RESPONSE OF FLAME SEEDLESS AND SUPERIOR GRAPEVINES GROWN ON SANDY CALCAREOUS SOIL TO SOME PHOSPHAT DISSOLVING BACTERIA TREATMENTS

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Abstract

High pH level in Egyptian sandy calcareous soils (soils of Sedmant Al-Gabl – Beni Suef Governorate) led to fix the phosphorus under insoluble form such as tri-calcium phosphate. In this study, two grapevine *cvs* Flame seedless and Superior were biofertilized with phosphorien as a source of phosphate dissolving bacteria "*Bacillus megaterium* " at 20g once, twice or thrice addition for to three consecutive seasons namely 2005/2006, 2006/2007, and 2007/2008.

The study showed that, regardless the cultivars treating the vines with phosphorien significantly increased the leaf area and shoot length especially in the third season. Phosphorien had a significant effect on leaf mineral contents especially NPK as compared with untreated vines. Neither Flame seedless nor Superior showed significant differences in magnesium contents for the three experiment seasons and calcium content for the first and second seasons, whatever the number of applications.

Yield per vine significantly increased as a result of phosphorien treatments in both cultivars especially for the vines received phosphorien three times. The response of berries chemical content to phosphorien application was much more remarkable than those of physical properties, except those of cluster weight. However, T.S.S and reducing sugars were significantly increased as a result of phosphorien treatment in both cultivars. An obvious decrease in total acidity was noticed due to the use of phosphorien application, this increment was more remarkable for the Superior cultivar. The investigated treatments had no negative effect on the overall quality characteristics of berries.

For overcoming soil P fixation problem as well as the stimulating growth and fruiting of Flame seedless and Superior grapevines growing under sandy calcareous soil, it is advised to application of phosphorien at 20g / vine three times.

Key Words: Phosphorien, Grapevine, Flame Seedless, Superior, Bacillus megaterium, Sandy soil.

INTRODUCTION

Grapevine is one of the major horticulture crops throughout the world. While grapes are cultivated on approximately 8.3 million ha worldwide, with a total world production of over 674 million tons of fruits per year (F.A.O., 2006). It is well known that vines have great adaptability and thrives in wide range of climatic and soil conditions (Bacha, 1986 and Allewldt *et al.*, 1990). Moreover, grapes are grown successfully in new Egyptian reclamation soil. Flame seedless and superior cultivars are newly early in ripening season grapevine *cvs*.

During the last four decades the reclamation and improvement of new lands in Egypt is an absolute must to face the ever-increasing demand of the growing population. One of the most important main problems of Egyptian desert soils is high pH level, led to fix the phosphorus under insoluble form such as tri-calcium phosphate. (Case of Sedmant Al-Gabl – Beni Souif Governorate).

Microorganisms can stimulate, inhibit, or be without effect on root growth, depending on the type of microorganism, plant species, and environmental conditions (Marschner 1995 and Fusseder 1984). From this point of view Bowen and Rovira (1991) classified the soil microorganisms into two categories in relation to their effect on plant growth:

- Negative (detrimental): such as root pathogens, subclinical pathogens; detrimental rizobacteria; and cyanide producers.
- Positive (beneficial): such as rhizobia, mycorrhizae; antagonists (bio control) of detrimental microorganisms; hormone producers; plant growth promoting bacteria. It is well known that Phosphate dissolving bacteria "Bacillus megaterium" is classified as beneficial bacteria, and it is widely used as biofertilizers.

Biofertilization for fruit crops has called the attention of research workers particularly grapevine growers and it has become in the last few tenth years a positive alternative to chemical fertilizers. It is well known that biofertilizers are very safe for human, animal and environment. The positive effects of applying phosphorien as biofertilizers were attributed to its effect on dissolving the tricalcium phosphate by

This study focused on the response of two early in ripening season grapevine *cvs* namely Flame seedless and Superior to the treatment of phosphorien biofertilizers as a source of phosphate dissolving bacteria "*Bacillus megaterium*" once, twice or thrice application for three consecutive seasons 2005/2006, 2006/2007 and 2007/2008.

