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PHOSPHORUS AND POTASSIUM FERTILIZATION EFFECT ON TWO COTTON CULTIVARS YIELD AND SOIL AVAILABITLITY OF PHOSPHORUS AND POTASSIUM

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ABSTRACT

Two field experiments were conducted during two the successive summer seasons (2007 and 2008) at the experimental farm of Sakha Agric. Res. station, Kafer El- Sheikh Governorate. The aim of this study was to investigate the effect of phosphorus fertilization levels (0, 22.5, and 45 Kg P_2O_5/ fad for P_0 (control), P_1, and P_2) and potassium fertilizer levels (0 and 50 K_2O / fad for K_0 and K_1, respectively) on yield of two cotton cultivars; Giza 86 (CV_1) and Giza 88 (CV_2) and the soil availability of phosphorus and potassium during cropping seasons. The experiments were conducted in split- split plot design where cotton cultivars as main plots, phosphorus fertilizer levels arranged as sub plot and potassium fertilization levels as sub– sub plot, with three replicates.

The obtained results can be summarized as following:

- The yield of cotton was significantly affected by cultivars and fertilization levels of P and K.
- Giza 88 attained higher yield compared to Giza 86.
- Application of P_1 treatment produced significant higher yield (26.0 and 24.8% in the two season respectively) than that of P_0 (control) treatment. There were about 6.8 and 7.6% increase in cotton yield in crop fertilized with P_2 compared to that with P_1 treatment.
- Cotton yield was significantly increased by 13.3 and 12.5% in 2007 and 2008 seasons, respectively with K_1 treatment compared with control treatment (K_0).
- The maximum mean value of cotton yield were 11.7 and 11.5 Kentar/fad in 2007 and 2008 seasons were obtained with K_1 under P_1 and P_2treatments, respectively for Giza 88 varity.
- Application of P_1 increased the available P by 38, 45, and 37.7% in 2007 and 2008 seasons, respectively.
- Available P is declined with P_0, P_1, and P_2 treatments as function of the growth stage of cotton.
- The maximum mean value of available P (28.3 mg/ Kg soil) was obtained by application of K_0 under P_2 for CV_1 in April 2007 and 2008 seasons. The minimum mean values (8.0 and 7.5 mg/ Kg soil in September 2007 and 2008 seasons, respectively) were obtained by application of K_0 and K_1 under P_0 for CV_2 and CV_1 , respectively.
- Application of K_1 increased available K by (10.84 and 10.81% than that of K_0 (control) in 2007 and 2008 seasons, respectively.
- The equilibrium of available K in the soil solution was re-established during cropping time.

INTRODUCTION

Since cotton production covers a broad spectrum of environments and economic circumstances, yields and hence nutritional requirements vary greatly. Supplying optimal quantities of mineral nutrients to the growing plants is one way to improve crop yield (Sawan, *et al.*, 2008). Fertilizers occupy pivotal position in raising seed cotton yield. Experiments have shown that an optimal yield could only be produced with balanced application of all major nutrients in soil (Makhdum *et al.*, 2001). Potassium is the essential macro nutrient for all living organism and required in large amount for the normal plant growth and development (Marschner, 1986). Potassium plays particularly important role in cotton fiber development and its shortage will result in pore fiber quality and lowered the yield (Cassman *etal.*, 1990).

Phosphorus has been found to be the life – limiting element in natural ecosystem because it is often bound in highly insoluble compounds and hence it becomes unavailable for plant uptake or utilization. Phosphorus is an essential nutrient and an integral component of several important compounds in plant cells (Ozanne, 1980). The importance of phosphorus for Egyptian cotton was confirmed by Sawan *et al.*, 2008 who concluded that application P at different concentrations significantly enhanced growth, N and K uptake as well as total chlorophyll concentration of cotton plants. Mehetre *et al.*,1990 found that fiber bundles strength was high with phosphorus fertilization.

The objective of the present study was to evaluate the response of two cotton cultivars to phosphorus and potassium fertilizers and to gain a better understanding of available phosphorus and potassium in soil during the growth cotton season.

