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THE INFLUENCE OF PHOSPHORUS SOURCES ON CHEMICAL COMPOSITION AND PRODUCTION OF GRAPE VINE UNDER FERTIGATION SYSTEM

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ABSTRACT

Field experiment was conducted with grapevine grown in sandy soil under drip irrigation at El Sadat city, Menoufiya Governorate, Egypt for two consecutive seasons (2006 and 2007) to investigate the effect of different sources of phosphorous fertilizers on Thompson seedless grapevine yield, average cluster weight, berry juice measurements, (TSS, Acidity, TSS/acidity) and chemical composition of blades. Four sources of phosphorous were used, i.e. phosphoric acid (H_3PO_4), monoammonium phosphate (MAP), ammonium polyphosphate (APP) and urea phosphate (UP) with two rates, 20 and 40 kg P_2O_5fed.$^{-1}$ applied as once, twice and three times /week through irrigation water. Results revealed that phosphorous at 40 kg P_2O_5fed.$^{-1}$ increased significantly vine yield and improved fruit quality more than 20 kg P_2O_5fed.$^{-1}$under all treatments. As regards to sources of phosphorous, yield ,cluster weight ,berry juice measurements and chemical composition of blades ,UP and APP were better than H_3PO_4 and MAP under the two rates and the different patterns of applications Also the results showed that application of phosphorous fertilizers at three times /week was the best.

Keywords: Grapevine, Thompson seedless, phosphorous fertilizers ,fertigation.

INTRODUCTION

On world wide basis, grapes (*vitis vinefera*,L) considered the fourth crop while it ranked the first largest deciduous fruit crop. Egypt ranks on the world production scale as 14 th largest producer of grapes .Grape vines are heavily planted in the newly reclaimed areas in Egypt .While grape quality is affected by vineyard conditions, it is also depend on cultural practices such as varity and fertilization.

Phosphorous is an essential plant nutrient and commonly limiting nutrient for grape especially in newly reclaimed soil. Because of the low mobility of P in the soil, P fertilizers should be placed near the roots, using the most efficient methods of application. Banding the fertilizer in concentrated zone near the plant root should be more efficient than broadcasting, Randall and Hoeft, (1988) .Although the use of P fertilizers in fertigation may cause clogging problems to the system, these problems can be overcome by using acidic fertilizers sources such as H_3PO_4 and UP, Mikkelson, (1989)

Fertigation minimizes leaching of water and nutrients from the rhizosphere ,thus minimizes ground water contamination, Hagin and Lowengart, (1995) and improves fertilizers use efficiency compared to preplant incorporation, Mohammed *et al*., (1999),Hagin *et al*., (2002) and Mohammed *et al*., (2004) .

Kafkafi, (1994) Considered fertigation as an efficient method for providing and supplying available forms of immobile elements such as P, at a desirable level in root zone. Also successful P fertigation has been reported by Papadopoulos, (2000) who found that the superiority of P fertigation over conventional methods was through maintaining continuous higher concentration of P in the soil solution. In addition Jagdev *et al*., (2008) reported that fertigation treatment in Thompson seedless grapevine increased P fertilizer use efficiency by 73.6% and gave higher yield than the conventional method of P fertilizer application.

This study was initiated to evaluate the effect of different sources, rates and suitable application patterns of phosphorus fertilizers on chemical composition and production of Thompson seedless grape vine grown in sandy soil under fertigation system.

MATERIALS AND METHODS

This study was conducted for two years (2006 and 2007) on one feddan of 5 years old Thompson seedless grape vine supported by Y shape in a vineyard located in El-Sadat city, Minoufya governorate, Egypt.