MATERIALS AND METHODS

The present study was conducted during successive seasons, 2005/2006; 2006/2007 and 2007/2008in a private vineyard located at Sedmant Al-gable Beni-Suef Governorate where the soil texture is sandy. In the first season of study, sixteen vines uniform in vigour from the two grapevine *cvs* Flame seedless and Superior were selected. The selected vines received the common and normal horticultural practices, that applied in the vineyard, namely 100 g N/vine applied in the form of urea (46% N), 250 kg calcium superphosphate (15.5 % P_2O_5) and 200 kg potassium sulphate

/fed. As well as well as irrigation, hoeing and pest management were cared out as usual.

Plant material

The selected Flame seedless and Superior grapevines were 7 years old at the start of experiment. The chosen vines were trained according to cane pruning system using Gable shape supporting system. Winter pruning was cared out the first week of January in the three experimental seasons. Vine load was adjusted to 66 buds per vine (6 fruiting cans X 9 buds plus 6 renewal spurs X 2 buds). The planting density was 1.5 X 2.5 meters. Drip irrigation system was followed in this vineyard.

Soil characters

Sedmant Al-gabl, where the present experiment was carried out, is a new reclamated area at the boerd of West desert Samosta District, Beni-Suef Governorate. Physical and chemical analysis of the vineyard soils was conducted according to the procedures outlined by Chapman and Partt,(1961) and the data are shown in Table (1).

Table 1. Physical and chemical Properties of the experimental soils.

Flame seedless soil analysis		Superior soil analysis	
Soil character	Values	Soil character	Values
Sand %	85.40	Sand %	85.68
Silt %	11.82	Silt %	12.84
Clay %	2.49	Clay %	1.45
Texture	Sandy	Texture	Sandy
Organic matter %	0.7	Organic matter %	0.6
pH (1: 2.5 extract)	8.1	pH 1 :2.5 W	7.9
Total $CaCO_3$ %	7.0	$CaCO_3$ %	7.0
Total N %	0.08	Total N %	0.07
Available P (Olsen, ppm)	3.25	Available P %	4.5
Exch. K^+ (mg/100g)	16.9	Exch. K^+ mg/100g	19.5
Exch. Ca^{++} (mg/100g)	20.8	Exch. Ca^{++} mg/100g	22.6

Experimental work

Preliminary studies were carried out during one season before the present study, on order to justify the suitable phosphorien dose. From the recommendation of Ministry of Agriculture of phosphorien suitable doses of fruit trees four doses of phosphorien 10, 20, 30, 40g (each g. contain 10^8 Cell of phosphate dissolving bacteria variety phosphaticum) were tested on grapevines under similar conditions of the present experiment. The obtained results confirmed that, the dose of 20g is the more adapted and suitable with grapevines needs. This means that all selected vines received phosphorien at fixed rate namely 20g/vine.

This experiment included two factors (A&B). The first factor (A) consisted from two grapevine *cvs* namely (a_1) Flame seedless and (a_2) Superior. The second factor (B) comprised from the four frequencies of the biofertilizers phosphorien namely (b_1) 0.0 (b_2) once at the middle of December, (b_3) twice at middle December and after pruning (middle of January), and thrice at the two previous dates and at the start of bud burst (15 and 10 March for Flame seedless and Superior grapevines respectively).

Experimental design

Treatments were arranged in a completely randomized block design in split plot arrangement, where the two cultivars occupied the main plots (A) and the phosphorien treatments ranked the sub plots (B). Each treatment was replicated four times; one vine per each replicate was used.

Different measurements

The following vegetative growth, leaf mineral content, yield as will as physical and chemical characters of berries were measured during the three experimental seasons.

1- Vegetative growth characters

Main Shoot length (cm) was measured at the middle of May in the experimental seasons in four main shoots in the four main directions of vine. Leaf area (cm^2) was estimated in the twenty leaves per vine from those leaves opposite to the first cluster on each shoot (at medal May) and leaf area was recorded according to Ahmed and Morsy (1999) equation.