MATERIALS AND METHODS

Two field experiments were carried out at the experimental farm of Sakha Agric. Res. Station during two successive summer seasons at (2007 and 2008) using cotton (*Gossypin barrbadense* L.). The experiment was conducted in split- split plot design with three replicates. The main plots were for cotton cultivars, Giza 86 (CV_1) and Giza 88 (CV_2). The sub- plots were occupied by phosphorus levels in form of super phosphate 15.5% P_2O_5 (0, 22.5, and 45 Kg P_2O_5/ fad for P_0, P_1, and P_2). The sub- sub plots to potassium fertilizer levels in from of potassium sulfate 48% K_2O. (0 and 50 K_2O / fad for K_0 and K_1), The phosphorus fertilizer was broadcasted and incorporated in the soil at sowing while potassium fertilizer was applied to the soil before the 2nd irrigation. All plots of the experiment were treated with 62Kg/ N/ fad in form of ammonium nitrate (33.5% N) splitted in two doses. The first dose was applied after thinning just before the second irrigation and the second dose was applied before the third irrigation.

Dry cotton seeds were planted during the second week of march in 2007 and 2008 seasons at the rate of 30 Kg/ fad by the broadcasting along the ridges and just irrigated. After complete recovery, cotton was thinned on to two plants hill.

The phosphorus and potassium availability during the season were monitored by collecting five cores from the surface layer for (0-15 cm) from each plot at 30, 60, 90, 120, 150, and 180 days after planting and prepared for chemical analysis. The phosphorus was extracted as describe by Olsen *et al.*, (1954) and then determined spectrophotometrically according to Jackson, (1967). Available potassium was determined by using flame photometer in the ammonium acetate extract, according to Jackson, (1967).

Soil samples were collected from the surface layer (0- 15 cm) before planting and air dried. Some chemical and physical properties were determined according to the standard methods (Jackson, 1967) and presented in Table 1.

Data were subjected to statistical analysis according to Snedecor and Cochran, (1980)

Table (1): Some chemical and physical properties of the soil before planting

pH*	EC_e dS/ m	OM%	Available nutrient mg/ Kg soil			Particle size distribution			
			N	P	K	Clay%	Silt%	Sand%	Texture
7.80	3.1	1.95	20	8.0	350	51.30	24.9	23.8	clayey

* In 1:2.5 soil : water suspension

RESULTS AND DISCUSSION

I- Seed cotton yield:

Data presented in Table 2a show the effect of cotton cultivars, phosphorus fertilizer and potassium levels on cotton yield.

Table 2a Mean values of cotton yield (kentar/ fad) in 2007 and 2008season as affected by cultivars, phosphorus and, potassium fertilizer levels

Treatment	2007 season	2008 season
CV_1	8.636	8.668
CV_2	9.792	9.768
P_0	7.273 c	7.340 c
P_1	9.829 b	9.755 b
P_2	10.540 a	10.560 a
K_0	8.558	8.603
K_1	9.869	9.833
V	*	*
P	**	**
K	**	**

Table 2b: Mean values of cotton yield (Kentar/ fad)in 2007 and 2008 seasons as affected by the interaction among cultivars, phosphorus and potassium fertilizer levels

CV	P	2007		2008	
		K_0	K_1	K_0	K_1
CV_1	P_0	6.35 c	7.02 b	6.60 c	7.00 b
	P_1	8.35 b	9.97 a	8.22 b	9.90 a
	P_2	9.80 a	10.33 a	9.87 a	10.42 a
CV_2	P_0	7.06 b	8.66 b	7.05b	8.88 b
	P_1	9.50 a	11.50 a	9.40a	11.50 a
	P_2	10.29 a	11.74 a	10.45a	11.50 a
V * P		ns		ns	
V * K		ns		ns	
P * K		ns		ns	
V * P * K		ns		ns	

P_0= 0, P_1= 22.5, and P_2= 50 Kg P_2O_5/ fad K_0= 0 , K_1= 50 Kg K_2O / fad
CV_1= Giza 86, CV_2= Giza 88

1- Cotton cultivars effect:

Data in Table 2a revealed that, the cotton cultivars differed significantly in yield. Giza 88 cultivar attained higher yield compared to Giza 86 in the two seasons. These differences may be due to the differences in the genetic ground of the used cultivars (Makhdum *et al.*,2001) or/ and to the reason that Giza 88 is more indeterminate in growth habit and produced great number of fruiting positions per unit area compared to Giza 86 (Zein *et al., 2003*)

2- Phosphorus fertilizer levels effect:

Table 2a showed that application of the different P levels had highly significant effect on seed cotton yield in the two seasons. Data indicate that cotton yield was increased with each increment of phosphorus dose. Application of P_1 (22.5 Kg P_2O_5/ fad) produced higher yield (26.0 and 24.8 %) than that of unfertilized plot P_0 (control) in 2007 and 2008 seasons, respectively. There were about 6.8 and 7.6% increase in cotton yield in crop fertilized with P_2 compared to the crop yield with P_1 treatment in the two seasons, respectively. The positive response to the added phosphorus in cotton yield due to that the experiment soil moderate in available phosphorus (Table 1) and phosphorus may fixed in the soil. These results are agreed with those obtained by Sawan, *et al.,* (2008), who reported that application of P fertilizer increased the number of opened bolls per plant as compared with the untreated control in both seasons. Makdhum *et al.,* (2001) concluded that, plots reserving phosphorus fertilizer led to better plant growth, higher fruiting positions, and intact fruit which was reflected on the cotton yield. Russell, (1973) explained this in the fact that phosphorus is essential for cell division and development of meristematic tissue, causing a stimulating effect on number of flower buds and bolls per plant. The plots maintaining extractable phosphorus in range of 13.7- 28.3 mg/ Kg produced higher seed cotton yield compared to plots having ≤ 13.7 mg/ Kg of soil during the season. It has been reported that cotton was likely to respond to phosphorus fertilization where extractable phosphorus was ≤ 14.0mg/ Kg of the clay soil at planting time (Halevy, 1979). Makhdum *et al.*,2000 reported that a significant increase in cotton yield in clay soils having phosphorus ≤12 mg/ Kg of soil at planting time. Crozir, (2009) reported that over a period of several years, replicated trials with soil testing high in available phosphorus have shown an average increase in cotton lint yield of 60 pounds per acre. On the other hand Malik *et al.,* 1996 came to the conclusion that, the phosphorus requirements of cotton are considered very low because of its deep root system and indeterminate growth habit.

3- Potassium fertilizer levels effect:

Data in Table 2a showed that cotton yield was significantly increased by 13.3 and 12.5% in both seasons, respectively with K_1 treatment compared with the control (K_0). Results obtained here were confirmed with those obtained by Pervez *et al.,* (2004), Ali *et al.,* (2007) and Sawan *et al.,* (2008). They reported that application of K fertilizer is economically viable for sustained crop production. Positive response to addition of K fertilizer could be due to the favorable effect of this nutrient on yield components of number of opened bolls per plant, boll weight, or both leading to higher cotton yield

(Zeng, 1996). Furthermore, K has an important role in the translocation of photosysnthates from sources to sinks (Cakmak, *et al.,* 1994)

4- Interactions among treatments:

Table 2b revealed that there were no significant interaction among cultivars, phosphorus and potassium fertilizers on seed cotton yield. The maximum mean value of cotton yield were 11.7 and 11.5 Kentar / fad, in 2007 and 2008 seasons, respectively) were obtained by application of K_1 under P_1 or P_2 for CV_2 (Giza.88)

II Available phosphorus in the soil:

1- Cotton cultivars effect:

Data in Tables (3a, 4a, and 5a) showed that cultivars significantly affected available P in all months during cropping in the two seasons except for May in 2008 season and September in the two seasons. Available P in plots cultivated with CV_1 was higher than that cultivated with CV_2. These increments were 0.58% and 0.59% (mean of all months) in the two seasons, respectively. This finding may be explained in the fact that CV_2 had growth yield more than CV_1 and it was consumed more available P and / or the differences between the used cultivars of root distribution and root refuse which affect phosphorus availabilty. Makhdum *et al.,* (2001) came to similar results, They reported that the differential response of cultivars to phosphorus nutrition is due to their inherent indeterminate growth habit and thereby efficiency in utilizing available and reserve nutrient resources.

2- Phosphorus fertilizer levels effect:

Data in Tables (3a, 4a, and 5a) and Fig.1 revealed that application of P fertilizer levels had highly significant effect on available P in all months in the two seasons. The results showed that phosphorus availability in soil was increased with each increment of fertilizer dose. However, increase in availability was not proportionate to added amount (Fig.1). Application of P_1 treatment produced increased the available P by 38.45 and 37.70 % than that of P_0 in the two growing season, respectively, while these increase were 3.14 and 3.44% as a results of increase P fertilizer level from P_1 to P_2in the two seasons, respectively. This occurred due to soil cation exchange capacity which affect electric double layer who affects phosphorus retention. The high amount of applied phosphorus fertilizer lossed from the soil rather than the low amount, and fixing a sizeable portion of phosphorus fertilizer and reducing its availability in soil with pH>7.5 (Vanderdeelen 1995).