The soil of the experiment was sandy in texture (Table1). The selected vines were of normal growth, healthy and uniform in figure. Rows and vines spacing were 1.5 X 3 M irrigated by ground water of which EC 0.9 dSm^{-1} and pH 7.60 under drip irrigation system (two lateral lines per row and emitters 50cm. space of GR type each at $4Lh^{-1}$) .Twenty four treatments were carried out in three replicates arranged in a complete randomized block design in split split plot. The sources of phosphorus fertilizers used were phosphoric acid (H_3PO_4 45% P_2O_5), monoammoniuim phosphate (MAP 60% P_2O_5 and 12%N), ammonium polyphosphate (APP 52% P_2O_5 and 15% N) and urea phosphate (UP 44% P_2O_5 and 18% N). Two rates of phosphorus were used, 20 and 40 Kg $P_2O_5fed.^{-1}$

Patterns of application were once, twice and three times / week. The phosphorous fertilization started from the first of March up to 15th of April while the rate of ammonium nitrate and potassium sulphate were 80 kg N/Fadden and 120 kg K_2Ofed^{-1} according to the recommendation of ministry of agriculture for Thompson seedless grapevine were applied from first of March up to 15th of June.

Table 1: Particles size distribution and chemical analysis of soil sample from the experimental sites.

Particle size distribution		Chemical Analysis	
• clay %	4.7	• pH (1-2.5)	8.2
• Silt %	5.0	• EC dSm^{-1}	0.34
• Fine sand %	22.8	• CaCo3 %	3.7
• Coarse sand %	67.5	• O.M %	0.06
• Texture class	Sandy	• Available nutrients(ppm)	N 32 P 4.6 K 61

The soil samples were air dried, ground in a wooden mortar and passed through a 2 mm pores sieve to be analyzed for physical and chemical characteristics. According to many workers, the following properties were recorded: texture and total $CaCO_3$ Black, (1965), pH, EC, organic matter, available K, Jackson, (1973), available P Olsen *et al*., (1958) and available N, Nelson and Sommers, (1982).

Measurements:-

1- **Yield**

Yield = average cluster weight per vine X number of clusters per vine

2- Average cluster weight (g)

3- Berry Juice measurements

a) TSS , expressed as Brix by using hand refract meter
b) Titratable acidity percentage according to A.O.A.C., (1985)
c) TSS/acidity

4- Chemical composition of leaf

Representative blades sample was taken and analyzed for macro and micronutrients after washing in sequence with tap water, 0.01 N HCL acidified bidistilled water and bidistilled water, respectively and then dried in a ventilated oven at 70^oC for 72 h. till constant weight. The plant sample were ground in stainless steel mill 0.5 mm sieve and kept in plastic containers for chemical analysis. Total nitrogen was determined using micro-kjeldahal, while P and K were measured using spectrophotometer and flame photometer, respectively. Fe, Zn and Mn were measured using atomic absorption spectrophotometer, Perkin Elemer model 1100 according to Jackson, (1973).

Data analysis:

The obtained data were stastically analyzed according to Snedecor and Cochran, (1990), treatments means were compared using the least significant differences LSD at 5% of probability.

RESULTS AND DISCUSSION

1- Yield:-

Results in Table 2 show that UP and APP as P sources gave the highest yield compared with MAP and H_3Po_4. This can be explained by the double acidification effect of UP. These results are in accordance to those obtained by Papadopoulos and Ristimaki – Leena. (2000) and Salem *et al*., (2004). As regards to the rate of P_2O_5, data revealed that 40 kg $P_2O_5fed.^{-1}$ increased yield significantly than 20 kg $P_2O_5fed.^{-1}$under the four P sources in both seasons. These results are in agreement with the findings obtained by Sidhu *et al*., (2002), Usha *et al*., (2004) and Rakicevic *et al*., (2007). A progressive increase in vine yield was found under the three times of application compared to once, for instance, yield increased by about 10% and 13% in the both seasons, respectively.