2- Determination of N, P, K, Ca and Mg in leaves

The petioles were separated and discarded and the blade only used for determine the leaf mineral content. The blades washed with distillated water and dried at air and oven dried and grounded, then 0.5g weight was digested using H_2SO_4 and H_2O_2 until clear solution was obtained (Martin-Prével *et al.,* 1984). The digested solution was quantitatively transferred to 100 volumetric flask and completed to 100 ml by distilled water. Thereafter, contents of N, P, K, Ca and Mg for each sample were determined as follows:

Nitrogen was determined by the modified microkejldahl method as described by (Martin-Prével *et al.,* 1984.)

Phosphorus was determined by using colorimetric methods, described by Martin-Prével *et al.,* 1984, by measuring the optical density of phosphor-molibdo-vanadate complex by spectrophotometer at wave length 430 nm.

Potassium was flame-photometrically determined by using the method outlined by Martin-Prével *et al.,* (1984), and calcium and magnesium were determined by atomic absorption by using the method outlined by Martin-Prével *et al.,* (1984).

3- Measurment of yield as well as physical and chemical properties of berries

The clusters were harvested when TSS/acid in the berries of the check treatment reached 24-25 (According to Winkler *et al.,* 1974 and Weaver., 1976). The yield per vine was recorded in terms of weight (kg) and number of clusters per vine. Five clusters were taken at random from the yield of each vine as a composite sample for determination of the following physical and chemical parameters:

- Average cluster weight (g) by using 0.01 sensitivity balance.
- Average berry weight (g) by using 0.01 sensitivity balance, and dimensions (longitudinal and equatorial, in cm) by using vernier caliper.
- Percentage of Total soluble solids in the juice by using handy refractometer.
- Percentage of total acidity (expressed as g of tartaric acid per 100 ml of juice) by titration against 0.1 NaOH using phenolphthalein as an indicator (A.O.A.C, 1985).
- Percentage of total reducing sugars in the juice by using Lane and Eynone volumetric method (Rangana, 1977).

Statistical analysis of data:

All the obtained data were tabulated and subjected for the proper statistical analysis, by analysis of variance (ANOVA) using the statistical package MSTATC Program. Comparisons between means were made by the F-test and least significant differences (L.S.D.) at P = 0.05.

RESULTS AND DISCUSSION

1- Effect of phosphorien on the shoot length and leaf area

Data concerning the effect of phosphorien on the shoot length and leaf area in the two tested cultivars during the three experimental seasons (2006/206; 2006/2007 and 2007/2008) are show in table (2). It's clear from this table that, phosphorien application significantly stimulated the main shoot length. However, a gradual increase in both cultivars shoot lengths as a result of increasing the times of application was observed. The response of Flame seed less *cv* remain much more clear than those of

Superior cultivar, and this increment was more clear in the third season than those in the second and first ones.

The same table (2) declares significant increment in the leaf area as the number of phosphorien treatment increased. Regarding the response of the tow cultivars, it is clear from the same table that Flame seed less was more responded than those of Superior. Moreover, the interaction between the cultivars and phosphorien treatment had significant effect on shoot length and leaf area. It is obvious that both shoot length and leaf area were gradually increased from year to year, with increasing number of phosphorien applications.

The role of phosphorien "as a source of phosphate dissolving bacteria" in augmenting shoot length and leaf area, which indicated in the present study, can be explained by the role of these bacteria in reduce soil pH level surround the vine roots system that led to increase the phosphorus valuable to plant absorption. It is known that, phosphorous in plant participant the bio energy compounds "ATP, ADP" which are very important for enhance the vine growth. Also, the increments in leaf area as a response of increasing the available soil phosphate were observed on others fruit trees such as olives (Ahmed and El-Dawwi 2005) and on other plants by Lynch *et al.,* (1991) and Marschner (1995).

2- Effect of phosphorien on the leaf mineral contents

Leaf mineral contents of Flame seedless and Superior grapevines cultivars in response to different frequencies of phosphorien (once twice and thrice times), are shown in Tables (3 and 4). All phosphorien treatments, at both cultivars, caused significant effect on leaf phosphorus content in the second and third experimental seasons. Their effect on Nitrogen and Phosphorus contents were significantly at 5% as shown in Table (3). They increased gradually by increasing the numbers of phosphorien applied from 0 to 3 times.

