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ECONOMICAL EVALUATION OF COTTON RESPONSE TO THE COMBINED OR INDIVIDUAL APPLICATION OF PHOSPHORUS AND POTASSIUM FERTILIZERS

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ABSTRACT

Two field experiments were conducted at El-Serw Agricultural Research Station (ARC), Damietta Governorate during 2006 and 2007 growing seasons to evaluate economically the effect of phosphorus fertilizer levels (0, 15, 30 and 45 kg P_2O_5/fed), potassium fertilizer levels (0, 24, 48 and 72 kg K_2O/fed) and their combinations as independent variables on some quantity and quality characters of cotton variety Giza 86 as dependent variables. The quantity characters were cotton seed yield (kg/fed), seed yield (kg/fed), lint yield (kg/fed.) and oil yield (kg/fed) and the quality characters were seed index (g), boll weight (g), number of open bolls/plant and nutrient concentrations (N, P and K %). Simple correlation, simple regression and stepwise regression analysis were used to detect different relationships included.

The results obtained could be summarized as follows:

1- Quantity characters:

A- Simple correlation

1- Results of simple correlation analysis indicated that the highest significant positive correlation of 2-tailed at 0.01 level was found between phosphorus fertilization and each of cotton seed, seed, lint and oil yields with r-values of 0.964, 0.966, 0.961, 0.979, respectively.

2- Significancy at 0.01 level and a positive correlation were found between potassium fertilization and each of cotton seed, seed, lint and oil yields with r-values of 0.964, 0.960, 0.929 and 0.969, , respectively.

3- Significancy at 1% level and a positive correlation were found between phosphorus x potassium fertilization and each of cotton seed, seed, lint and oil yields with r-values of 0.964, 0.606, 0.658 and 0.562, , respectively.

4- Also, the result of simple correlation analysis showed that the significant at 0.01 level and positive correlation was found between phosphorus and potassium as independent variables and cotton seed yield as dependent variable with r-values of 0.728 and 0.433, respectively.

B- Simple regression analysis:

1- Result of simple regression analysis cleared that the relative contributions of (R^{-2}) for P, K and PK fertilization as independent variables were accounted by 92%, 89% and 39% from the total variation of cotton seed yield as dependent variable successively, the relative fertilization contributions of (R^{-2}) for P, K and PK fertilization were accounted by 93%, 91% and 35% from the total variation of seed yield , respectively, also the relative contributions of (R^{-2}) for P, K and PK fertilization were accounted by 92%, 85% and 42% from the total variation of lint yield successively and the relative contributions of (R^{-2}) for P, K and PK fertilization were accounted by 95%, 93% and 30% from the total variation of oil yield, respectively.

C- Stepwise regression analysis:

Result of stepwise regression analysis revealed that the P fertilization was the highest factor contributing to the total variation of cotton seed yield with R^2 being 52.3%; on the other hand, the K fertilization was the second factor contributing to the total variation of cotton seed yield with R^2 being 19.7%.

11- Quality characters:

A- Simple correlation analysis:

Result of simple correlation analysis indicated that the highest significant positive correlation (at 0.01 level) was found between P fertilization and each of seed index, boll weight and number of open bolls/plant with r-value of 0.988, 0.981 and 0.986, , respectively.

A significant and a positive correlation were found between K fertilization and each of seed index, boll weight and number of open bolls/plant with r-value of 0.955, 0.933 and 0.949 successively. Significant and positive correlation was found between (P x K) fertilization and each of seed index, boll weight and number of open bolls/plant with r-value of 0.400, 0.363 and 0.646, respectively. Also, the result of simple correlation analysis indicated that the highest significant positive correlation (at 0.01 level) was found between P fertilization and each of N%, P%, and K% with r-value of 0.985, 0.972 and 0.979, respectively. A significant and a positive correlation (at 0.01 level) was found between K fertilization and each of N%, P% and K% with r value of 0.883, 0.998 and 0.996, successively.

B- Simple regression analysis:

Result of simple regression analysis cleared that the relative contribution of each of P, K and PK fertilization as independent variable were accounted by 98%, 90% and 32% from the total variation of seed index as dependent variable successively. The relative contribution of each of P, K and PK fertilization were accounted by 96%, 87% and 28% from the total variation of boll weight , respectively, and the relative contribution of each of P, K and PK fertilization were accounted by 97%, 89% and 41% from the total variation of number of open bolls/plant, successively.

III- Economic evaluation

Result of the study indicated that the highest productivity and the highest net revenue were accounted by 7.49 Kentar / fed and 2558 LE / fed successively of using 72 kg K_2O/fed + 30kg P_2O_5/fed.

INTRODUCTION

Cotton (*Gossypium barbadense* L.) is the most important crop in Egypt. It is the main raw material for the largest national industry. It is the textile industry and it is also the main source of locally produced cotton seed oil; therefore, continuous efforts have been directed towards it. It is necessary to know the adequate amount of phosphors, potassium and their combinations needed to obtain the highest productivity of most crops.