Fig.1 showed that extractable available phosphate is declined in the control (P_o) and the fertilized plots (P_1 and P_2) as a function of growth stage. These decrement were 31.9, 46.3, and 53.6 by increasing of the plant age (from 30 to 180 days) for P_o, P_1, and P_2 in the first season, respectively and 35.0, 46.7, and 53.7% in the second season, respectively. This could be explained on the fact that in soil with pH ≥7.5, phosphate chemistry is dominated by a precipitation reaction with calcium ions, starting from the highly soluble dicalcium phosphate dehydrate (DCPD), ultimately the sparing Insoluble hyhroxyapatite (HA) of fluorapatite (FA) are obtained via the intermediate octaculcium phosphate (OCP) (Vanderdeelen 1995). Also plants absorb great amount of available phosphorus during growth period On the other hand, (Tinker,1980) reported that P availability in soil was also increased with the advancement in crop age. This could be ascribed to increase in root activity in soil plant roots excrete organic acid and chelating organic compounds in rhizosphere. These compounds form multiple complex compounds with Ca, Mg, and/or Fe and thereby increased phosphorus availability in soil.

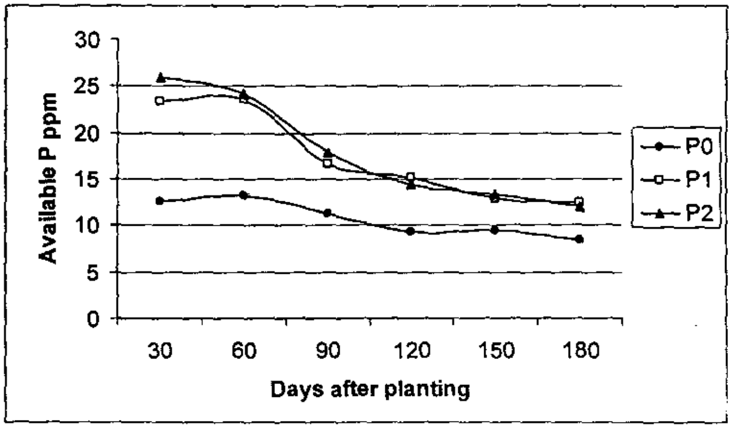

Fig.1: Phosphorus availability in soil versus after planting with increment of phosphorus fertilizers dose (mean value of the two seasons).

3- Potassium fertilizer levels effect:

Tables 3a, 4a, and 5a showed that application of potassium fertilizer had significant effect on available P in all months during cropping except for May and June 2007 and September in the two seasons.

Available P was increased by 3.9 and 4.6 % (values of all months) in the first and second seasons, respectively with K_1 compared to K_0 treatment. The positive response to addition of K fertilizer could be due to acidity of K_2SO_4 fertilizer which decrease soil pH and increase phosphorus availability in addition to presence of potassium nutrient activate soil microorganisms who lead to increase phosphorus availability.

4- Interactions among treatments:

Tables (3b, 4b, and 5b) showed the interaction effect among cultures, phosphorus and potassium fertilizer levels on available P during cropping.

The maximum mean value of available P (28.3 mg/ Kg soil) was obtained with K_0 under P_2 for CV_1 in April 2007 and 2008 seasons. The minimum mean values for available P (8.0 and 7.5 mg/ Kg soil in September 2007 and 2008 seasons) were obtained with K0 and K_1 under P_0 for CV_2 and CV_1, respectively.

Table 3a: Available phosphorus in 2007 and 2008 seasons as affected by cultivars, Phosphorus and potassium fertilizer levels as mean of every month

	April		May	
	2007	2008	2007	2008
CV_1	20.12	19.90	21.08	20.65
CV_2	21.52	20.95	19.93	19.61
P_0	12.70	12.55	13.25	13.05
P_1	23.63	23.15	23.83	23.43
P_2	26.13	25.58	24.45	23.93
K_0	20.15	19.61	21.48	21.25
K_1	21.48	21.23	19.53	19.02
V	*	*	*	ns
P	**	**	**	**
K	*	*	ns	**

Table 3b: Interaction effect of cultivars, P, , and K levels in 2007 and 2008 seasons on available phosphorus during crop seasons as mean of every month