Leaves potassium content, in response to phosphorien application followed the same trend of leaves nitrogen content present in the same table. Gradual and consistent increase in leaves K content was observed parallel to the increasing in the number of phosphorien application in the three experimental seasons and significant differences were found, in the three experimental seasons. Moreover, the leaves of Superior *cv* had higher and significant potassium content than those of Flame seedless during the three experimental seasons (Table 3).

On the other hand, non significant differences in Mg content were remarked, except those of the interaction between the cultivars and the number of phosphorien application in the second season for the two tested cultivars, where the vine treated with phosphorien at three times yearly. However, the calcium absorption and accumulation in leaves remain more affected by phosphorien treatments than those of magnesium. Flame seedless had higher and significant calcium content than those of Superior in the first and second seasons, however, the differences were slightly and un significant at the third season. The highest calcium level for the two tested cultivars were obtained when the vine treated three time with phosphorien at the third season (2.283 %) for Flame leaves and (2.33 %) in the first season for Superior cultivar.

The obtained results indicated that the most effective treatment on increasing the leaf N, P and K was the application of phosphorien at three times yearly for the three consecutive years.

The stimulation on vine nutritional status in response to using biofertilizers was confirmed by the results of El-Sayed (2001) and Ahmed *et al.,* (2003) on Flame seedless grapevines, as well as Abada (2002) and Ahmed *et al.,* (1995) on Red Roomy grapevine

Effect of phosphorien treatments on yield components

The data listed in Table (4) show the influence of the application of phosphorien on yield component of Flame seedless and Superior cultivars. The obtained results reveled that increasing the number of phosphorien applications resulted in a significant increase in cluster number and cluster weight.

Vines treated by phosphorien were characterized by increasing cluster numbers and cluster weight compared to the untreated vines. This increment varied depending on the number of applications. The application of phosphorien at three times a year produced the highest number of cluster and highest cluster weight in the three experimental seasons followed by using two applications (Table 4). Gradual and significant increase in cluster weight was observed as a result of increasing the number of phosphorien applications. This increment remained clearly at the second and third seasons. However, the number of clusters did not alter significantly in the first season of study.

Yield in kg per vine also increased as a result of increasing clusters number and weight, especially when the vine received three doses of phosphorien yearly. This increment was 28 % than control in the first season, 52 % than the control in the second season and 46 % for the third season.

Yield and cluster weight promotion in response to using the biofertilizer phosphorien was confirmed by the results of Ahmed *et al.,* (1997), El-Sayed (2001), Abada (2002) and Ibrahim Asmaa (2005).

Effect of phosphorien treatments on berry physical properties

Data concerning the effect of phosphorien application once, twice and three times on physical properties of berries in the two tested cultivars during the three experimental seasons are shown in Table 4. From this table, slightly and non significant effect of phosphorien on berry dimensions (longitudinal and equatorial) of two cultivars, except the third season when it was three time applied in both cultivars. Moreover, berry weight increased slightly during the first and second seasons, but in the third season this increment remained significantly (Table 4).

The observed increase in berry weight during the third seasons may be attributed to the increase in the phosphorus absorption by roots that caused an increase in photosynthesis activity as well as cell division and elongation (Marschinar 1995).

Effect of phosphorien treatments on berry chemical properties

Significant increase of total soluble solids and reducing sugars of berry juice of vine treated with phosphorien was recorded. Moreover, this increment related to the numbers of phosphorien applications, once twice and thrice times (Table 6).

The same table declared that, increasing the number of phosphorien applications (once, twice and thrice times) was associated with a progressive and significant decrement in the berry juice acidity. This decrement was more clear in the second and third seasons than in the first season.

Table (7) indicated the existence of significant differences, on the chemical characters in the three experimental seasons, for the interaction between cultivars and number of phosphorien applications. The results indicated that the vines which received of phosphorien twice and three times for each season gave the highest T.S.S ratio and reducing sugar percentage than those untreated or received phosphorien once per season. On the other hand, the same table declared that, increasing the T.S.S and reducing the total acidity led to remarkable and significant increasing in the T.S.S/ acidity ratio as compared to untreated vines.

