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RESPONSE OF TWO SEEDLESS GRAPEVINE CULTIVARS GROWN ON SANDY CALCAREOUS SOIL TO SOME PHOSPHATE DISSOLVING BACTERIA TREATMENTS

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ABSTRACT

High pH level in Egyptian sandy calcareous soils (soil of Sedmant Al-Gabl – Beni Suef Governorate) led to fix the soluble phosphorus to insoluble form such as tri-calcium phosphate. In this study, two grapevine *cvs* Early Superior and Superior were treated with phosphorien as a source of phosphate dissolving bacteria "*Bacillus megatherium*" at 20g/vine once, twice or thrice addition for three consecutive seasons namely 2012/2013, 2013/2014 and 2014/2015.

The study showed that, vines treated with phosphorien significantly increased the leaf area and shoot length especially in the third season. Application of phosphorien resulted in a significant effect on leaf mineral contents especially NPK as compared with untreated vines. Neither Superior nor Early Superior showed significant differences in magnesium contents for the three experimental seasons and calcium 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 was 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, this increment was more remarkable for the Superior cultivar. The investigated treatment had no negative effect on the overall quality characteristics of berries.

To overcome soil Phosphorus fixation problem and to stimulate growth and fruiting of Superior and Early Superior grapevines growing under sandy calcareous soil, application of phosphorien at rate of 20 g/vine three times a yearly is highly recommended.

Keywords*: Phosphorien, Superior, Early Superior, Bacillus megaterium, Sandy soil.*

INTRODUCTION

Grapevine is one of the major horticulture crops throughout the world. While grapevines are cultivated on approximately 8.7 million ha worldwide, with a total world production of over 678 million tons of fruits per year (F.A.O., 2012). 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. Superior and Early Superior cultivars are newly early in ripening season grapevine *CVS*.

During the last fifth 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-Gable- 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 producer.
- Positive (beneficial): such as rhizobia, mycorrhizae; antagonists (bio control) of detrimental microorganisms; hormone producer; 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.

Phosphate dissolving bacteria are a group of beneficial bacteria capable of hydrolyzing inorganic phosphorus from insoluble compounds. P-solubilization ability of the microorganisms is considered to be one of the most important traits associated with plant phosphate nutrition. It is generally acceptably that the mechanism of mineral phosphate solubilization by Phosphate dissolving bacteria strains is associated with the release of low molecular weight organic acids, through which their hydroxyl and carboxyl groups chelate the cations bound to phosphate, thereby converting it into soluble forms. In addition, some PSB produce phosphatase like phytase that hydrolyses organic forms of phosphate compounds efficiently. One or both types of PSB have been introduced to Agricultural community as phosphate Biofertilizer . The positive effects of applying phosphorien as source of phosphate dissolving bacteria were attributed to its effect on dissolving the tri-calcium phosphate and facility its absorption by plant root (Chen et al., 2006 and Malboobiet al., 2009, Gunes et al., 2009 : and Seshachala 2012).

Boifertilization 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 (Gaur. and Gaind (1999), Delas (2000) Igual *et al.,* (2001) and Carvajal-Munoz and Carmona-Garcia 2012).

This study focused on the response of two early in ripening season grapevines *CVS* Superior and Early Superior to the treatment of phosphorien biofertilizer as a source of phosphate dissolving bacteria "*Bacillus megaterium*" once, twice or thrice application for three consecutive seasons 2012/2013, 2013/2014 and 2014/2015.

MATERIALS AND METHODS

The present study was conducted during three successive seasons 2012/2013, 2013/2014 and 2014/2015 in a private vineyard located at Sedmant Al-Gabl Beni-Suef Governorate where the soil texture is sandy. In

the first season of study, sixteen vines uniform in vigour from the two tested grapevine CVS Superior and Early Superior were selected. The selected vines received the common and normal horticulture practices that already applied in the vineyard, namely 210 kg urea (46% N), 250 kg/fed calcium superphosphate (15.5% P_2O_5) and 200 kg/fed potassium sulphate, as well as irrigation, hoeing and pest management were carried out as usual.

Plant material:

The selected Superior and Early Superior grapevines were 7 years old at the start of experiment. The chosen vines were trained according to cane pruning system using Gable trellis system. Winter pruning was carried out at the first week of January in the three experimental seasons. Vine load was adjusted to 66 buds per vine (6 fruiting cans × 9 eyes plus 6 renewal spurs × 2 eyes). The planting density was 2 X 3 meters under drip irrigation system was followed in this vineyard.