Cotton yield has very complex attributes. It is the final outcome of a number of components. Phosphorus (P), Potassium (K) and their interaction are the greatest variables influencing in this yield. Therefore, it is necessary to detect variables having the greatest effect on the yield and the relative contributions to variables having the greatest effect on the yield and the relative contribution to variation in the yield. Many statistical methods such as correlation and path coefficient analysis are successfully applied to determine the contribution of each attribute to the potential seed yield (Mitkees *et al*.,

1991, El-Taweel *et al*., 2001 and Rahmou *et al*., 2007). It was found that these statistical approaches are not enough to predict the yield because many yield components have high correlation with seed yield but may contribute little efficiency to the prediction equation (El-Sayed and Mohamed, 1992). The stepwise multiple linear regression analysis may be the appropriate technique due to its sequence of multiple linear regression equations in a stepwise manner. The criterion for adding or removing an independent variable can be stated equivalently in terms of error of sum of squares terms reduction coefficient of partial correlation of F^* statistic (Draper and Smith, 1981).

The main objective of this study was to investigate the relationships between P, K and their interactions as independent variables and some quality characters of cotton variety Giza 86 as dependent variables. The quantity characters were seed cotton, seed, lint, oil and their yields and the quality characters were seed index, boll weight, No. of open bolls and NPK concentrations in the youngest fourth fully matured leaf on the main stem at full flowering.

MATERIALS AND METHODS

Two field experiments were carried out at El-Serw Research Station Damietta Governorate, ARC, during 2006 and 2007 seasons on cotton cv. Giza 86. Some physical and chemical properties of the experimental soil (Page et al., 1982) are given in Table (1). A split plot design with four replicates was used where the main plots were arranged for potassium fertilizer rates 0, 24, 48 and 72 kg K_2O/fed., while sub plots were devoted to phosphorus fertilizer rates (0, 15, 30 and 45 kg P_2O_5/fed).

Other agricultural practices were applied as usually done in the ordinary cotton fields.

Table (1): The physical and chemical analyses of the soils under investigation

1- Physical analysis					
Seasons	**Coarse sand %**	**Fine sand %**	**Silt %**	**Clay %**	**Texture class**
2006	1.33	10.85	24.10	63.72	**Clayey**
2007	1.52	10.10	23.50	64.88	**Clayey**

2- Chemical analysis						
Seasons	**$CaCO_3$%**	**Organic matter %**	**EC dS/m (1: 5 soil:water extract)**	**pH (1:2.5 Soil:water suspension)**	**Available nutrients (ppm)**	
					K	**P**
2006	1.35	1.20	5.8	8.1	480	8.3
2007	1.48	1.32	4.4	8.2	430	7.8

Data collected included some quantity and quality characters as dependent variables and P, K and their interactions as independent variables as shown in Table (2).

Table (2): Dependent and independent variables in the study

1-Dependent variables	
1-Quantity characters	
1- cotton seed yield (kg/fed) (yi)	y1 by P – y2 by K – y3 by PK
2- seed yield (kg/fed) (qi)	q_1 by P – q2 by K – q3 by PK
3- lint yield (Kg / fed) (ci)	c1 by P – c2 by K – c3 by PK
4- oil yield (kg/ fed) (Gi)	G1 by P – G2 by K – G3 by PK
11- Quality characters	
1- seed index (g) ai	a1 by P – a 2 by K a3 by P k
2- boll weight (g) di	d1 by P – d2 by K d3 by Pk
3- No. of open bolls /plant Ei	E1 by P – E2 by K E3 by PK
4- N concentrations * Fi	F1 by P – F2 by K
5- P concentrations *Hi	H1 byP– H2 by K
6- K concentrations * Li	L1 by P – L2 by K
Independent variables	
1- phosphorus (P) --- x1	
2- potassium (K) --- x2	
3- phosphorus x potassium (PK) – x3	

* A sample of the youngest fourth fully matured leaf on the main stem at full flowering was taken according to Walsh and Beaton (1977), to determine nutrients concentrations as described by Jackson (1973).

Statistical analysis:

Relationships among dependent and independent variables were studied using statistical technique following the two growing seasons of 2006 and 2007:

1- Simple correlation coefficient was calculated as applied by Sendecor and Cochran (1980) to estimate the correlation coefficient (r) between each of dependent and independent variables.

2- Simple regression analysis was performed as outlined by Heady (1961), and Johnsston (1989) to estimate the coefficient (Bi), R^2 and adjusted R square (R^2), to present relative independent variables for each dependent variable.

RESULTS AND DISCUSSION

In accordance with the objective of this study, the results and discussion are presented under two parts as follows:

1- Quantity characters as affected by P, K and PK fertilization:

This part includes the relationships between quantity characters as dependent variables and each of P, K and PK fertilization as independent variables. The quantity characters were cotton (yi), seed (qi), lint (Ci) and oil (Gi).