The role of phosphorien treatment in augmenting T.S.S and reducing sugars content and reducing total acidity, which obtained in the present study, was in accordance with the results obtained by Ahmed *et al.,* (1997), El-Sayed (2001), Abada (2002) and Ibrahim Asmaa (2005) and Ibrahim Hamdy (2001) on some French wine cultivars. Similar results insured the positive effect of phosphorien on increasing the T.S.S and Sugars and reducing the total acidity as those stated by Ahmed and El-Dawwy (2001) on olive trees.

As a conclusion treating Flame seedless and Superior grapevines grown under sandy soil with phosphorien three times for each seasons obviously overcoming the fixation of P and the same time improving growth and fruiting of the vines.

Table 2. Effect of phosphorien treatments on main shoot length (cm) and leaf area (cm^2) of Flame seedless and Superior cultivars cultivated at sandy soil.

	Main shoot length (cm)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	84.75	98.18	91.46	84.53	100.20	92.36	92.58	96.47	94.53
b2	91.45	99.85	95.65	94.23	108.00	101.11	105.58	110.57	107.93
b3	87.67	107.25	97.46	108.30	111.78	110.04	119.43	114.10	116.76
b4	100.70	107.25	103.98	110.75	118.60	114.67	124.58	125.03	124.80
Mean b	91.14	101.13		99.45	109.64		110.54	111.47	
LSD 5%	*A= 6.5 B=8.62 AB=12.19*			*A=NS B=7.34 AB=10.37*			*A=NS B=7.90 AB=11.16*		
	Leaf area (cm^2)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	125.23	119.95	122.29	122.59	122.97	121.45	122.50	120.83	121.66
b2	126.65	123.10	124.88	127.18	125.53	126.35	123.35	124.88	124.11
b3	127.35	124.43	125.89	126.00	123.97	124.99	123.68	125.18	124.43
b4	127.05	126.23	126.64	127.13	125.83	126.48	127.58	127.35	127.46
Mean b	126.57	123.43		125.82	124.19		124.28	124.56	
LSD 5%	*A=NS B=3.23 AB=4.57*			*A= B= AB=*			*A= B= AB=*		

Table 3. Effect of phosphorien treatments on leaf N, P, and K contents (% dry weight) of Flame seedless and Superior cultivars cultivated at sandy soil during 2005/2006, 2006/2007 and 2007/2008 seasons.

	Leaf N content (% dry weight)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	2.032	1.860	1.946	2.063	1.900	1.981	2.002	1.852	1.927
B2	2.272	2.308	2.900	2.215	2.418	2.316	2.257	2.420	2.339
B3	2.320	2.502	2.411	2.362	2497	2.430	2.418	2.456	2.436
B4	2.390	2.475	2.433	2.417	2.478	2.447	2.423	2.470	2.446
Mean a	2.254	2.286		2.264	2.323		2.275	2.299	
LSD 5%	*A=0.55 B=0.38 AB=0.21*			*A=0.32 B=0.28 AB=0.36*			*A=0.71 B=0.21 AB=0.23*		
	Leaf P content (% dry weight)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	0.237	0.202	0.220	0.230	0.217	0.224	0.227	0.200	0.214
B2	0.252	0.225	0.239	0.280	0.227	0.255	0.305	0.238	0.271
B3	0.297	0.250	0.274	0.325	0.317	0.321	0.345	0.340	0.343
B4	0.317	0.315	0.316	0.343	0.328	0.3335	0.350	0.345	0.348
Mean a	0.276	0.248		0.295	0.272		0.307	0.281	
LSD 5%	*A= 0.036 B= 0.03 AB=0.047*			*A=0.04 B=0.02 AB=0.05*			*A=0.019 B=0.02 AB=0.025*		
	Leaf K content (% dry weight)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	1.350	1.468	1.409	1.300	1.493	1.396	1.360	1.465	1.413
b2	1.538	1.587	1.462	1.333	1.583	1.458	1.392	1.525	1.459
b3	1.440	1.637	1.539	1.390	1.635	1.513	1.490	1.688	1.589
b4	1.442	1.780	1.611	1.470	1.745	1.607	1.550	1.770	1.660
Mean a	1.392	1.618		1.373	1.614		1.448	1.612	
LSD 5%	*A= 0.09 B=0.105 AB=0.148*			*A=0.05 B=0.088 AB=0.152*			*A=0.05 B=0.066 AB=0.09*		