Soil characters:

Sedmant Al-Gabl, where the present experiment was carried out, is new reclaimed area at the bored 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 analysis of vineyard soils.

Early Superior		**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)	8.2	pH (1 : 2.5 extract)	7.9
Total $CaCO_3$ %	17.0	Total $CaCO_3$ %	16.9
N %	0.10	N %	0.08
Available P (Olsen, ppm)	3.25	Available P (Olsen, ppm)	4.52
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, in 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 and 40g/vine (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 20 g/vine 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 of two grapevine cultivars CVS namely (A1) Superior and (A2)

Early Superior. The second factor (B) comprised the four frequencies of the bio fertilizers phosphorien namely (b1) 0.0 control, (b2) once at the middle of December, (b3) twice at the middle of December and middle of January (after pruning), and (b4) thrice at the two previous dates and at the start of bud burst.

Experimental design:

Treatments were arranged in a randomized complete 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.

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 the four main shoots in the four main directions of vine. Leaf area (cm^2) was estimated in the twenty leaves per vine from those opposite to the first cluster on each shoot (at medal May). Leaf area leaves was measured by using an area meter (Area Meter Cl, 202)

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 0.5 g weight was digested using H_2SO_4 and H_2O_2 until clear solution was obtained (Martin-Prevel *et al.,* 1984). The digested solution was quantitatively transferred to 100ml 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-Prevel et al., (1984).
- Phosphorus was determined by using colorimetric method, described by Martin-Prevel et al., (1984), by measuring the optical density of phosphor-molibdo-vanadate complex by *Spectro-photometrically* at wave length 430 nm.
- Potassium was flam-photometrically determined by using the method outlined by Martin-Prevel et al., (1984).
- Calcium and magnesium were determined by atomic absorption using the methods outlined by Martin-Prevel et al., (1984)

3- Measurement of yield as well as physical and chemical properties of berries:

The clusters were harvested when T.S.S/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 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 tartaric acid per 100 g of juice) by titration against 0.1 NaOH using phenolphthalein as an indicator (A.O.A.C, 1985).
- Percentage of total reducing sugar 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 (2012/2013, 2013/2014 and 2014/2015) are shown in table (2). It is clear from this table that, phosphorien application significantly stimulated the main shoot length. However, a gradual increase in shoot length was observed in both cultivars as a result of increasing the times of application. The response of Early Superior remain much more clear than those of Superior cultivar, and this increment was more clear in the third season than those of 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 two cultivars, it is clear from the same table that Early superior 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 the 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 reducing soil pH level surrounding the vine root system that led to increase the phosphorus valuable to plant absorption. It is known that, phosphorous in plant participant the bio-energy compounds "ATP and ADP" which are very important for enhance vine growth. Also, the increments in leaf area as a response to increasing the available soil phosphate were observed on vineyard by Delas (2000), on others fruit trees such as olives (Ahmed and El-Dawwi 2005) and on other plants by Lynch et al., (1991), Marschner (1995) and Cuningham and Kuiak (1992).

Table (2): Effect of phosphorien treatments on main shoot length (cm) and leaf area (cm^2) of Early Superior and Superior cultivars cultivated at sandy soil during 2012/2013, 2013/2014 and 2014/2015 seasons.

	Main shoot length (cm)								
	Season 2012/2013			Season 2013/2014			Season 2014/2015		
	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b
Control B1	84.7	98.2	91.5	84.5	100.2	92.4	92.6	96.5	94.5
B2	91. 5	99.8	95.6	94.2	108.0	101.1	105.6	110.6	107.9
B3	87.6	106.4	97.5	108.3	111.8	110.0	119.4	114.1	116.7
B4	100.7	108.2	103.9	110.8	118.6	114.7	124.6	125.0	124.8
Mean A	91.2	102.9		99.5	109.6		110.5	111.5	
LSD 5%	a= ns b= 8.62, ab= 12.159			a= 6.82, b= 7.34, ab= 10.37			a= ns, b= 7.90, ab= 11.14		
	Leaf area (cm^2)								
	Season 2012/2013			Season 2013/2014			Season 2014/2015		
	Early Sp	Superior	Mean b	Ear Sup	Superior	Mean b	Early Sp	Superior	Mean b
Control B1	122.6	121.9	122.25	121.2	119.9	120.55	121.5	120.8	121.15
B2	127.2	125.5	126;35	126.7	120.1	123.4	123.4	122.1	122.75
B3	126.1	125.9	126.01	127.4	122.4	125.05	126.7	124.7	125.7
B4	129.1	127.8	128.45	130.1	125.2	127.65	131.6	126.2	128.9
Mean A	126.25	125.27		126.35	121.9		125.8	123.4	
LSD 5%	a=ns , b= 3.71, ab= 5.22			a= 3.01, b= 3.23, ab= 4.55			A= 2.1, b= 4.1, ab=5.77		