CV	P	April				May			
		2007		2008		2007		2008	
		K_0	K_1	K_0	K_1	K_0	K_1	K_0	K_1
CV_1	P_0	12.6 c	12.7 b	12.5 c	12.5 b	13.8 b	13.9 b	13.7 c	13.5 c
	P_1	18.0 b	24.1 a	17.0 b	25.1 a	27.8a	23.5 a	27.7 a	23.0 a
	P_2	28.3 a	25.0 a	28.3 a	24.0 a	25.5 a	22.0 a	25.0 b	21.0 b
CV_2	P_0	12.2 b	13.3 b	12.0 b	13.2 b	12.5 b	12.8 c	12.4 b	12.6 c
	P_1	26.1 a	26.3 a	25.2 a	25.3 a	24.5 a	19.5 b	24.0 a	19.0 b
	P_2	23.7 a	27.5 a	22.7 a	27.3 a	24.8 a	25.5 a	24.7a	25.0a
V * P		**		*		*		**	
V * K		ns		ns		ns		ns	
P * K		ns		**		ns		**	
V * P * K		***		***		ns		*	

* P_0= 0, P_1= 22.5, and P_2= 50 Kg P_2O_5/ fad
K_0= 0 , K_1= 50 Kg K_2O / fad
CV_1= Giza 86, CV_2= Giza 88

Table 4a: Available phosphorus in 2007 and 2008 seasons as affected by cultivars, Phosphorus and potassium fertilizer levels as mean of every month during crop season

	June		July	
	2007	2008	2007	2008
CV_1	15.72	15.85	13.47	13.20
CV_2	14.95	14.68	12.63	12.48
P_0	11.38	11.20	9.38	9.18
P_1	16.78	16.58	15.23	15.00
P_2	17.85	18.03	14.50	14.35
K_0	14.98	14.85	12.23	12.03
K_1	15.68	15.68	13.87	13.64
V	*	*	*	*
P	**	**	**	**
K	ns	**	**	**

Table 4b: Interaction effect of cultivars, P, and K levels in 2007 and 2008 seasons on available phosphorus during crop seasons as mean of every month

CV	P	June				July			
		2007		2008		2007		2008	
		K_0	K_1	K_0	K_1	K_0	K_1	K_0	K_1
CV_1	P_0	12.8 c	10.8 b	12.9 c	10.5 b	9.9 c	8.8 c	9.8 c	8.3 c
	P_1	15.2 b	18.3 a	15.0 b	18.3 a	12.5 b	19.8 a	12.0 b	19.7 a
	P_2	18.3 a	18.9 a	18.7 a	19.7 a	14.9 a	14.9 b	14.7 a	14.7 b
CV_2	P_0	9.8 c	12.1 c	9.5 c	11.9 c	9.2 b	9.6 b	9.1 a	9.5 b
	P_1	15.5 b	18.1 a	15.0 b	18.0 a	13.5 a	15.3 a	13.3 a	15.0 a
	P_2	18.3 a	15.9 b	18.0 a	15.7 b	13.4 a	14.8 a	13.3 a	14.7 a
V * P		ns		*		ns		*	
V * K		ns		ns		ns		ns	
P * K		**		**		**		**	
V * P * K		**		**		**		**	

*P_0= 0, P_1= 22.5, and P_2= 50 Kg P_2O_5/ fad
K_0= 0 , K_1= 50 Kg K_2O / fad
CV_1= Giza 86, CV_2= Giza 88

Table 5a: Available phosphorus in 2007 and 2008 seasons as affected by cultivars, Phosphorus and potassium fertilizer levels as mean of every month

	August		September	
	2007	2008	2007	2008
CV_1	11.72	11.44	11.00	10.53
CV_2	12.23	12.32	11.32	11.01
P_0	9.40	9.59	8.65	8.16
P_1	13.0	12.8	12.7	12.33
P_2	13.53	13.25	12.13	11.83
K_0	11.32	11.38	10.92	10.69
K_1	12.63	12.38	11.40	11.85
V	*	*	ns	ns
P	**	**	**	**
K	**	**	ns	ns

Table 5b: Interaction effect of cultivars, P, , and K levels in 2007 and 2008 seasons on available phosphorus during crop seasons as mean of every month