Table 4. Effect of phosphorien treatments on leaf Ca and Mg contents (% dry weight) of Flame seedless and Superior cultivars cultivated at sandy soil during 2005/2006, 2006/2007 and 2007/2008 seasons.

	Leaf Ca content (% dry weight)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	2.340	2.168	2.254	2.260	0.022	2.141	2.207	2.070	2.139
B2	2.377	2.140	2.259	2.220	2.202	2.211	2.235	2.092	2.164
B3	2.278	2.188	2.233	2.123	2.133	2.128	2.185	2.018	2.101
B4	2.345	2.180	2.263	2.163	2.138	2.150	2.283	2.330	2.306
Mean a	2.335	2.169		2.191	2.124		2.228	2.127	
LSD 5%	*A=0.32*	*B= 0.29*	*AB=0.42*	*A=0.31 B=0.21 AB=0.30*			*A=NS B=0.66 AB=0.30*		
	Leaf Mg content (% dry weight)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	0.302	0.310	0.331	0.318	0.370	0.340	0.358	0.345	0.351
B2	0.293	0.350	0.321	0.325	0.361	0.341	0.358	0.346	0.351
B3	0.315	0.328	0.321	0.317	0.352	0.335	0.345	0.365	0.355
B4	0.335	0.328	0.328	0.327	0.367	0.342	0.401	0.355	0.380
Mean a	0.314	0.331		0.322	0.364		0.366	0.352	
LSD 5%	*A=NS*	*B=NS*	*AB=NS*	*A=NS B = NS AB= 0.09*			*A=NS B=NS AB=0.039*		

Table 5. Effect of phosphorien treatments on yield components of Flame seedless and Superior cultivars cultivated at sandy soil during 2005/2006, 2006/2007 and 2007/2008 seasons.

	Cluster numbers								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	18.8	20.5	19.6	18.0	20.0	19.0	19.8	19.8	19.8
B2	19.8	20.8	20.25	21.0	23.3	22.1	22.3	23.0	22.6
B3	21.5	21.8	21.63	23.0	24.0	23.8	23.8	24.0	23.9
B4	23.5	22.5	22.0	25.0	24.5	24.8	26.6	25.8	26.1
Mean a	20.9	21.4		21.9	22.9		23.2	23.1	
LSD 5%	*A=NS B=NS AB=NS*			*A=NS B=3.66 AB= 5.2*			*A= NS B=1.9 AB=2.7*		
	Cluster weight (g)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	358.8	306.8	332.8	381.8	315.0	348.38	392.0	340.3	366.1
B2	356.8	327.5	342.1	391.0	338.3	364.63	396.5	389.0	392.8
B3	358.0	321.0	339.5	399.3	395.8	397.5	403.0	394.3	393.6
B4	392.3	328.0	360.1	406.8	402.8	404.75	405.5	401.8	403.6
Mean a	366.4	320.8		394.7	362.9		399.3	381.3	
LSD 5%	*A=8.3 B=11.6 AB=16.5*			*A=8.7 B=1.8 AB=16.7*			*A=NS B=NS AB=22.4*		
	Yield / vine (kg)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	6.70	6.28	6.49	6.85	6.30	6.58	7.75	6.65	7.20
B2	7.05	6.83	6.94	8.20	7.85	8.03	8.83	8.90	8.86
B3	7.70	6.98	7.34	9.38	9.53	9.45	9.53	9.45	9.51
B4	8.80	7.88	8.34	10.18	9.88	10.03	10.75	10.37	10.56
Mean a	7.56	6.99		8.65	8.39		9.23	8.84	
LSD 5%	*A=NS B=0.8 AB=1.2*			*A=NS B=1.4 AB=2.0*			*A=NS B=0.8 AB=1.2*		

Table 6. Effect of phosphorien treatments on berry physical properties of Flame seedless and Superior cultivars cultivated at sandy soil during 2005/2006, 2006/2007 and 2007/2008 seasons.