1- Relationship between cotton seed yield (yi) and each of P, K and PK fertilization:

a- Simple correlation: Simple correlation coefficients between cotton seed yield (kg/fed), yi and each of P, K and PK are clear in Table (3). The analysis of data presented was highly significant positive correlation of (2- tailed) at 0.01 level with r-values of 0.96, 0.96 and 0.96, respectively.

b- **Simple regression analysis:** Data in Table (3) contain equation numbers 1, 2 and 3 indicate that there was highly significant positive relation at 0.01 level between cotton seed yield (kg/fed.) and each of P, K and PK, respectively. Results also recorded that increasing each of P, K and PK with one unit led to increase of each of y1, y2 and y3 by significant positive increment at 0.01 level by 3.34, 2.08 and 3.35 (kg/fed.), respectively. Also Table (3) recorded that the values of adjusted coefficient determined were 0.92, 0.89 and 0.39 from changing dependent variables (cotton seed yield) y1, y2 and y3 due to the change of independent variables for each of P, K and PK inside every equations number, 2 and 3, respectively, in case of no change in other factors.

Table (3): Simple correlation, simple regression analysis for cotton seed yield as affected by P, K and their interaction PK over the 2006 and 2007 seasons

The cases	**The values**				
Simple correlation coefficient between xi and yi and its Significance of (2- tailed)	y1 x 1	y2 x2	y3 x 3		
	y1 P	y2 K	y3 PK		
	(0.964)**	(0.964)**	(0.964)**		
	0.000	0.000	0.000		
Prediction equation according to simple regression Between:	The equation		R^2	R^{-2}	F
1-y1, P	Y1 = 910.868 + 3.341 x1 (110.921)**		0.93	0.92	(130.391)**
2-y2,K	Y2 = 911.299 + 2.075 x2 (9.336)**		0.90	0.89	(87.17)**
3-y3, PK	Y3 = 910.798 + 3.345 x3 (5.521)**		0.40	0.39	(30.485)**

(**) = correlation is significant at the 0.01 level (2- tailed).

2-Relationship between seed yield (Kg/fed.) qi and each of P, K and PK:

a- Simple correlation: The simple correlation values (r) between seed yield and its attributes shown in Table (4) indicate that there was highly significant positive correlation of (2-tailed) at 0.01level between seed yield (qi) and P, K and PK with r values of 0.97, 0.96 and 0.61, respectively.

b- Simple regression analysis: Equations number 4, 5 and 6 shown in Table (4) indicate that there was highly significant positive relation at 0.01 level between seed yield (kg/fed.) qi and each of P, K and PK, respectively. Results also recorded that increasing any of P, K and PK with one unit (kg/fed.) led to increase each of q1, q2 and q3 with significantly positive increment at 0.01level by 1.75, 1.62 and 1.75 kg/fed, respectively. Also Table (4) indicates that (R^{-2}) values were 0.93, 0.91 and 0.35 that means changing seed yield q1, q2 and q3 due to the change in independent variables for each of P, K and PK inside every equation numbers 4, 5 and 6 , respectively in case of no change in other factors.

Table (4): Simple correlation and simple regression analysis for seed yield (kg/fed.) as affected by P, K and their interactions over the 2006 and 2007 seasons

The cases	The values				
Simple correlation coefficient between xi and qi and its Significance of (2- tailed)	Q1 x 1	q2 x2	q3 x 3		
	Q1 p	q2 K	q3 PK		
	(0.966)**	(0.960)**	(0.606)**		
	0.000	0.000	0.000		
Prediction equation according to simple regression Between:	The equations		R^2	R^{-2}	F
4-q1, P	q1 = 575.219 + 1.751P (137.778)**		0.93	0.93	(130.579)**
5-q2, K	q2 = 572.779 + 1.162K (10.879)**		0.92	0.91	(118.863)**
6-q3, PK	q3 = 575.174 + 1.753PK (5.163)**		0.38	0.35	(26.661)**

3- Relationship between lint yield (kg/fed.) and each of P, K and PK fertilization:

a- Simple correlation: Results in Table (5) show that there was a highly significant positive correlation of (2-tailed) at 0.01level between lint yield (Ci) and P, K and PK with R values of 0.961, 0.929 and 0.658, , respectively.

b- **Simple regression analysis**: Data in Table (5) contain equation Nos. 7, 8 and 9 indicate that there was a highly significant positive relation at 0.01 level between lint yield (kg/fed.) and each of P, K and PK, respectively.

The results also noted that increasing each of P, K and PK with one unit (kg/fed.), led to increase each of y1 , y2 and y3 by significant positive increments at 0.01 level by 1.58, 0.91 and 1.59 (kg/fed.) , respectively. Also Table (5) indicated that the values of adjusted determined coefficients were 0.92, 0.89 and 0.39 from changing the dependent variables (lint yield) C1, C2 and C3 due to changing independent variables for each of P, K and PK in equations 7, 8 and 9 , respectively, in case of no change in other factors.