CV	P	August				September			
		2007		2008		2007		2008	
		K_0	K_1	K_0	K_1	K_0	K_1	K_0	K_1
CV_1	P_0	9.0 b	9.1 b	8.55 b	9.0 c	8.2 b	8.9 b	8.1 b	7.5 b
	P_1	11.9 a	14.8 a	11.7 a	14.8 a	12.5 a	12.2 a	12.3 a	11.3 a
	P_2	12.5 a	13.0 a	12.1 a	12.5 a	11.1a	13.1 a	11.0 a	13.0 a
CV_2	P_0	8.0 c	11.5 b	9.5 c	11.3 b	8.0 b	9.5 b	7.75 b	9.3 b
	P_1	11.8 b	13.5 a	11.7 b	13.0 a	13.2 a	12.9 a	13.0 a	12.7 a
	P_2	14.7 a	13.9 a	14.7 a	13.7 a	12.5 a	11.8 a	12.0 a	11.3 a
V * P		*		*		ns		ns	
V * K		ns		ns		ns		ns	
P * K		ns		**		ns		ns	
V * P * K		ns		**		ns		**	

* CV1= Giza 86, CV_2= Giza 88
P_0= 0, P_1= 22.5, and P_2= 50 Kg P_2O_5/ fad
K_0= 0 , K_1= 50 Kg K_2O / fad

III- Available potassium in the soil

1- Cotton cultivars effect:

Data presented in Tables (6a, 7a ,and 8a) showed that cultivars had no significant effect on available K in all months during cropping in the two seasons except for September 2007, Jun 2008, and July in the two seasons.

2- Phosphorus fertilizer levels effect:

Data in the same tables showed that application of P fertilizer during cropping in the two seasons had highly significant effect on available K in the first season, while in the second season there were no significant effects. It seemed that there was no increasing or decreasing trend at available K as affected by P fertilizer during the experiment.

3- Potassium fertilizer levels effect:

Data in the same tables and Fig. 2 reveled that application of K fertilizer had highly significant effect on available K in all months during cropping in the two seasons except for April and may 2008.

Application of K_1 treatment increased the available K by 10.84 and 10.81% over than that with K_0 (control) in 2007 and 2008 seasons, respectively. This may be due to application of potassium fertilizer increased soluble, exchangeable and fixed potassium in the soil which led to increase available potassium during cotton growth period. Crozier, (2009) reported that , although potassium is retained by soils more strongly than nitrogen, it can be lost through leaching and may need replacing.

Fig. 2 showed that available K during (30- 150 days of cropping season) ranged between 449- 515 mg/ Kg soil with K_0 treatment, and 502-571 mg/ Kg with K_1 treatment. These results could be explained on the fact that potassium in solution is in equilibrium with that found in the slowly available fixed. As plants take up potassium from soil solution it is restocked from slowly pool of potassium or from K held on the surface of Clay particles, and equilibrium is re- established (Mengel and Kirkby, 1982). After 180 days from planting the soil was dried and available K decreased. This may be explained by the fact that, some clay menials fix K^+ under dry conditions, for this reason fixation is frequently higher under dry than moist soil conditions (Mengel and Kirkby, 1982).

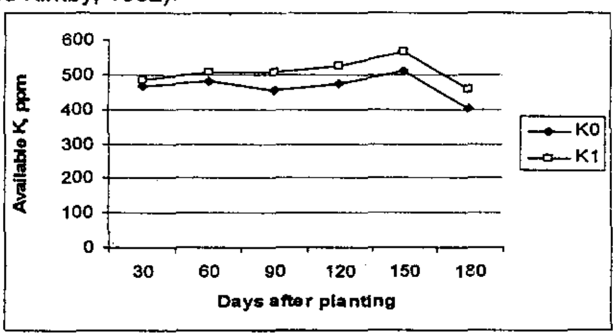

Fig.2: Potassium availability in soil versus after planting with increment of potassium fertilizers dose (mean value of the two seasons).

4- Interactions among treatments:

Data in Tables 6b, 7b, and 8b showed the significant effect of cultivars, phosphorus and potassium levels interaction on available K. The maximum mean values of available K (636 and 672 mg/ Kg soil) in August and June 2007 and 2008 seasons respectively were obtained by application of K_1 under P_0 and P_1 for CV_1. The minimum available potassium (390 and 368 mg/ Kg in September 2007 and 2008 seasons, respectively) were obtained by application of K_0 under P_2 for CV_1 and CV_2, respectively.

