	1.09
Sulphur rates (S)	S_0	13.35	0.89	10.12	1.47	7.50	13.61	0.90	9.78	1.61	8.15
	S_1	14.78	0.92	10.87	1.58	8.49	15.03	0.95	11.87	1.52	9.37
$L.S.D_{0.05}$		0.88	NS	0.18	NS	0.95	1.03	NS	0.58	NS	0.89
$L.S.D_{0.05}$											
N x T		*	NS	*	NS	*	*	NS	*	NS	*
N x S		*	NS	*	NS	*	*	NS	*	NS	*
T x S		*	NS	*	NS	*	*	NS	*	NS	*
N x T x S		*	NS	*	NS	*	*	NS	*	NS	*

Am. = Ammonium. * = Significant. NS = Not significant.

9. Sugars content

Data in Table (4) showed that nitrogen sources and application times and sulphur rates did not affect berries non-reducing sugars content, in both seasons. Meanwhile, the reducing sugars were increased by urea or ammonium nitrate application at three equal doses and by sulphur application, in both seasons. Harhash and Abd El-Nasser (2000) found that sulphur application did not affect fruit sugars, while the different nitrogen sources affected fruit sugars content.

10. Berries anthocyanin

Regarding the effect of nitrogen sources and application times and sulphur rates, data in Table (4) showed that the berries anthocyanin content was increased by the addition of urea or ammonium nitrate, nitrogen application at three equal doses and by sulphur application rates, in both seasons. Harhash and Abd El-Nasser (2000), on Flame Seedless grapes, found that berries anthocyanin content was increased by the sulphur and nitrogen organic manure.

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الملخص العربى

إستجابة أشجار العنب صنف فيلام سيدلس النامى فى أرض جيرية ورى صرف لإضافة الكبريت والنتروجين بصور وعدد مرات إضافة مختلفة.
٢- النضج - فترة الجمع - صفات جودة الثمار الطبيعية والكيماوية بعد القطف.

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أجريت هذه الدراسة خلال عامى ٢٠٠١ ، ٢٠٠٢ على أشجار العنب صنف فيلام سيدلس النامى فى أرض جيرية وظروف رى ماء الصرف لغرض دراسة تأثير نوع وميعاد وعدد مرات السماد النتروجينى وكذلك الإضافة الأرضية للكبريت على النضج وفترة الجمع وصفات جودة الثمار الطبيعية والكيماوية بعد القطف.

وفيمايلى ملخص النتائج المتحصل عليها:

١- بغض النظر عن عدد مرات إضافة النتروجين ومعدل إضافة الكبريت، فإن تسميد الأشجار بكل من سماد اليوريا ونترات الأمونيوم سبب زيادة فى كل من وزن وطول العنقود الثمرى - وزن وحجم وقطر وطول الثمرة - محتوى الثمار من المواد الصلبة الذائبة الكلية والسكريات المختزلة وصبغة الأنثوسيانين فى عامى الدراسة. التسميد بسماد اليوريا سبب زيادة فى تجانس لون الثمار والنضج خلال عامى الدراسة بينما التسميد بسلفات الأمونيوم يسبب زيادة فى الصلابة وفترة الجمع وكل من الحموضة والسكريات الغير مختزلة لم تتأثر بأى من مصدر النتروجين.

٢- بغض النظر عن مصدر النتروجين ومعدل الكبريت الأرضى فإن إضافة التسميد النتروجينى على ثلاث دفعات سبب زيادة فى كل من وزن وطول العنقود - وزن وحجم وقطر وطول الثمرة - محتوى الثمار من المواد الصلبة الذائبة الكلية والسكريات المختزلة وكذلك الأنثوسيانين والنضج وتجانس لون الثمار خلال عامى الدراسة بينما الإضافة على دفعة واحدة سبب زيادة فى صلابة الثمار وفترة الجمع ولم يكن هناك تأثير لميعاد الإضافة على محتوى الثمار من الحموضة والسكريات الغير مختزلة.

٣- بغض النظر عن مصدر وعدد مرات إضافة السماد النتروجينى سبب الكبريت الأرضى زيادة فى وزن وطول العنقود - وزن وحجم وقطر الثمار خلال العام الثانى فقط - صلابة الثمار وتجانس لونها ومحتواها من المواد الصلبة الذائبة الكلية والسكريات المختزلة والنضج وكذلك فترة الجمع خلال عامى الدراسة. كل من طول الثمرة ومحتوى الثمار من الحموضة والسكريات الغير مختزلة لم تتأثر بإضافة الكبريت الأرضى.