Table (5): Simple correlations and simple regression analysis for lint yield (kg/fed.) (Ci) as affected by P, K and PK over the 2006 and 2007 seasons

The cases	The values				
Simple correlation coefficient between xi and Ci and its Significance of (2- tailed)	C1 x 1	C2 x2	C3 x 3		
	C1P	C2 K	C3 PK		
	(0.961)**	(0.929)**	(0.658)**		
	0.000	0.000	0.000		
Prediction equation according to simple regression Between:	The equation		R^2	R^{-2}	F
7- C1, P	C1 = 335.709 + 1.584 P (11.057)**		0.96	0.92	(122.251)**
8- C2,K	C2 = 338.439 + 914K (7.910)**		0.86	0.85	(62.567)**
9- C3, PK	C3 = 335.624+ 1.592PK (5.931)**		0.43	0.42	(35.173)**

4- Relationship between oil yield (Gi) and each of P, K and PK fertilization:

a- Simple correlation: The simple correlation (r) values between oil yield and its attributes are shown in Table (6). The estimates indicated that there was a highly significant positive correlation of (2- tailed) at 0.01level between oil yield (Gi) and P, K and PK with r values of 0.979, 0.969 and 0.562, respectively.

b- Simple regression analysis: Equations number 10, 11 and 12 are shown in Table (6). They indicated that there was a highly significant positive relation at 0.01level between oil yield (kg/fed.) and each of P, K and PK, respectively. Results also recorded that increasing each of P, K and PK with one unit (kg/fed) led to increase each of G1, G2 and G3 in significant positive increments at 0.01 level by 0.57, 0.32 and 0.48 (kg/fed.), respectively. Also Table (6) indicated that the values of adjusted determined coefficients were 0.95, 0.93 and 0.30 from changing dependent variables (oil yield) G1, G2 and G3 due to changing independent variables for each of P, K and PK in equations No. 10, 11 and 12, respectively, in case of no change in other factors.

Table (6): Simple correlation and simple regression analysis for oil yield (kg/fed) Gi, as affected by P, K and their interaction PK over the 2006 and 2007 seasons

The cases	**The values**				
Simple correlation coefficient between xi and Gi and its	G1 x 1	G2 x2	G3 x 3		
	G1 P	G2 K	G3 PK		
	(0.979)**	(0.969)**	(0.562)**		
Significance of (2- tailed)	0.000	0.000	0.000		
Prediction equation according to simple regression between:	The equation		R^2	R^{-2}	F
10- G1, P	G1 = 104.130 + 0.565P (15.153)**		0.96	0.95	(229.621)**
11- G2, K	G2 = 105.180 + 0.324K (12.443)**		0.94	0.93	(154.819)**
12- G3, PK	G3 = 105.950 + 0.480PK (4.612)**		0.32	0.30	(21.271)**

11- Quality characters as affected by P, K and PK fertilization:

This part includes the relationship between quality characters as dependent variables and each of P, K and PK as independent variables. The quality characters in this study were P by seed index (A1), P boll weight (d1), P by number of open bolls/plant (E1), K by seed index (A2), K by boll weight (d2), K by number of open bolls/plant, PK by seed index (E1), PK by boll weight (E2), PK by number of open bolls/plant.

1- Relationship between seed index and each of P, K and PK fertilizations:

a- Simple correlation: Simple correlation coefficient between seed index and each of

P, K and their interactions PK were clear in Table (7). Results showed that there was highly significant positive correlation between each of P, K and PK and seed index with r-values of 0.988, 0.955 and 0.400 at 0.01 level, respectively.

B- Simple regression analysis: Data in Table (7) containing equations number 13, 14 and 15 and indicated that there was a highly significant positive relation at 0.01level between seed index (kg/fed.) and each of P, K and PK, respectively. Results also noted that increasing each of P, K and PK with one unit led to increase seed index a1, a2 and a3 by significant positive increments at 0.01level by 0.0245, 0.0195 and 0.0243 (kg/fed.), respectively. Also Table (7) revealed that the values of adjusted determined coefficients were 0.98, 0.90 and 0.32 from changing dependent variables seed index a1, a2 and a3 due to changing independent variables.

Table (7): Simple correlation and simple regression analysis for seed index (kg/fed.) as affected by P, K and their interaction PK over the 2006 and 2007 seasons

The cases	**The values**				
Simple correlation coefficient between xi and ai and its	a1 x 1	a2 x2	a3 x 3		
	a1 P	a2 K	a3 PK		
	(0.988)**	(0.955)**	(0.400)**		
Significance of (2- tailed)	0.000	0.000	0.000		
Prediction equation according to simple regression between:	The equation		R^2	R^{-2}	F
13- a1, P	a1 = 8.058 + 0.02453P (20.520)**		0.98	0.98	(421.07)**
14- a2, K	a2 = 7.938 + 0.0195K (9.885)**		0.9	0.90	(97.704)**
15- a3, PK	a3 = 8.077 + 0.02433PK (4.762)**		0.33	0.32	(22.674)**

2- Relationship between boll weight (di) and each of P, K and PK fertilization:

a- Simple correlation: The simple correlation values (r) between boll weight and its attributes are shown in Table (8). The estimates indicated that there was a highly significant positive correlation of (2-tailed) at 0.01level between boll weight (di) and P and K with (r) values of 0.981 and 0.933, respectively. Results also cleared that there was a significantly positive correlation at 5% level between boll weight and PK with r-value of 0.363.