Table 2: Effect of different sources, rates and patterns of phosphorus fertilizers application on yield (kg .vine^{-1}) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed.$^{-1}$			Mean	40 kg.fed.$^{-1}$.			Mean
	Once/ week	Twice/ week	Three times /week		Once/ week	Twice/ week	Three times /week	
H_3PO_4	6.42	7.39	7.16	6.99	8.00	8.33	8.97	8.43
MAP	7.20	7.32	7.56	7.36	8.10	8.40	9.00	8.50
APP	7.20	7.50	7.90	7.53	8.20	8.80	9.40	8.80
UP	8.27	8.21	8.27	8.25	8.30	8.90	9.80	9.00
Mean	7.27	7.61	7.72	7.27	8.15	8.61	9.29	8.68
$LSD_{0.05}$	Sources	0.61						
	Rates	0.41						
	Patterns	0.31						
Season 2007								
H_3PO_4	7.90	8.17	8.67	8.25	8.53	9.10	9.10	8.91
MAP	7.77	8.10	8.43	8.10	8.43	9.13	9.90	9.15
APP	7.83	8.53	9.07	8.48	8.10	9.60	10.40	9.37
UP	8.00	8.43	9.20	8.54	8.93	9.53	10.87	9.78
Mean	7.88	8.31	8.84	8.34	8.50	9.34	10.07	9.30
$LSD_{0.05}$	Sources	0.60						
	Rates	0.23						
	Patterns	0.35						

2- Average cluster weight (g.)

Data presented in Table 3 indicate that UP produced higher vine clusters than the other three sources in the first season while in the second season; MAP was the best under 20kg P_2O_5fed.$^{-1}$ Similar findings were reported by Salem *et al*., (2004) who found that cluster weight was heavier by MAP than the other sources. Fertigation at the rate of 40kg P_2O_5fed.$^{-1}$ resulted in higher cluster weight than 20 kg P_2O_5fed.$^{-1}$in both growing seasons (Table 2). This is in agreement with the findings of Sidhu *et al*., (2002) who reported that bunch weight increased with increasing rate of P.

The highest cluster weight with application at three times compared to once and twice could be attributed to the more uptake of phosphorus. This attribution is in agreement with Mohammed *et al*., (2004) who found that more P uptake by squash plants grown under continuous P fertigation.

Table 3: Effect of different sources, rates and patterns of phosphorus fertilizers application on average cluster weight (kg.vine^{-1}) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed. $^{-1}$			**Mean**	**40 kg.fed. $^{-1}$**			**Mean**
	Once/ week	**Twice/ week**	**Three times /week**		**Once/ week**	**Twice/w eek**	**Three times /week**	
H_3PO_4	0.45	0.48	0.50	0.48	0.46	0.50	0.51	0.49
MAP	0.45	0.48	0.49	0.47	0.43	0.50	0.51	0.48
APP	0.47	0.47	0.50	0.48	0.51	0.51	0.52	0.51
UP	0.48	0.50	0.51	0.50	0.48	0.51	0.53	0.51
Mean	0.46	0.48	0.50	0.48	0.47	0.51	0.52	0.50
LSD $_{0.05}$	Sources	0.016						
	Rates	0.012						
	Patterns	0.013						
Season 2007								
H_3PO_4	0.47	0.47	0.47	0.47	0.48	0.50	0.50	0.49
MAP	0.44	0.50	0.50	0.48	0.47	0.50	0.50	0.49
APP	0.46	0.46	0.46	0.46	0.49	0.51	0.51	0.50
UP	0.47	0.46	0.45	0.46	0.50	0.52	0.52	0.51
Mean	0.46	0.47	0.47	0.47	0.49	0.51	0.51	0.50
LSD $_{0.05}$	Sources	0.03						
	Rates	0.02						
	Patterns	0.02						

3- Berry Juice measurements

a – Total soluble solid (TSS):-

Data presented in Table 4 indicate that APP as P source gives the best measurable TSS, followed by UP and MAP in the two growing seasons. On the other hand, the least TSS was observed with H_3PO_4 treatment. As regards to P rate, 40 kg P_2O_5fed.$^{-1}$ was better than 20 kg P_2O_5fed.$^{-1}$in all treatments in both seasons. These results could be enhanced by those obtained by Salem *et al*., (2004) and Patil *et al*., (2008) who reported that raising P rate improved TSS in Thompson seedless grapevine. The results also indicate that the application of P three times / week give the best TSS compared with once and twice in all treatments in both seasons.

b- Acidity:-

Data in Table 5 indicate that the juice acidity was affected by P source, since the accumulation of acid was reduced by APP application. Percentage of acidity in fruit from vines treated with APP was lower than that treated with other sources in the two seasons.