2- Effect of phosphorien on the leaf mineral contents:

Leaf mineral contents of Superior and Early Superior grapevines cultivars in response to different frequencies of phosphorien (once, twice and thrice applications), are shown in table (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 was significant at 5% as shown in Table (3). They increased gradual with increasing the number of phosphorien application from 0 to 3 times.

Leaves potassium content, in response of phosphorien application followed the same trend of leaves nitrogen contents, 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 Early Superior during the three experimental seasons (Table 3).

Moreover, the interaction between the cultivars and phosphorien treatment had significant effect on leaf N and P content. It is obvious that both N and P content were gradually increased from year to year, with increasing the number of phosphorien applications.

Table (3): Effect of phosphorien treatments on leaf N, P and K contents (% at dry weight) of Early Superior and Superior cultivars cultivated at sandy soil during 2012/2013, 2013/2014 and 2014/2015 seasons.

	Leaf Nitrogen content (% of dry weight)								
	Season 2012/2013			Season 2013/2014			Season 2014/2015		
	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b
B1	2.03	1.99	2.01	2.06	1.90	1.98	2.02	1.95	1.99
B2	2.27	2.35	2.31	2.22	2.42	2.32	2.26	2.43	2.35
B3	2.31	2.50	2.41	2.36	2.49	2.43	2.42	2.48	2.45
B4	2.37	2.49	2.43	2.42	2.48	2.45	2.44	2.51	2.48
Mean A	2.25	2.34		2.26	2.32		2.29	2.34	
LSD 5%	a= 0.091; b= 0.181; ab= 0.25			a=0.031 ; b=0.042 ; ab= 0.060			a= 0.037 b= 0.077 ab= 0.109		
	Leaf Phosphorus content (% of dry weight)								
	Season 2012/2013			Season 2013/2014			Season 2014/2015		
	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b
B1	o-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	0.334	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=0.032 ab=0.047			a= 0.04 b= 0.03 ; ab= 0.042			a=0.04 b= 0.05; ab=0.0.07		
	Leaf Potassium content (% of dry weight)								
	Season 2012/2013			Season 2013/2014			Season 2014/2015		
	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b	Early Sp	Superior	Mean b
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= 0.096; b=0.105; ab=0.148			a= 0.059 ; b= 0.088 ; ab= 0.113			a=0.052 ;b= 0.066;ab= 0.093		

On the other hand, non significant differences in Mg content were detected except those of the interaction between the cultivars and the number of phosphorien application in the second season, where the vines 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, Early Superior had higher and significant calcium content than those of Superior in the first and second seasons, however, the differences were slightly and nonsigificant 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 (2.28%) for Early Superior and (2.33%) in the first seasons for Superior cultivar.

Table (4): Effect of phosphorien treatments on leaf Calcium and Magnesium contents (% at dry weight) of Early Superior and Superior cultivars cultivated at sandy soil during 2012/2013, 2013/2014 and 2014/2015 seasons.

	Leaf Calcium content (% dry weight)								
	Season 2012/2013			Season 2013/2014			Season 2014/2015		
	Early Supr.	Superior	Mean b	Early Supr.	Superior	Mean b	Early Supr.	Superior	Mean b
Control B1	2.440	2.168	2.304	2.260	2.022	2.141	2.207	2.070	2.139
B2	2.477	2.140	2.309	2.320	2.202.	2.261	2.235	2.192	2.214
B3	2.278	2.188	2.233	2.423	2.133	2.278	2.397	2.218	2.307
B4	2.345	2.280	2.313	2.563	2.238	2.401	2.583	2.330	2.457
Mean A	2.385	2.194		2.392	2.149		2.356	2.202	
LSD 5%	a=0.122., b=,ns ab=0.179			a=0.113; b=0.122; ab=0.172			a=0.110 ;b=0.172; ab=0.242		
	Leaf Magnesium content (% dry weight)								
	Season 2012/2013			Season 2013/2014			Season 2014/2015		
	Early Supr.	Superior	Mean b	Ear Supr.	Superior	Mean b	Early Supr.	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=0.041			a= ns ; b= ns; ab=ns		