b- Simple regression analysis: Equations number 16, 17 and 18 are shown in Table (8) and indicate that there was highly significant positive relation at 0.01 level of boll weight (kg/fed.) di and each of P, K and PK, respectively. Results also recorded that increasing each of P, K and PK with one unite (kg/fed.) led to increase each of d1, d2 and d3 with significantly positive increments at 0.01level by 0,009, 0,004 and 0,008 (kg/fed.) equation 16, 17 and 18 , respectively. Also Table (8) indicated, that ($R^{-2)}$ were 0.96 , 0.87 and 0.28 that means changing boll weight d1, d2 and d3 due to changing independent variables for each of P, K and PK of every equations number 16, 17 and 18, respectively in case of no change in other factors.

Table (8): Simple correlation and simple regression analysis for boll weight (kg/fed.) as affected by P, K and PK over the 2006 and 2007 seasons

The cases	The values				
Simple correlation coefficient between xi and di and its	d1 x 1	d2 x2	d3 x 3		
	d1 P	d2 K	d3 PK		
	(0.981)**	(0.933)**	(0.363)**		
Significance of (2- tailed)	0.000	0.000	0.012		
Prediction equation according to simple regression between:	The equation		R^2	R^{-2}	F
16- d1, P	d1 = 2.430 + 0.008667K (16.781)**		0.97	0.96	(281.616)**
17- d2, K	d2 = 2.515 + 0.003958K (8.566)**		0.88	0.87	(73.376)**
18- d3, PK	d3 = 2.450 + 0.00750PK (4.365)**		0.29	0.28	(19.049)**

3- Relationship between number of open bolls/plant (Ei) and each of P, K and PK fertilization:

a- Simple correlation: Table (9) cleared that there was a highly positive correlation at 0.01 level between number of open bolls/plant and each of P, K and PK with r-values of 0.98, 0.949 and 0.646, respectively.

b- Simple regression analysis: Data in Table (9) containing equations No. 19, 20 and 21 indicated that there was a highly significant positive relation at 0.01level between No. of open bolls/plant, and each of P, K and PK, successively. The results also recorded that increasing each of P, K and PK with one unit (kg/fed.) led to increase each of e1, e2 and e3 by a significantly positive increment at 1% level by 0.039, 0.023 and 0.04, successively. Also Table (9) indicated that (R2) were 0.97, 0.89 and 0.41 from changing dependent variables No. of open bolls/plant e1, e2 and e3 due to changing independent variables for each of P, K and PK in equation Nos19, 20 and 21, successively, in case of no change in other factors.

4- The relationship between N% (F1), P% (h1) and K% (L1) as affected by the level of application of 15, 30 and 45 (kg P_2O_5/fed.):

The relationship between quality characters as dependent variables and nutrient concentrations N% (Fi), P% (hi) and K% (Li) as affected by different P fertilization levels as independent variables.

a- Simple correlations: Simple correlation coefficient between nutrient concentrations N% (F1), P% (h1) and K% (L1) as affected by different P levels is presented in Table (10). Results showed that there was a highly significant positive correlation with r-values of 0.985, 0.972 and 0.975 at 0.01 level, successively.

Table (9): Simple correlation and simple regression analysis for No. of open bolls/ plant as affected by P, K and PK over the 2006 and 2007 seasons

The cases	The values				
Simple correlation coefficient between xi and Ei and its	E1 x 1	E2 x2	E3 x 3		
	E1 P	E2 K	Y3 PK		
	(0.986)**	(0.949)**	(0.646)**		
Significance of (2-tailed)	0.000	0.000	0.000		
Prediction equation according to simple regression between:	The equation		R^2	R^{-2}	F
19- E1, P	E1 = 8.980 + 0.03867P (18.718)**		0.972	0.969	(350.370)**
20- E2, K	E2 = 9.090 + 0.02250K (9.487)**		0.900	0.890	(90.00)**
21- E3, PK	E3 = 8.605 + 0.04033PK (5.747)**		0.418	0.405	(33.024)*

b- Simple regression analysis: Data in Table (10) containing equations No. 22, 23 and 24 indicated that there was highly significant positive relation at 0.01 level between different P levels and each of nutrient concentrations of N% (F1), P% (h1) and K% (L1), successively. Results also indicated that increasing P with 15, 30 and 45 P_2O_5 (kg/fed.) led to increase each of F1, h1 and L1 by significant positive increments at 0.01 level by 0.0043, 0.0026 and 0.0064, respectively.