Slightly lower level of acidity was recorded with 20 P_2O_5fed.$^{-1}$ in the first season, while at the second season lower level of acidity was recorded with 40 kg P_2O_5/fed. compared to 20 kg P_2O_5fed.$^{-1}$ This is in agreement with the findings of Dhillon *et al*., (1998) who reported that increasing the rate of phosphorus reduced the fruit acidity.

With regard to the pattern of application the presented data revealed that the mean values of juice acidity under various patterns of application ranged from 0.40 to 0.41 and from 0.41 to 0.40 % for 20 and 40 kg P_2O_5fed.$^{-1}$ in the second season, respectively.

Table 4 : Effect of different sources, rates and patterns of phosphorus fertilizers application on TSS (%) of Thompson seedless grape vine.

Sources	20 kg.fed. $^{-1}$ Once/ week	Twice/ week	Three times /week	Mean	40 kg.fed. $^{-1}$ Once/ week	Twice/week	Three times /week	Mean
Season 2006								
H_3PO_4	20.17	20.60	21.33	20.70	21.00	21.50	22.17	21.56
MAP	21.00	21.53	22.17	21.57	21.67	22.33	23.00	22.33
APP	21.33	22.17	22.67	22.06	21.17	23.00	24.00	22.72
UP	21.53	21.67	22.00	21.73	22.17	22.67	22.83	22.56
Mean	21.01	21.49	22.04	21.51	21.50	22.38	23.00	22.29
LSD $_{0.05}$ Sources	0.22							
Rates	0.15							
Patterns	0.19							
Season 2007								
H_3PO_4	20.33	20.70	21.30	20.78	21.00	21.50	22.30	21.60
MAP	21.00	22.00	23.00	22.00	22.00	22.50	23.40	22.63
APP	22.00	22.00	23.60	22.53	22.33	23.00	24.00	23.11
UP	22.00	22.00	23.00	22.33	22.33	22.90	23.37	22.87
Mean	21.33	21.68	22.73	21.91	21.92	22.48	23.27	22.55
LSD $_{0.05}$ Sources	0.21							
Rates	0.24							
Patterns	0.20							

Table 5: Effect of different sources, rates and patterns of phosphorus fertilizers application on Acidity (%) of Thompson seedless grape vine.

Sources	20 kg.fed. $^{-1}$ Once/ week	Twice/ week	Three times /week	Mean	40 kg.fed. $^{-1}$ Once/ week	Twice/week	Three times /week	Mean
Season 2006								
H_3PO_4	0.41	0.42	0.42	0.42	0.41	0.43	0.43	0.42
MAP	0.40	0.41	0.41	0.41	0.42	0.42	0.43	0.42
APP	0.40	0.41	0.41	0.41	0.40	0.41	0.42	0.41
UP	0.40	0.41	0.41	0.41	0.40	0.41	0.43	0.41
Mean	0.40	0.41	0.41	0.41	0.41	0.42	0.43	0.42
LSD $_{0.05}$ Sources	0.003							
Rates	0.002							
Patterns	0.003							
Season 2007								
H_3PO_4	0.43	0.42	0.41	0.42	0.41	0.41	0.40	0.41
MAP	0.42	0.42	0.41	0.42	0.41	0.41	0.40	0.41
APP	0.42	0.41	0.40	0.41	0.41	0.41	0.40	0.41
UP	0.43	0.41	0.41	0.42	0.42	0.42	0.41	0.42
Mean	0.43	0.42	0.41	0.42	0.41	0.41	0.40	0.41
LSD $_{0.05}$ Sources	0.002							
Rates	0.002							
Patterns	0.003							

C-TSS / acidity:-

Data in Table 6 indicate that APP as P source gives the best measurable TSS / Acidity, followed by UP and MAP in the two growing seasons. On the other hand, the least TSS/ acidity were obtained with H_3PO_4. These results were in agreement with Salem *et al*., (2004) who reported that TSS/ acidity was higher in response to MAP than phosphoric acid in Thompson seedless grape vine.