Table 6a: Available potassium in 2007 and 2008 seasons as affected by cultivars, Phosphorus and potassium fertilizer levels as mean of every month during crop season

	April		May	
	2007	2008	2007	2008
CV_1	480	470	511	506
CV_2	503	498	483	473
P_0	468	472	519	507
P_1	525	504	492	487
P_2	481	478	479	474
K_0	466	462	486	477
K_1	517	507	508	502
V	ns	ns	ns	ns
P	**	ns	**	ns
K	**	ns	**	ns

Table 6b Interaction effect of cultivars, P, , and K levels in 2007 and 2008 seasons on available potassium during crop seasons as mean of every month

CV	P	April				May			
		2007		2008		2007		2008	
		K_0	K_1	K_0	K_1	K_0	K_1	K_0	K_1
CV_1	P_0	425 a	450 c	425 a	477 a	510 a	595 a	505 a	588 a
	P_1	458 a	597 a	442 a	537 a	501 a	520 b	496 a	516 ab
	P_2	448 a	500 b	448 a	492 a	470 a	472 c	467 a	462 b
CV_2	P_0	482 ab	515 a	479 a	505 a	490 a	482 a	458 a	477 a
	P_1	519 a	525 a	516 a	520 a	458 a	490 a	452 a	485 a
	P_2	462 b	515 a	461 a	509 a	485 a	490 a	481 a	486 a
V * P		ns		ns		**		. ns	
V * K		**		ns		ns		ns	
P * K		**		ns		ns		ns	
V * P * K		***		ns		**		ns	

*P_0= 0, P_1= 22.5, and P_2= 50 Kg P_2O_5/ fad
K_0= 0 , K_1= 50 Kg K_2O / fad CV₁= Giza 86, CV_2= Giza 88

Table 7a: Available potassium in 2007 and 2008 seasons as affected by cultivars, Phosphorus and potassium fertilizer levels as mean of every month during crop season

	June		July	
	2007	2008	2007	2008
CV_1	495	490	515	510
CV_2	514	509	489	482
P_0	480	474	496	493
P_1	526	524	514	510
P_2	506	500	596	485
K_0	456	449	474	471
K_1	553	550	530	521
V	ns	*	*	*
P	**	ns	**	ns
K	**	**	**	**

Table 7b Interaction effect of cultivars, P, , and K levels in 2007 and 2008 seasons on available potassium during crop seasons as mean of every month

CV	P	June				July			
		2007		2008		2007		2008	
		K_0	K_1	K_0	K_1	K_0	K_1	K_0	K_1
CV_1	P_0	401 b	501 b	388 a	498 b	478 b	515 b	508 a	512 b
	P_1	478 a	620 a	474 a	627 a	490 a	612 a	486 a	600 a
	P_2	476 a	492 b	466 a	487 b	488 a	505 b	485 a	500 b
CV_2	P_0	472 a	546 b	469 a	541 a	482 a	508 a	480 a	505 a
	P_1	458 a	548 b	453 a	540 a	433 b	520 a	433 a	519 a
	P_2	448 a	609 a	444 a	604 a	470 a	520 a	466 a	490 a
V * P		**		*		**		ns	
V * K		ns		ns		ns		ns	
P * K		ns		ns		**		**	
V * P * K		***		ns		**		ns	

*P_0= 0, P_1= 22.5, and P_2= 50 Kg P_2O_5/ fad
K_0= 0 , K_1= 50 Kg K_2O / fad CV₁= Giza 86, CV_2= Giza 88

Table 8a: Available potassium in 2007 and 2008 seasons as affected by cultivars, Phosphorus and potassium fertilizer levels as mean of every month during crop season

	August		September	
	2007	2008	2007	2008
CV_1	540	528	435	426
CV_2	545	546	438	426
P_0	556	552	432	423
P_1	548	541	463	457
P_2	524	517	415	398
K_0	515	508	407	397
K_1	571	565	466	454
V	ns	ns	*	ns
P	**	ns	**	ns
K	**	**	**	**

Table 8b : Interaction effect of cultivars, P, and K levels in 2007 and 2008 seasons on available potassium during crop seasons as mean of every month

CV	P	August				September			
		2007		2008		2007		2008	
		K_0	K_1	K_0	K_1	K_0	K_1	K_0	K_1
CV_1	P_0	468 b	636 a	462 a	626 a	415 a	448 b	410 a	443 a
	P_1	448 b	588 b	438 a	584 a	395 a	510 a	393 a	500 a
	P_2	550 a	550 c	509 a	549 a	390 a	453 b	377 a	433 a
CV_2	P_0	556 a	565 a	556 a	564 a	398 b	465 ab	388 a	449 a
	P_1	575 a	580 a	570 a	574 a	452 a	496 a	448 a	486 a
	P_2	490 b	505 b	515 a	495 a	390 b	425 b	368 a	415 a
V * P		**		ns		ns		ns	
V * K		**		**		ns		**	
P * K		**		ns		ns		ns	
V * P * K		***		ns		ns		ns	