Table (10): Simple correlation and simple regression analysis for nutrient concentrations N, P and K presented as affected of different phosphorus levels over the 2006 and 2007 seasons

The cases	The values				
Simple correlation coefficient between of N , P and K as affected of P levels .	F1 x 1	H1 x2	L1x 3		
	N%, P	P%, P	K%, P		
	0.985**	0.972**	0.975**		
Significance of (2- tailed)	0.000	0.000	0.000		
Prediction equation according to simple regression Between:	The equation		R^2	R^{-2}	F
22- F1, P	F1 = 2.468 + 0.00431 x1 (18.193)**		0.97	0.97	(330.992)22
23- h1, p	H1 = 0.389 + 0.00256x1 (13.137)**		0.95	0.94	(172.592)23
24- L1, p	L1= 2.835 + 0.00636x1 (13.736)**		0.95	0.95	(188.667)24

5- The relationship between N% (F2), P% (h2) and K% (L2) as affected by different potassium levels of application of 24, 48 and 72 kg K_2O/fed:

a- Simple correlations: Simple correlation coefficient between nutrient concentrations N% (F2), P% (k2) and K% (L2) as affected by different K levels are recorded in Table (11). Results showed that there was a

highly significant positive correlation with r-values of 0.883, 0.998 and 0.996 at 0.01level, successively.

b- Simple regression analysis: Data in Table (11) contain equation numbers 25, 26 and 27 indicate that there was highly significant positive relation at 1% level between different of K levels and each of nutrient concentrations of N% (F2), P % (h2) and K% (L2), respectively. Results also recorded that increasing K with 24, 48, 72 kg K_2O/fed led to increase each of F2, h2 and L2 by significant positive increases at 1% level by 0.0034, 0.0013 and 0.0055 unit, successively.

Table (11): Simple correlation and simple regression analysis for Nutrient concentrations N, P and K as affected by different potassium levels over the 2006 and 2007 seasons

The cases	**The values**				
Simple correlation coefficient between each of N% , P% and K% as affected by K levels	F2 x 2	h2 x2	L2 x2		
	N%, K	P%, K	K%, K		
	0.883**	0.998**	0.996**		
Significance of (2- tailed)	0.000	0.000	0.000		
	correlation is significant at 0.01 level (2- tailed)				
Prediction equation according to simple regression between:	The equation		R^2	R^{-2}	F
25- F2, K	F2 = 2.414 + 0.00339x2 (5.953)**		0.78	0.76	(35.438)**
26- h2, K	H2= 0.479 + 0.001296x2 (48.331)**		0.99	0.99	(2335.933)**
27- L2, K	L2= 2.781 + 0.005483x2 (34.967)**		0.99	0.99	(1222.696)**

III- Quantity characters as affected by using P together with K fertilization and this part includes the relationships between quantity characters (cotton seed yield (y4) and P together with K fertilization:

a- Simple correlation: Simple correlation coefficients between cotton seed yield (Kentar/ fed) and P together with K fertilization is cleared in Table (12). Data analysis presented that there was a significant positive correlation of (2- tailed) at 0.01level for P and K with r-values of 0.73 and 0.535, successively.

b- Stepwise regression analysis: Table (12) also showed that the development of the sequence of stepwise regression equation by accepting two variables was accepted as significantly contributing to the variation in cotton seed yield, their variables were contributed by 71% from the total variation of cotton seed yield, the residual value was 29%, which indicated that some other characters were probably not included in this study. These accepted variables (P and K) with relative contributions (R^2) were 52.3% and 15.6%, successively.

Table (12): Simple correlation and stepwise regression analysis for cotton seed yield (y4) as affected by P, K together over the 2006 and 2007 seasons

The cases	**The values**	
Simple correlation coefficient between xi and y4 and its	Y4 x1	Y4 x2
	Y4 P	Y4 k
	(0.728)**	(0.535)**
Significance of (2- tailed)	0.000	0.007
Prediction equation according to stepwise value of (F) for equation:	$Y_4 = 5.684 + 0.01973X_1 + 0.007720$ (6.273)** (3.729)**	
Value of (F) for equation:		F = (26.628)**
Relutive contribution (R^2) accepted variables according		
Stepwise regression		71 %
X_1 phosphorus fertilizers		46.4%
X_2 potassium fertilizers		24.6%
Residual Value		29 %
Total effect accepted removed and residual		100%

*** Correlation is significant at 0.05 level (2 – tailed).**
**** Correlation is significant at 0.01 level (2 – tailed).**
**** (F) for equation is significant at 0.01 level.**

IV- Economic evaluation: Data in Table (13) indicated that the variable cost (V.C) of cotton Giza 86, reached about 1260, 1285 and 1310 LE /fed for phosphorus fertilization 15, 30 and 45 kg P_2O_5/fed. for potassium fertilization 1335, 1435 and 1535 LE / fed at the rate of 24, 48, 72 Kg K_2O/fed, respectively. In case of the combination of phosphorus and potassium the maximum cost was 1560 LE /fed at the rate of 72 kg K_2O and 15 or 30 kg P_2O_5/fed.

Result of the study in Table (13) showed that the highest productivity and the highest net revenue were accounted by 7.49 Kentar/fed and 2558 LE /fed, successively for using 72 kg K_2O/fed and 30 P_2O_5/fed.