As regards to P rate, 40 kg P_2O_5fed.$^{-1}$ was better than 20 kg P_2O_5fed.$^{-1}$ in all treatments in both seasons. Similar results were obtained by Patil *et al*., (2008) who found that P at a rate of 500 P_2O_5ha^{-1} increased TSS / acidity in Thompson seed les grapevine compared with low P rates.

The results also indicate that the application of P three times / week gave the best TSS / acidity compared with once and twice at all treatments in both seasons.

Table 6: Effect of different sources, rates and patterns of phosphorus fertilizers application on TSS / acidity of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed.$^{-1}$			Mean	40 kg.fed.$^{-1}$			Mean
	Once/ week	Twice/ week	Three times /week		Once/ week	Twice/week	Three times /week	
H_3PO_4	47.27	48.29	52.00	49.19	50.00	51.19	54.13	51.77
MAP	48.83	50.87	54.57	51.42	52.87	54.55	57.50	54.97
APP	50.40	53.75	56.23	53.46	54.10	56.10	60.00	56.73
UP	49.70	52.44	57.03	53.06	54.10	55.69	57.10	55.63
Mean	49.05	51.34	54.96	51.78	52.77	54.38	57.18	54.78
LSD $_{0.05}$	Sources	0.75						
	Rates	0.41						
	Patterns	0.70						
Season 2007								
H_3PO_4	47.47	49.29	51.97	49.58	50.00	51.19	54.43	51.87
MAP	50.00	52.38	56.13	52.84	53.70	54.88	58.53	55.70
APP	52..40	54..88	59.03	59.03	54.40	56.10	60.00	56.83
UP	50.27	53.66	56.10	53.34	54.40	55.85	58.47	56.24
Mean	49.25	51.78	55.81	53.70	53.13	54.51	57.86	55.16
LSD $_{0.05}$	Sources	0.56						
	Rates	0.44						
	Patterns	0.67						

4-Mineral composition:-

a- Nitrogen concentration:-

Data in Table 7 reveal that petiole nitrogen concentration (%) was no significantly affected by various P application sources, rates and patterns of P application in the first season. While in the second season the application of APP led to a significantly higher concentration of nitrogen compared to H_3PO_4. This result is in agreement to some extent with, Dhillon *et al*., (1998).

Table 7 : Effect of different sources, rates and patterns of phosphorus fertilizers application on nitrogen (N %) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed.$^{-1}$			Mean	40 kg.fed.$^{-1}$			Mean
	Once/ week	Twice/ week	Three times /week		Once/ week	Twice/week	Three times /week	
H_3PO_4	2.29	2.30	2.32	2.30	2.30	2.31	2.33	2.31
MAP	2.39	2.40	2.41	2.40	2.40	2.41	2.42	2.41
APP	2.40	2.41	2.43	2.41	2.41	2.42	2.44	2.42
UP	2.38	2.39	2.40	2.39	2.39	2.40	2.41	2.40
Mean	2.37	2.38	2.39	2.38	2.38	2.39	2.40	2.39
LSD $_{0.05}$	Sources	0.13						
	Rates	0.03						
	Patterns	0.09						
	Season 2007							
H_3PO_4	2.24	2.25	2.45	2.31	2.39	2.40	2.42	2.40
MAP	2.47	2.48	2.50	2.48	2.49	2.50	2.51	2.50
APP	2.47	2.49	2.52	2.49	2.50	2.51	2.53	2.51
UP	2.46	2.47	2.49	2.47	2.48	2.49	2.50	2.49
Mean	2.41	2.42	2.49	2.44	2.47	2.48	2.49	2.48
LSD $_{0.05}$	Sources	0.04						
	Rates	0.07						
	Patterns	0.08						