	Berry Weight (g)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	2.73	3.23	2.98	2.78	2.83	2.80	2.73	3.33	3.03
B2	2.83	3.30	3.07	2.85	3.45	3.15	2.86	3.58	3.23
B3	2.85	3.37	3.11	2.85	3.35	3.10	2.90	3.63	3.26
B4	2.93	3.47	3.20	2.85	3.60	3.23	3.00	3.77	3.39
Mean a	2.84	3.34		2.83	3.61		2.86	3.58	
LSD 5%	*A=NS B= NS AB=0.199*			*A=0.05 B=0.015 AB=0.21*			*A=0.05 B=0.15 AB=0.10*		
	Berry longitudinal (cm)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	3.43	1.50	2.46	1.45	1.62	1.53	1.40	1.64	1.52
B2	1.40	1.50	1.45	1.46	1.57	1.52	1.43	1.40	1.53
B3	1.41	1.53	1.47	1.44	1.55	1.50	1.45	1.68	1.57
B4	1.43	1.53	1.47	1.45	1.64	1.55	1.47	1.82	1.64
Mean a	1.92	1.53		1.45	1.60		1.44	1.69	
LSD 5%	*A=NS B=1.47 AB=1.82*			*A=0.07 B=0.07 AB=0.09*			*A=0.12 B=0.08 AB=0.12*		
	Berry equatorial (cm)								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	1.25	1.42	1.34	1.27	1.44	1.36	1.20	1.57	1.39
B2	1.21	1.46	1.33	1.27	1.47	1.37	1.23	1.57	1.40
B3	1.22	1.48	1.35	1.24	1.50	1.37	1.24	1.58	1.41
B4	1.23	1.51	1.37	1.29	1.54	1.41	1.34	1.59	1.46
Mean a	1.23	1.47		1.27	1.49		1.26	1.58	
LSD 5%	*A=0.04 B=0.06 AB=0.08*			*A=0.10 B=0.05 AB=0.07*			*A=0.14 B=0.09 AB=0.12*		

Table 7. Effect of phosphorien treatments on berry chemical properties of Flame seedless and Superior cultivars cultivated at sandy soil.

	Juice T.S.S %								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	17.55	18.65	18.10	18.15	20.23	19.19	17.88	19.30	18.59
b2	17.43	21.15	19.29	19.29	18.90	19.69	18.65	22.03	20.34
b3	18.25	22.20	20.23	18.85	22.00	20.43	20.90	23.53	22.21
b4	18.10	22.50	20.30	20.15	23.43	21.79	20.95	24.90	22.93
Mean a	17.83	21.13		19.01	21.53		19.59	22.44	
LSD 5%	*A=1.10 B=0.56 AB=0.81*			*A=1.06 B=0.94 AB=1.33*			*A=0.55 B=1.11 AB=1.57*		
	Juice reducing sugars %								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	14.98	15.82	15.40	15.54	17.27	16.41	15.06	16.97	16.01
b2	14.91	17.92	16.41	16.18	17.46	16.82	15.55	18.87	17.21
b3	15.62	18.80	17.21	16.14	18.59	17.37	17.76	20.14	18.95
b4	15.49	19.06	17.28	17.25	20.01	18.63	17.94	21.31	19.62
Mean a	15.25	17.90		16.28	18.33		16.58	19.32	
LSD 5%	*A=0.95 B=0.51 AB=0.73*			*A=0.84 B=0.79 AB=1.09*			*A=1.01 B=0.99 AB=1.39*		
	Juice acidity %								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	0.747	0.718	0.733	0.789	0.733	0.761	0.774	0.714	0.744
b2	0.688	0.690	0.689	0.765	0.679	0.722	0.730	0.663	0.696
b3	0.607	0.638	0.622	0.752	0.667	0.709	0.711	0.681	0.697
b4	0.642	0.635	0.390	0.704	0.668	0.686	0.690	0.657	0.673
Mean a	0.671	0.670		0.752	0.687		0.726	0.679	
LSD 5%	*A=NS B=0.0232 AB=0.047*			*A=0.035 B=0.045 AB=0.047*			*A=0.036 B=0.018 AB=0.026*		
	T.S.S / Acidity ratio								
	Season 2005 / 2006			Season 2006 / 2007			Season 2007 / 2008		
	Flame	Superior	Mean b	Flame	Flame	Mean b	Flame	Superior	Mean b
Control b1	24.25	26.00	25.125	23.05	26.85	24.95	23.28	26.75	25.01
b2	25.50	30.45	27.975	24.73	30.15	27.44	26.05	33.25	29.65
b3	28.18	34.80	31.488	25.13	33.00	29.06	29.43	34.53	31.96
b4	28.23	35.30	31.762	28.65	34.40	31.53	30.33	37.65	33.99
Mean a	26.538	31.637		25.39	31.10		27.27	33.04	
LSD 5%	*A=2.35 B=1.69 AB=2.39*			*A=2.11 B=1.42 AB=2.01*			*A=0.88 B=1.58 AB=2.24*		