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التقييم الاقتصادي لاستجابة القطن للتسميد بالأسمدة الفوسفاتية والبوتاسية وتفاعلاتها

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أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بالسرومحافظة دمياط خلال موسمى الزراعة ٢٠٠٦ ، ٢٠٠٧ على محصول القطن صنف جيزة ٨٦ وذلك لدراسة أثر إضافة الفوسفور (صفر، ١٥، ٣٠، ٤٥ كجم فو٢ أ٥/ فدان) في صورة سوبر فوسفات الكالسيوم ١٥,٥% فو٢ أ٥ والبوتاسيوم (صفر، ٢٤، ٤٨، ٧٢ كجم بو٢أ/ فدان) على صورة سلفات البوتاسيوم ٤٨% بو٢أ وأضافتهما معا كمتغيرات مستقلة على بعض الصفات الكمية والنوعية لمحصول القطن كمتغيرات تابعة وكانت الصفات لكمية هى محصول القطن الزهر، محصول البذور، محصول الشعر ومحصول الزيت.

وكانت الصفات النوعية هى استخدام مستويات مختلفة من الفوسفور والبوتاسيوم وتأثير ذلك على البذرة، وزن البذرة ووزن اللوزه وعدد اللوز المتفتح/ نبات. والنسبة المئوية لتركيز كل من ن، فو، بو وقد

استخدم لدراسة تلك العلاقة معامل الإرتباط البسيط ومعامل الإنحدار البسيط ومعامل الإنحدار المتعدد وقد لخصت النتائج كما يلى:

أولاً- الصفات الكمية:

أ-أظهرت نتيجة معامل الإرتباط البسيط وجود إرتباط موجب عالى المعنوية على مستوى ١% بين التسميد الفوسفاتي وكل من محصول القطن الزهر، البذور، الشعر، الزيت وكانت قيم هذا الإرتباط هى ٠,٩٦٤، ٠,٩٦٦، ٠,٩٦١، ٠,٩٧٩ على الترتيب كما وجد أيضاً إرتباط موجب عالى المعنوية على مستوى ١% بين التسميد البوتاسى والمتغيرات الكمية التابعة السابقة وكان قيم هذا الإرتباط هى ٠,٩٦٤، ٠,٩٦٠، ٠,٩٢٩، ٠,٩٦٩ على التوالى. كما أظهرت أيضاً نتيجة التحليل وجود إرتباط موجب عالى المعنوية على مستوى ١% بين تفاعل التسميد (الفوسفاتي × البوتاسى) وكل من المتغيرات الكمية التابعة سالفة الذكر وكان قيم هذا الإرتباط هى ٠,٩٦٤، ٠,٦٠٦، ٠,٦٥٨، ٠,٥٦٢ على الترتيب.

كما أظهرت نتيجة تحليل (r) عن وجود إرتباط موجب عالى القيمة على مستوى ١%، بين كل من التسميد الفوسفاتي والبوتاسى عند إضافتها معا كمتغيرات مستقلة بكميات مختلفة والمتغير التابع (محصول القطن الزهر) وكانت قيم هذا الإرتباط هى ٠,٧٢٨، ٠,٥٣٥ على التوالى:

ب- أظهرت نتيجة تحليل الإنحدار البسيط أن المساهمة النسبية من معامل التحديد المعدل (R^{-2}) لكل من التسميد الفوسفاتي، البوتاسى، الفوسفاتي × البوتاسى كمتغيرات مستقلة هو ٩٢%، ٨٩%، ٣٩% إسهاما فى تباين محصول القطن الزهر على التوالى، ٩٣%، ٩١%، ٣٥% إسهاما فى تباين محصول البذور على الترتيب، ٩٢%، ٨٥%، ٤٢% إسهاما فى تباين محصول الشعر على التوالى ٩٥%، ٩٣%، ٣٠% إسهاما فى تباين محصول الزيت على الترتيب.

ج- كما أظهرت نتيجة تحليل الإنحدار المتعدد المرحلى أن المساهمة النسبية – من R^2 – لكل من التسميد الفوسفاتي والبوتاسى معا كمتغيران مستقلان هو ٧٢% إسهاماً فى تباين محصول القطن الزهر. كما أظهرت أيضاً النتائج أن أعلى مساهمة نسبية كانت للتسميد الفوسفاتي وكانت قيمة الإسهام ٤٦,٤% بينما بلغت للتسميد البوتاسى ٢٤,٦% وذلك إسهاما فى تباين محصول القطن الزهر.

ثانياً: الصفات النوعية:

أ- أظهرت نتيجة تحليل معامل الإرتباط البسيط (r) وجود إرتباط موجب عالى المعنوية على مستوى ١% بين التسميد الفوسفاتي وكل من دليل البذرة، وزن اللوزة بالجرام، عدد اللوز المتفتح لكل نبات وكان قيم معامل الإرتباط هى ٠,٩٨٨، ٠,٩٨١، ٠,٩٨٦ على الترتيب.

كما وجد إرتباط موجب عالى المعنوية على مستوى ١% بين التسميد البوتاسى وكل من دليل البذرة ، وزن اللوزة بالجرام، عدد اللوز المتفتح لكل نبات وكانت قيم معامل الإرتباط هى ٠,٩٥٥، ٠,٩٣٣، ٠,٩٤٩ على الترتيب وأظهرت أيضا نتائج التحليل أنه يوجد إرتباط موجب معنوى بين التسميد (الفوسفاتي × البوتاسى) وكل من المتغيرات التابعة سالفة الذكر وكانت قيم معامل الإرتباط هى ٠,٤٠٠، ٠,٣٦٣، ٠,٦٤٦ على التوالى.