b- Phosphorus concentrations:-

Phosphorus concentration in petiole under the two rates of P differed significantly among P sources (Table 8). At 20 kg, P concentration ranged from 0.21 to 0.24 and from 0.24 to 0.26 in the two seasons, respectively. While at 40 kg, P concentration ranged from 0.24 to 0.26 and from 0.28 to 0.29 in the two seasons, respectively. In the present study, APP gives the highest values of P concentration compared to the other sources. As regards to P rate, 40 kg P_2O_5fed.$^{-1}$ was better than 20 kg P_2O_5fed.$^{-1}$ Similar results were obtained by Osmar and George, (2000) who reported that application of P at rates greater than 25 kg ha^{-1} increased leaf P concentration. Also Dihlon *et al*., (1998) indicated that the level of leaf petiole P increased with increasing P doses up to 800g P_2O_5 vine^{-1}over the control.

The results also indicat that the application of P three times / week gave the highest petiole P content compared with once and twice in all treatments in both seasons.

C-Potassium concentrations:-

The results from data in Table 9 indicate that APP and UP as P sources gave better values than MAP and H_3PO_4. Also application of phosphorous at high rate (40 kg P_2O_5fed.$^{-1}$) enhanced the uptake of potassium by the vines as compared to the low rate (20 kg P_2O_5fed.$^{-1}$). These results were in agreement with Dhillon *et al*., (1998) who reported that increasing P rate from 0 up to 800 g.vine^{-1} lead to increase petiole K content. Also Nijjar, (1972) recorded that varying levels of P increase K content in Thompson seedless grapevine.

Also the results indicated that application of P three times/week gave better K content of blades than other patterns.

Table 8: Effect of different sources, rates and patterns of phosphorus fertilizers application on phosphorus (P%) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed.$^{-1}$.			**Mean**	**40 kg.fed.$^{-1}$**			**Mean**
	Once/ week	**Twice/ week**	**Three times /week**		**Once/ week**	**Twice/week**	**Three times /week**	
H_3PO_4	0.19	0.21	0.24	0.21	0.23	0.25	0.26	0.25
MAP	0.20	0.23	0.24	0.22	0.22	0.25	0.26	0.24
APP	0.21	0.24	0.27	0.24	0.24	0.26	0.27	0.26
UP	0.21	0.22	0.23	0.22	0.23	0.24	0.26	0.24
Mean	0.20	0.23	0.25	0.22	0.23	0.25	0.26	0.25
$LSD_{0.05}$	Sources			0.005				
	Rates			0.004				
	Patterns			0.003				
Season 2007								
H_3PO_4	0.22	0.24	0.26	0.24	0.25	0.28	0.30	0.28
MAP	0.23	0.26	0.26	0.25	0.24	0.28	0.31	0.28
APP	0.24	0.25	0.28	0.26	0.26	0.30	0.32	0.29
UP	0.24	0.25	0.28	0.26	0.26	0.30	0.32	0.29
Mean	0.23	0.25	0.27	0.25	0.25	0.29	0.31	0.29
$LSD_{0.05}$	Sources			0.004				
	Rates			0.005				
	Patterns			0.006				

Table 9: Effect of different sources, rates and patterns of phosphorus fertilizers application on potassium (K%) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed.$^{-1}$			**Mean**	**40 kg.fed.$^{-1}$**			**Mean**
	Once/ week	**Twice/ week**	**Three times /week**		**Once/ week**	**Twice/week**	**Three times /week**	
H_3PO_4	1.58	1.71	1.77	1.69	1.70	1.83	1.92	1.82
MAP	1.54	1.70	1.73	1.66	1.68	1.81	1.90	1.80
APP	1.74	1.76	1.86	1.79	1.84	2.10	2.20	2.05
UP	1.69	1.76	1.82	1.76	1.87	2.20	2.34	2.14
Mean	1.64	1.73	1.80	1.72	1.77	1.99	2.09	1.95
$LSD_{0.05}$	Sources			0.08				
	Rates			0.05				
	Patterns			0.07				
Season 2007								
H_3PO_4	1.71	1.81	1.90	1.81	1.80	1.95	2.10	1.95
MAP	1.60	1.79	1.83	1.74	1.75	1.95	2.02	1.91
APP	1.80	1.86	1.96	1.87	1.95	2.15	2.25	2.12
UP	1.78	1.85	1.93	1.85	1.91	2.20	2.20	2.10
Mean	1.72	1.83	1.91	1.82	1.85	2.06	2.14	2.02
$LSD_{0.05}$	Sources			0.03				
	Rates			0.02				
	Patterns			0.02				

