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USING SOME STATISTICAL PROCEDURES FOR DETECTING THE RELATION BETWEEN SOME QUANTITY AND QUALITY CHARACTERS OF FLAX AS AFFECTED BY NPK FERTILIZATION AND THEIR INTERACTIONS

El-Taweel, A. M. S. A.*; K. E. Nassar; A. A. Rahmou ** and Madiha M. Badran ****

*** Central Lab for Design & Statistical Analysis Res., ARC, Giza, Egypt.**

**** Soils, Water and Environment Res. Inst., ARC, Giza, Egypt.**

ABSTRACT

Two field experiments were conducted at Abo hammad region Sharkia Governorate, Egypt during 1999/2000 and 2000/2001 seasons to detect the relationships between N, P, K, NP, NK, PK and NPK fertilization as independent variables and some quantity and quality characters of flax variety Giza 8 as dependent variables. The quantity characters were seed, oil, straw and fiber yields and the quality characters were N, P and K uptake in both seed and straw. Simple correlation, multiple regression and stepwise regression analysis were used to detect this relationship and the results obtained can be summarized as follows:

I - Quantity characters:

1- Result of simple correlation analysis indicated that the heights significant positive correlation was found between N fertilization and each of seed, oil, straw and fiber yield with r-values were 0.858,0.782,0.765 and 0.607, respectively. Significant and positive correlation was found between phosphorus fertilization and each of seed, oil and straw yield except fiber yield. On the other hand, the r-values between potassium fertilization and each of seed, oil and straw yields were not significant but it was significant with fiber yield.

2- Result of multiple regression analysis cleared that the relative contribution for N, P, K, NP, NK, PK and NPK fertilization were accounted by 80%, 50.7%, 68.6% and 69.4% from the total variation of seed, oil, straw and fiber yields, respectively.

3- Result of stepwise regression analysis revealed that the N fertilization was the heights factor contributing in the total variation of seed, straw and fiber yield with R^2 being 73.7 %, 58.5% and 65.5 %, respectively. On the other hand, the NP fertilization was the height factor contributing in the total variation of oil yield with R^2 being 40.5%.

II - Quality characters:

1- Result of simple correlation analysis indicated that the heights significant positive correlation was found between N fertilization and each of N uptake in seed and straw, P uptake in seed, K uptake in seed and straw with r-values were 0.773, 0.845, 0.894, 0.899 and 0.630, respectively. Significant and positive correlation was found between phosphorus fertilization and each of P uptakes in straw, P uptake in seed and straw except N uptake in seed and straw and P uptake in seed. On the other hand, r-values between potassium fertilization and each of N, P and K uptake in straw were significant except N, P and K uptake in seed.

2- Result of multiple regression analysis cleared that the relative contribution of N, P, K, NP, NK, PK and NPK fertilization were accounted by 62%, 86.1%, 86.7%, 41.4, 87.4% and 61.3% from the total variation of N, P and K uptake in flaxseed and straw, respectively.

3- Result of stepwise regression analysis revealed that the N fertilization was the heights factor contributing in the total variation of N uptake in seed and straw, P

uptake in straw and K uptake in seed with R^2 being 59.8%, 71.4 %, 79.9% and 80.8%, respectively. On the other hand, the PK fertilization was the heights factor contributing in the total variation of P uptake in straw with R^2 being 25.2%. Similarly, the NP fertilization was the height factor contributing in the total variation of K uptake in straw with R^2 being 46.7%.

INTRODUCTION

Flax (*Linum usitatissimum*) is a double purpose crop for production of fiber from straw and oil from seeds. In fact, the Egyptian soil is poor in available nitrogen, phosphorus and potassium. Hence, it is necessary to know the adequate amount of nitrogen phosphor, potassium and their combinations needed to obtain the highest productivity of most crops.

Yield is a very complex attribute. It is a final outcome of a number of components. Nitrogen (N), phosphorus (P), potassium (K) and their interactions are the greatest variables influencing in this yield. Therefore, it is necessary to detect the variables having the greatest effect on the yield and their relative contributions to variation in the yield. Many statistical methods such as correlation, regression and path coefficient analysis are successfully applied to determine the contributions of each attribute to the potential seed yield (El-Rassas *et al.,* 1987; Mitkees *et al.,* 1991; Nie *et al.,* 1994; Zedan 1994 and Kineber *et al.,* 1997). It was found that these statistical approaches are not enough to construct a prediction equation because many yield components have high correlation with seed yield but may contribute little to the efficient of the prediction equation (El-Sayed and Mohamed 1992). The stepwise multiple linear regression analysis might be the appropriate technique due to its sequence in analyzing data of such genotypes. It improves a 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 sum of squares reduction, coefficient of partial correlation or F^* statistic (Draper and Smith 1981).

The main objective of this study was to investigate the relationships between N, P, K fertilization and their interactions as independent variables and some quantity and quality characters of flax variety Giza 8 as dependent variables. The quantity characters were seed, oil, straw and fiber yields and the quality characters were N, P, K uptakes in both seed and straw.