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

It's well known that, phosphate dissolving bacteria have been found effective in solubilising inorganic phosphate in the soil potentially enhancing P absorption. During its activity organic acids produced include citric, glutamic, succinct, lactic, oxalic, formic and tartaric acid as observed in several experiments. The action of these organic acids has been attributed to its effect in reducing pH level, this effect may be increased the availability of the nutrient elements surround the vine roots and to facilitate its absorption by plant roots (Chen et al., 2006 and Malboobiet al., 2009, Gunes et al., 2009 : and Seshachala 2012).

The stimulation on vine nutritional status in response to using biofertilizers was confirmed by the results of Ali Samar (2015), El-Sayed (2001), Abada (2002) and Ahmed et al., (2003).

3- Effect of phosphorien treatments on yield components:

The data listed in Table (5) show the influence of the application of phosphorien on yield component of Early Superior and Superior cultivars. The obtained results reveled that increasing the number of phosphorien application resulted in a significant increase in cluster number, particular in the third season, and the same trend was observed for the cluster weight in the three experimental seasons.

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 cluster number and weight, especially when the vine received three doses of phosphorien yearly. This increment was 28 % than control (untrated vines) 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., (19997), El-Sayed (2001), Abada (2002) and Ibrahim (2005).

Table (5): Effect of phosphorien treatments on yield component of Early Superior and Superior cultivars cultivated at sandy soil during 2012/2013, 2013/2014 and 2014/2015 seasons.

	No. of clusters / vine								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	18.8	20.5	19.6	18.0	20.0	19.0	19.8	19.8	19.8
B2	19.8	20.8	20.3	21.2	23.3	22.3	22.3	23.0	22.6
B3	21.5	21.8	21.6	23.0	24.0	23.8	23.8	24.0	23.9
B4	23.5	22.5	22.0	25.1	25.5	25.3	26.6	25.3	26.1
Mean A	20.9	21.4		21.9	23.2		23.2	23.1	
LSD 5%	a=ns ; b= ns ; ab= ns			a= ns ; b=ns ; ab= 5.3			a=ns ; b= 3.5 ; ab=4.9		
	Cluster weight (g)								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	346	306	326	356	315	335.5	362	312	337
B2	366	348	357	387	338	362.5	389	361	375
B3	368	341	354.5	391	349	390	399	379	389
B4	393	349	371	416	389	342.5	420	391	405.5
Mean A	368.3	336		380	347.8		392.5	360.8	
LSD 5%	a=18.5 : b= 27.3 ; ab= 38.5			a= 15.5 ; b= 19.3 ; ab 27.2			a= 22.4 ; b= 31.5 ; ab=44.4		
	Yield / Vine (kg)								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	6.51	6.27	6.39	6.41	6.30	6.36	7.17	6.18	6.68
B2	7.25	7.23	7.24	8.20	7.87	8.04	8.67	8.30	8.49
B3	7.91	7.43	7.67	8.99	8.38	8.69	9.49	9.09	9.29
B4	9.23	7.85	7.54	10.44	9.92	10.18	11.17	9.89	10.53
Mean A	7.73	&.19		8.51	8.12		9.13	8.37	
LSD 5%	a= ns ; b= 0.82 ; ab= 1.61			a= ns ; b= 1. 21 ; ab= 1.71			a= sn ; b= 1.12 ; ab= 1.58		

4- Effect of phosphorien 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 (6). From this table, slightly and non significant effect of phosphorien application on berry dimension (longitudinal and equatorial) of two cultivars, except the third season when applied three times in both cultivars. Moreover, berry weight

increased slightly during the first and second seasons, but in the third season this increment remained clear and significant (Table 6).

Table (6): Effect of phosphorien treatments on berry physical properties of Early Superior and Superior cultivars cultivated at sandy soil during 2012/2013, 2013/2014 and 2014/2015 seasons.