أظهرت نتيجة تحليل الإنحدار البسيط إن المساهمة النسبية (معامل التحديد المعدل $\bar{R}^2$) لكل من التسميد الفوسفورى، البوتاسى، (الفوسفاتي × البوتاسى) كمتغيرات مستقلة هو ٩٨%، ٩٠%، ٣٢% إسهاما فى تباين دليل البذرة على التوالى. كما أظهرت النتائج أن ($\bar{R}^2$) بلغ ٩٦%، ٨٧% ، ٢٨% إسهاما فى تباين وزن اللوزة بالجرام بالترتيب. كما بينت أيضا النتائج أن المساهمة النسبية ($\bar{R}^2$) بلغت ٩٧%، ٨٩%، ٤١% إسهاما فى تباين عدد اللوز المتفتح / نبات بالترتيب.

ج- كما أظهرت أيضاً نتائج التحليل أن يوجد إرتباط موجب عالى المعنوية على مستوى ١% بين التسميد الفوسفاتي والنسبة المئوية لتركيز كل من النتروجين، الفوسفور البوتاسيوم وكانت قيم معامل الإرتباط هى ٠,٩٨٥، ٠,٩٧٢، ٠,٩٧٥ كما بينت أيضاً نتائج التحليل الإحصائى أنه يوجد إرتباط موجب عالى المعنوية على مستوى ١% بين التسميد البوتاسى والنسبة المئوية لتركيز كل من النتروجين والفوسفور والبوتاسيوم وكانت قيم معامل الإرتباط هى ٠,٨٨٣، ٠,٩٩٨، ٠,٩٩٦ على التوالى.

ثالثاً: التقييم الإقتصادى:

أظهرت النتائج أن أعلى إنتاجية فدانية وكذلك أعلى صافى عائد هو ٧,٤٩ قنطار/ فدان، ٢٥٥٨ جنيه/ فدان عند إستعمال ٧٢كجم بو٢ أ/فدان، ٣٠كجم فو٢ أ٥/فدان معاً.

Table (13): Net revenue of cotton using P or K and combination of them

Treatment			Cotton seed yield (kentar*/fed.)	Price (L.E/fed.)	Total revenue (LE/fed.)	Variable cost (LE/fed.)				Rent (LE/fed)	Total cost (LE/fed)	Net revenue (L.E/fed.)
N	K (kg/fed)	P (kg/fed)						Other things	Total v.c			
	X2	X1	Y4	P	R	K	P	O.V	V.C	F.C	T.C	N
1	0	0	5.81	750	4358	0	0	1235	1235	1500	2735	1623
2	0	15	6.19	750	4643	0	25	1235	1260	1500	2760	1883
3	0	30	6.68	750	5010	0	50	1235	1285	1500	2785	2225
4	0	45	6.75	750	5063	0	75	1235	1310	1500	2810	2253
5	0	0	5.90	750	4425	0	0	1235	1235	1500	2735	1690
6	24	15	6.13	750	4598	100	0	1235	1335	1500	2835	1763
7	48	30	6.69	750	5018	200	0	1235	1439	1500	2939	2079
8	72	45	6.71	750	5033	300	0	1235	1535	1500	3035	1998
9	0	0	5.46	750	4095	0	0	1235	1235	1500	2735	1360
10	0	15	5.84	750	4380	0	25	1235	1260	1500	2760	1620
11	0	30	6.01	750	4508	0	50	1235	1285	1500	2785	1723
12	0	45	6.29	750	4718	0	75	1235	1310	1500	2810	1908
13	24	0	5.89	750	4418	100	0	1235	1335	1500	2835	1583
14	24	15	6.01	750	4508	100	25	1235	1360	1500	2860	1648
15	24	30	6.22	750	4665	100	50	1235	1385	1500	2885	1780
16	24	45	6.42	750	4815	100	75	1235	1410	1500	2910	1905
17	48	0	5.97	750	4478	200	0	1235	1435	1500	2935	1543
18	48	15	6.49	750	4868	200	25	1235	1460	1500	2960	1908
19	48	30	7.01	750	5258	200	50	1235	1485	1500	2985	2273

20	48	45	7.31	750	5483	200	75	1235	1510	1500	3010	2473
21	72	0	5.91	750	4433	300	0	1235	1535	1500	3035	1398
22	72	15	6.45	750	4838	300	25	1235	1560	1500	3060	1778
23	72	30	7.49	750	5618	300	50	1235	1560	1500	3060	2558
24	72	45	7.00	750	5250	300	75	1235	1610	1500	3110	2140
Mea	30	22.5	6.4	750	4770.0	125.0	31.3	1235	1390.4	1500	2890.4	1879.7

***Kentar = 157.5, other things: preparation, irrigation, N-fertilizer, collections ---- etc.**