d- Micronutrients (Fe – Zn- Mn) :-

Results presented in Tables 10, 11 and 12 show significant variations in Fe, Zn and Mn concentrations under different P sources during the two seasons. The petiole Fe, Zn and Mn concentration were higher under APP applications compared with other sources. This effect may be attributed to the benefit from the presence of APP in solutions is the fact that iron and zinc can be sequestered by being attached to the various polyphosphate species between two adjacent hydroxyl group. The net effect is to render these materials more soluble and in essence prevent the precipitation. The other advantage for the use of polyphosphates through the sequestering reaction is the fact that these materials are able to maintain higher concentrations of certain micronutrient metals in solution without precipitation (Follet *et al*., 1981).

Irrespective of P sources, Fe, Zn and Mn concentration responded to increase phosphorus level from 20 to 40 kg/fed. there was an increase in Fe concentration from 120 to 127 ppm and from 123 to 130 ppm in the two seasons respectively. This increase in the micronutrients concentration is similar to the findings of Dhillon, *et al*., (1998).

Concerning the patterns of application effects, the data in Tables 10, 11 and 12 show that Fe, Zn and Mn were increased slightly under three times of application compared to other patterns.

Table 10: Effect of different sources, rates and patterns of phosphorus fertilizers application on iron (Fe ppm) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed.$^{-1}$			Mean	40 kg.fed.$^{-1}$			Mean
	Once/ week	Twice/ week	Three times /week		Once/ week	Twice/week	Three times /week	
H_3PO_4	117.67	118.00	118.00	117.89	124.33	125.00	126.33	125.22
MAP	116.67	117.00	117.00	116.89	123.67	124.00	125.00	124.22
APP	127.30	127.67	129.00	127.99	133.33	131.00	135.00	133.11
UP	117.33	118.67	119.00	118.33	125.33	126.00	127.00	126.11
Mean	119.74	120.34	120.75	120.28	126.67	126.50	128.33	127.17
$LSD_{0.05}$	Sources			1.27				
	Rates			0.87				
	Patterns			0.95				
	Season 2007							
H_3PO_4	121.00	121.00	122.00	121.33	127.00	128.00	129.00	128.00
MAP	120.00	120.00	121.00	120.33	126.67	127.00	127.00	126.89
APP	131.00	131.00	132.00	131.33	136.00	138.00	140.00	138.00
UP	121.00	122.00	122.00	121.67	128.00	129.00	130.00	129.00
Mean	123.25	123.50	124.25	123.67	129.42	130.50	131.50	130.47
$LSD_{0.05}$	Sources			0.79				
	Rates			0.45				
	Patterns			0.52				

Table 11: Effect of different sources, rates and patterns of phosphorus fertilizers application on zinc (Zn ppm) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed. $^{-1}$			**Mean**	**40 kg.fed. $^{-1}$**			**Mean**
	Once/ week	**Twice/ week**	**Three times /week**		**Once/ week**	**Twice/week**	**Three times /week**	
H_3PO_4	27.00	27.00	27.33	27.11	28.00	28.67	29.00	28.56
MAP	26.00	27.00	27.33	26.78	27.00	27.67	28.33	27.67
APP	33.00	33.33	34.00	33.44	35.67	38.33	38.67	37.56
UP	27.33	27.33	28.00	27.55	27.67	28.67	29.00	28.45
Mean	28.33	28.67	29.17	28.72	29.59	30.84	31.25	30.56
LSD $_{0.05}$	Sources			0.61				
	Rates			0.47				
	Patterns			0.58				
Season 2007								
H_3PO_4	30.00	31.00	31.00	30.67	31.00	32.00	32.00	31.67
MAP	29.00	30.00	30.00	29.67	30.00	31.00	31.00	30.67
APP	35.00	36.00	38.00	36.33	38.00	41.00	41.00	40.00
UP	30.00	31.00	31.00	30.67	31.00	32.00	32.00	31.67
Mean	31.00	32.00	32.50	31.83	32.50	34.00	34.00	33.50
LSD $_{0.05}$	Sources			0.94				
	Rates			0.58				
	Patterns			0.52				