	Berry Weight (g)								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	3.26	3.27	3.26	3.33	3.02	3.16	3.29	3.33	3.31
B2	3.29	3.31	3.30	3.47	3.33	3.40	3.60	3.57	3.58
B3	3.44	3.38	3.41	3.51	3.53	3.52	3.72	3.76	3.75
B4	3.47	3.49	3.48	3.61	3.68	3.65	3.91	3.81	3.86
Mean A	3.37	3.36		3..48	3.38		3.63	3.62	
LSD 5%	a= ns ; b= ns ; ab=ns			a= 0.05 ; b= 0. 12 ; ab= 0.18			a= ns ; b= 0.22 ; ab=0.31		
	Berry longitudinal (cm)								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	1.54	1.50	1.52	1.53	1.49	1.51	1.53	1.49	1.51
B2	1.61	1.52	1.58	1.57	1.56	1.57	1.54	1.54	1.54
B3	1.59	1.55	1.57	1.59	1.63	1.61	1.57	1.61	1.59
B4	1.59	1.55	1.57	1.60	1.64	1.62	1.62	1.64	1.63
Mean A	1.58	1.56		1.57	1.58		1.57	1.57	
LSD 5%	a= ns : b= ns ; ab= 0.07			a= ns ; b= ns ; ab=0.07			a= ns ; b=0.05 ; ab= 0.07		
	Berry equatorial (cm)								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	1.31	1.43	1.73	1.42	1.42	1.42	1.41	1.43	1.42
B2	1.42	1.44	1.43	1.44	1.46	1.45	1.43	1.51	1.47
B3	1.44	1.46	1.45	1.46	1.50	1.48	1.45	1.54	1.49
B4	1.46	1.48	1.47	1.47	1.53	1.50	1.46	1.58	1.1.52
Mean A	1.44	1.45		1.45	1.48		1.1.44	1.51	
LSD 5%	a= ns; b= 0.02 ; ab= 0.03			a= ns ; b= 0.04 ; ab=0.06			a= 0.05 ; b=0.03 ; ab=0.04		

The observed increase in berry weight during the third season 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).

5- 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 number of phosphorien application, once, twice and three times (Table 7).

The same table declared that, increasing the number of phosphorien application was associated with a progressive and significant decrement in the berry juice acidity. This decrement was clearer in the second and third seasons than those 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 phosphorien application. 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 decreasing the total acidity lead to remarkable and significant increasing in the TSS/acidity ratio as compared to untreated vines.

The role of phosphorien "as a biofertilizers" treatment in improving T.S.S and reducing sugars content and decreasing total acidity, which obtained in the present study, was in accordance with the results of some studies carried out on some grapevines cultivars and other fruits spices treated with some biofertilizers, such as those obtained by Ali (2015) Mosa *et al.,* (2014) Carvajal-Munoz and Carmona-Garcia (2012), Ahmed (*2009)* and Ahmed et al (2014).

Moreover, the interaction between the cultivars and phosphorien treatment had significant effect juice T.S.S, reducing sugars and total acidity. It is obvious that both T.S.S and reducing sugars were gradually increased from year to year, with increasing the number of phosphorien applications. Contrary, the total acidity was gradually decreased from year to year.

In conclusion, treating Superior and Early Superior grapevines grown under sandy soil with phosphorien three times each season obviously overcame the fixation of P and improve growth and fruiting of the vines.

Table (7):Effect of phosphorien treatments on berry chemical properties of Early Superior and Superior cultivars cultivated at sandy soil during 2012/2013, 2013/2014 and 2014/2015 seasons.