*P_0= 0, P_1= 22.5, and P_2= 50 Kg P_2O_5/ fad
K_0= 0 , K_1= 50 Kg K_2O / fad
CV_1= Giza 86, CV_2= Giza 88

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تأثير التسميد الفوسفاتي والبوتاسي على إنتاجية صنفين من القطن وصلاحية الفوسفور والبوتاسيوم في التربة

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أقيمت تجربتين حقليتين في المزرعة البحثية- محطة البحوث الزراعية بسخا – كفر الشيخ- مصر خلال الموسمين الصيفيين المتعاقبين (٢٠٠٧ – ٢٠٠٨).

الهدف من البحث دراسة تأثير مستويات التسميد الفوسفاتي بمعدل (صفر و ٢٢,٥ و ٤٥ كجم فو٢ أ٥ / فدان) والتسميد البوتاسي بمعدل (صفر و ٥٠ كجم بو٢أ/ فدان) على إنتاجية صنفين من القطن (جيزة ٨٦ و جيزة ٨٨) وصلاحية الفوسفور والبوتاسيوم في التربة طوال فترة نمو المحصول.

وقد أقيمت التجارب في تصميم قطع منشقة مرتين في ثلاث مكررات وكان العامل الرئيسي هو أصناف القطن والعامل تحت الرئيسي معاملات الفوسفور والعامل تحت/ تحت الرئيسي مستويات البوتاسيوم **ويمكن تلخيص النتائج كما يلي:-**

- تأثر محصول قطن الزهر معنويا بكل من الصنف ومستويات التسميد الفوسفاتي والبوتاسي.
- أعطى صنف جيزة ٨٨ محصول قطن أعلى من صنف جيزة ٨٨ .
- ازداد محصول القطن بمقدار ٢٦ و٢٤,٨ % في الموسمين ٢٠٠٧ و ٢٠٠٨ باستخدام معدل(٢٢,٥ كجم فو٢ أ٥ / فدان) مقارنة بمعاملة الكنترول (صفر كجم فو٢ أ٥ / فدان).
- بزيادة معدل التسميد الفوسفاتي إلى(٤٥ كجم فو٢ أ٥ / فدان) يزداد محصول القطن بمقدار ٦,٨ و٧,٦ % مقارنة بمعدل (٢٢ كجم فو٢ أ٥ / فدان)ز
- ازداد محصول القطن الزهر بمقدار ١٣,٣ و ١٢,٥ % في الموسمين الزراعيين ٢٠٠٧ و ٢٠٠٨ عند معدل ٥٠ كجم بو٢أ/ فدان) عنها بمعاملة الكنترول.
- كان أعلى محصول قطن ١١,٧ و١١,٥ قنطار/ فدان في ٢٠٠٧ و ٢٠٠٨ على التوالي مع معدل (٢٢,٥ كجم فو٢ أ٥ / فدان) و٥٠ كجم بو٢أ/ فدان وصنف جيزة ٨٨.
- ازداد الفوسفور الميسر بمقدار٣٨,٤٥ و٣٧,٧% عند التسميد بمعدل (٢٢,٥ كجم فو٢ أ٥ / فدان) مقارنة بمعاملة الكنترول (صفر كجم فو٢ أ٥ / فدان) في الموسمين الأول والثاني على التوالي.
- خلال فترة نمو القطن انخفض الفوسفور الميسر وكان أعلى تركيز له (٢٨,٣ جزء في المليون) في شهر إبريل عند التسميد الفوسفاتي (٢٢,٥ كجم فو٢ أ٥ / فدان) ومع صنف جيزة ٨٦؛ بينما كانت أقل قيمة (٧,٥ جزء في المليون) في شهر سبتمبر وصنف جيزه ٨٨
- ازداد البوتاسيوم الميسر بمقدار (١٠,٨٤ و١٠,٨١ %) عند التسميد بمعدل (٥٠ كجم بو٢أ/ فدان) مقارنة بمعاملة الكنترول (صفر كجم فو٢ أ٥ / فدان) في الموسمين الأول والثاني على التوالي.
- خلال فترة نمو القطن يجدد إتزان البوتاسيوم الميسر في محلول التربة.