Table 12: Effect of different sources, rates and patterns of phosphorus fertilizers application on manganese (Mn ppm) of Thompson seedless grape vine.

Sources	Rates and patterns of application							
	Season 2006							
	20 kg.fed. $^{-1}$			**Mean**	**40 kg.fed. $^{-1}$**			**Mean**
	Once/ week	**Twice/ week**	**Three times /week**		**Once/ week**	**Twice/week**	**Three times /week**	
H_3PO_4	31.00	31.33	32.00	31.44	33.00	34.67	35.33	34.33
MAP	31.33	31.67	32.00	31.67	32.33	34.33	35.33	34.00
APP	33.33	35.33	38.00	35.55	37.33	39.67	41.67	39.56
UP	31.67	31.67	33.67	32.34	32.67	34.67	35.00	34.11
Mean	31.83	32.50	33.92	32.75	33.83	35.84	36.83	35.50
LSD $_{0.05}$	Sources			0.37				
	Rates			0.42				
	Patterns			0.57				
Season 2007								
H_3PO_4	34.00	35.00	36.00	35.00	36.00	37.00	38.00	37.00
MAP	34.00	35.00	35.00	34.67	35.00	37.00	38.00	36.67
APP	38.00	39.00	40.00	39.00	40.00	42.00	44.00	42.00
UP	35.00	35.00	36.00	35.33	36.00	38.00	38.00	37.33
Mean	35.25	36.00	36.75	36.00	36.75	38.50	39.50	38.25
LSD $_{0.05}$	Sources			0.77				
	Rates			0.51				
	Patterns			0.44				

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تاثير مصادر الفوسفور تحت نظام الري التسميدي على التركيب الكميائى وانتاج محصول العنب

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أجريت تجربة حقلية في أرض رملية منزرعة بالعنب تحت نظام الري بالتنقيط فى مدينة السادات – محافظة المنوفية – مصر لمدة موسمين ٢٠٠٦-٢٠٠٧ لدراسة تأثير المصادر والمعدلات المختلفة للأسمدة الفوسفاتيه علي عنب الطومسون سيدلس من حيث المحصول ، متوسط وزن العنقود ، المواد الصلبة الكلية ، الحموضة ، المواد الصلبة الكلية / الحموضة والتركب الكيميائي فى أنصال الأوراق مستخدماً أربع مصادر للفسفور وهي (حمض الفوسفوريك ، فوسفات أحادي الأمونيوم ،بولي فوسفات الأمونيوم و يوريا فوسفات) ومعدلين للإضافة وهما (٢٠ ، ٤٠ كجم فو٢أ٥ /فدان) ونمط إضافة مرة واحدة ، مرتين وثلاث مرات فى الأسبوع من خلال مياه الري .

– ***وقد أوضحت النتائج ما يلي :***

- معدل الإضافة ٤٠ كجم / فدان أعطي أفصل نتائج مقارنة بمعدل ٢٠ كجم / فدان فى كل المعاملات فى كلا الموسمين
- اليوريا فوسفات وبولي فوسفات الامونيوم كانا أفضل من حامض الفوسفوريك وفوسفات آحادي الأمونيوم
- الإضافة ثلاث مرات فى الأسبوع أعطت نتائج أفضل من الإضافة مرة واحدة أومرتين فى الأسبوع على التوالي.

قام بتحكيم البحث

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