	Juice T.S.S %								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	19.1	20.4	19.7	19.6	20.2	19.9	19.5	19.3	19.4
B2	19.4	2.0.8	20.1	20.9	21.5	21.2	19.9	22.2	21.1
B3	19.5	20.7	20.1	20.5	22.5	21.5	21.9	23.7	22.8
B4	19.3	22.5	20.9	20.7	23.7	22.2	22.5	24.9	23.7
Mean A	19.3	21.1		20.4	22.0		20.9	22.5	
LSD 5%	a=1.1 ; b= 0.71 ; ab= 0.99			a= 1.3 ; b= 1.2 ; ab= 1.7			a=1.2 ; b= 1.6 ; ab=2.25		
	Juice reducing Sugars %								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
B1	15.9	15.7	15.8	16.2	17.4	16.8	16.1	16.9	16.5
B2	15.9	17.9	16.9	17.4	17.6	17.5	16.7	18.4	17.6
B3	16.2	18.8	17.5	17.5	18.6	18.1	18.8	20.4	19.6
B4	16.9	19.7	18.3	18.3	20.1	19.2	19.3	21.6	20.5
Mean A	16.2	18.1		17.4	18.4		17.7	19.3	
LSD 5%	a=ns ; b= 1.2 ; ab= 1.7			a= 0.9 ; b= 1.2 ; ab=1.6			a=1.5 ; b=1.7 ; ab=2.4		
	Juice acidity %								
	Season 2012/2013			**Season 2013/2014**			**Season 2014/2015**		
	Early Sp	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**	**Early Sp**	**Superior**	**Mean b**
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	0.697
B3	0.637	0.638	0.638	0.752	0.667	0.709	0.711	0.651	0.681
B4	0.632	0.635	0.634	0.741	0.612	0.677	0.620	0.617	0.619
Mean A	0.676	0.670		0.762	0.673		0.709	0.661	
LSD 5%	a= ns ; b= 0.023 ; ab= 0.033			a= 0.011 ; b= 0.041 ; ab= 0.057			a= 0.032 ; b=0.046 ; ab=0.065		

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إستجابة صنفين من أصناف العنب عديمة البذور نامية فى تربة رملية جيرية لبعض معاملات البكتريا المذيبة للفوسفات

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يؤدى إرتفاع رقم الـ فى الأراضى الرملية الجيرية (كما فى حالة أرض سدمنت الجبل – محافظة بنى سويف – مصر) إلى حدوث تثبيت للفوسفور فى صورة فوسفات الكالسيوم الثلاثية الغير ذائبة. فى هذه الدراسة تم التسميد الحيوى لصنفين من أصناف العنب عديمة البذور هما السوبيريور والأيرلى سوبيريور بسماد الفوسفورين كمصدر للبكتريا المذيبة للفوسفات "*Bacillus megaterium*" بمعدل ٢٠ جرام للكرمة وتمت الإضافة مرة أو مرتين أو ثلاثة مرات فى العام بالإضافة إلى معاملة الكنترول خلال ثلاثة مواسم متتالية ٢٠١٢/٢٠١٣ , ٢٠١٣/٢٠١٤ و ٢٠١٤/٢٠١٥.

أشارت نتائج الدراسة إلى أنه بغض النظر عن صنف العنب المختبر فإن المعاملة بالفوسفورين أدت إلى حدوث تحسن فى مساحة الورقة وطول النمو الرئيسى خصوصاً فى الموسم الثالث. كذلك كان للفوسفورين أثر واضح على التركيب المعدنى للورقة خصوصاً النيتروجين والفوسفور والبوتاسيوم وذلك بالمقارنة بعدم إستخدامة ولم يكن لإختلاف أصناف العنب أية تأثير على محتوى الورقة من الماغنسيوم فى المواسم الثلاثة وكذلك محتوى الورقة من الكالسيوم فى الموسم الأول والثانى بغض النظر عن عدد مرات إضافة الفوسفورين. كانت هناك زيادة معنوية فى المحصول نتيجة إستخدام الفوسفورين فى كلا الصنفين محل الدراسة وخاصة عند إستخدامة ثلاث مرات فى العام.

كان تأثيرأضافة الفوسفورين أكثر وضوحاً على الخصائص الكيميائية للثمار بالمقارنة بتأثيرة على الخصائص الطبيعية, بإستثناء وزن العنقود. وقد أدت المعاملة بالفوسفورين إلى إحداث زيادة معنوية فى النسبة المئوية للمواد الصلبة الذائبة الكلية والسكريات المختزلة فى كلا الصنفين محل الدراسة, كذلك كان هناك نقص معنوى فى النسبة المئوية للحموضة الكلية, وكان هذا النقص أكثر وضوحاً فى صنف السوبيريور.

أمكن التغلب على تثبيت الفوسفور فى التربة الرملية الجيرية وكذلك تم تحسين النمو والإثمار فى صنفى العنب السوبيريور والأيرلى سوبيريور النامية فى الأراضى الرملية الجيرية عن طريق إستخدام الفوسفورين بمعدل ٢٠ جرام/الكرمة ثلاث مرات فى العام.