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إستجابة كرمات العنب الفلايم سيدلس والسوبريور النامية في التربة الرملية الجيرية لبعض معاملات البكتريا المذيبة للفوسفور

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يؤدي ارتفاع رقم الـ pH في الأراضي الرملية الجيرية (كما في حالة أرض سدمنت الجبل – محافظة بني سويف) إلى حدوث تثبيت للفوسفور في صورة فوسفات الكالسيوم الثلاثية الغير ذائبة. في هذه الدراسة تم التسميد الحيوي لصنفين من أصناف العنب هما الفلايم سيدلس والسوبريور بسماد الفوسفورين كمصدر للبكتريا المذيبة للفوسفور "*Bacillus megaterium*" بمعدل ٢٠ جرام للكرمة وتمت الأضافة مرة، ومرتان وثلاث مرات في العام بالأضافة الي معاملة الكنترول خلال الثلاث مواسم المتتالية ٢٠٠٥/٢٠٠٦ و ٢٠٠٦/٢٠٠٧ و ٢٠٠٧/٢٠٠٨.

أشارت نتائج الدراسة أنه بغض النظر عن أصناف العنب فأن معاملة الكرمات بالفوسفورين أدت الي حدوث تحسنن واضح في مساحة الورقة وطول النموالرئيسي خصوصاً في الموسم الثالث. كذلك كان للفوسفورين تأثير واضح علي التركيب المعدني للورقة خصوصاً النيتروجين والفوسفور والبوتاسيوم وذلك بالمقارنة بعدم أستخدامة ولم يكن لأختلاف أصناف العنب أية تأثير علي محتوي الورقة من الماغنسيوم في المواسم الثلاثةوكذلك محتوي الورقة من الكالسيوم في الموسم الأول والثاني بغض النظر عن عدد مرات إضافة الفوسفورين. وكانت هناك زيادة معنوية في المحصول نتيجة أستخدام الفوسفورين في كلا الصنفين خاصة عند أستخدامة ثلاث مرات.

وكان تأثير إضافة الفوسفورين أكثر وضوحاً علي الخصائص الكيميائية للثمار بالمقارنة بتأثيرة علي الخصائص الطبيعية، بأستثناء وزن العنقود. وقد أدت المعاملة بالفوسفورين الي زياده معنوية في النسبة المئوية للمواد الصلبة الذائبة الكلية والسكريات المختزلة في كلا الصنفين وكذلك كان هناك نقص معنوي في النسبة المئوية للحموضة الكلية وكان هذا النقص أكثر واضوحاً في صنف العنب السوبريور.

لأجل التغلب علي تثبيت الفوسفور في التربة الرملية الجيرية وكذلك تحسين النمو والأثمار في صنف العنب الفلايم سيدلس والسوبريور النامية في التربة الرملية الجيرية فأنه ينصح بأستخدام الفوسفورين بمعدل ٢٠ جرام / الكرمة ثلاث مرات في العام.