MATERIALS AND METHODS

Two field experiments were carried out at Abo Hammad region, Sharkia Goverovate during 1999/2000 and 200/2001 seasons. Giza 8 variety was used which developed by across between the local variety Giza 6 and Santna caline variety from Argentina. Each experiment included 27 treatments resulted from all possible combinations of different three rates of nitrogen, phosphorus or potassium. These rates were 30, 45 and 60 kg N/fad, 15, 22.5 and 30 kg p_2o_5/fad and 24, 36 and 48 kg K/fad. The physical and chemical analysis of the soil under investigation is presented in Table 1

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

I- Physical analyses							
Seasons	**Coarse sand %**	**Fine sand %**	**Silt %**	**Clay %**	**Texture Class**		
1999/2000	2.86	18.49	31.07	47.58	Clayey		
2000/2001	1.59	19.00	32.11	47.30	Clayey		
I I- Chemical analyses							
Seasons	**$CaCO_3$ %**	**Organic matter %**	**EC (ds/m,1soil; 5 water extract)**	**PH (1 oil:2.5 water suspension)**	**Available nutrients (ppm)**		
					N	**P**	**K**
1999/2000	2.65	1.35	1.20	7.8	19.9	7.5	273.2
2000/2001	2.80	1.43	1.27	8.2	21.1	8.0	288.7

Data collected included some quantity and quality characters as dependent variables and N, 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 **I- Quantity characters:**		**2- Independent variables**	
1- Seed yield ton/fad.	Y1	1- Nitrogen (N)	X1
2- Oil yields Kg/fad.	Y2	2- Phosphorus P (X2)	X2
3- Straw yields ton/fad.	Y3	3- Potassium (K)	X3
4-Fiber yields ton/fad.	Y4	4- Nitrogen X phosphorus (NP)	X4
II – Quality characters:		5- Nitrogen X potassium (NK)	X5
1- Nitrogen uptake in seed kg/fad	Y5	6- Phosphorus X potassium (PK)	X6
2- Nitrogen uptake in straw kg/fad	Y6	7-Nitrogen x phosphorus x potassium (NPK)	X7
3- Phosphor uptake in seed kg/fad	Y7		
4- Phosphor uptake in straw kg/fad	Y8		
5- Potassium uptake in seed kg/ fad	Y9		
6- Potassium in straw kg/fad	Y10		

A split plot design with four replications was used which included nitrogen rates in main plots, phosphorus rates in sub plots and potassium rates in sub sub plots. Other agricultural practices were applied as usually done in the ordinary flax fields. Ten guarded plants were hand-pulled at random for each experimental unit to be used in recording the yield components of flax at maturity. Flaxseed and straw yields ton/fad were estimated on the whole plot area basis.

Statistical analysis:

Relationships among dependent and independent variables were studies using statistical technique follows:

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

2-Multiple regression analysis was performed as outlined by Draper and Smith (1980) to estimate the coefficient of determination (R^2) to present relative contribution of independent variables for each dependent variable and obtained the predication equations.

3-Stepwise multiple regression analysis was aimed to estimate the variables accounting for the majority of the total dependent character variability. This procedure develops a sequence of multiple regression equation in a stepwise manner. One variable is added to the regression equation at each step. The added variable is the variable that the greatest contribute in the error sum of squares. Also this variable has a highest partial correlation with the dependent variable for fixed values of those variables already added, and it is the variable that has the highest F value. The stepwise regression analysis was performed as described by Draper and Smith (1981). Simple correlation, multiple regression and stepwise analysis were applied to the data over both seasons of 1999/2000 and 2000/2001.

RESULTS AND DISCUSSION

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

I - Quantity characters as affected by N, P, K, NP, NK, PK and NPK fertilization:

This part includes the relationship between quantity characters as dependent variables and each of N, P, K, NP, NK, PK and NPK fertilization as independent variables. The quantity characters were seed (Y_1), oil (Y_2), straw (Y_3) and fiber yield (Y_4) of flax crop.

1- Relationship between seed yield (Y_1)and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Simple correlation coefficients between seed yield ton/fad and each of N, P, K, NP, NK, PK and NPK are cleared in Table 3. The analysis of data presented that there was highly significant positive correlation between seed yield and N, P, NP, Nk and NPK with r-values were 0.858, 0.243, 0.761, 0.618, and 0.621,respectively. Results also recorded that the relation between seed yield and PK was significant with r-value being 0.185. On the other hand, the r-value between seed yield and K fertilization was not significant.

b- Multiple regression:

Results of multiple regression analysis in Table 3 also recorded that the relative contributions R^2 for all variables (accepted and removed) in seed yield (Y_1) were 80%. The residual value was 20%, which indicated that the most characters were included this study.

C-Stepwise regression analysis:

Data in Table 3 indicate that 2 variables out of 7 were accepted as significantly contributing to variation in flaxseed yield. These accepted variables were nitrogen N and P with R^2 being 73.7 and 5.9% according to stepwise analysis, respectively. These results indicted that stepwise analysis develops a sequence of multiple regression equation by removing 5 from 7 variables from the full module equation with relative contribution was 4%.

Table 3: Simple correlation, multiple regression and stepwise regression analysis for seed yield ton/fad (Y1) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation coefficient between Xi and Y1 and its significant of t tailed	Y1X1	Y1X2	Y1X3	Y1X4	Y1X5	Y1X6	Y1X7
	Y1N	Y1P	Y1K	Y1NP	Y1NK	Y1PK	Y1NPK
	0.858	0.243	0.032	0.761	0.618	0.185	0.621
	0.000	0.014	0.389	0.000	0.000	0.050	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + Bx2 + bX3 + bX4 + bX5 + bX6 + bX7 Y =.377 +.00190x1 -.00117x2 -.00247x3 +.00011x4 +.00008x5 +.00012x6 -.000003x7						
Relative contributions (R^2) for all variables according to full model regression							80 %
Prediction equation according to stepwise.	Y= a + bX1 + bX2 Y=.303 +.00432 x1+ .00244x2						
Relative contributions (R^2) for accepted variables according to stepwise regression X1 Nitrogen fertilization. X2 Phosphorus fertilization.							79.6 % 73.7 % 5.9 %
Relative contributions (R^2) for removed variables according to stepwise regression							0.4 %
Residual value							20 %
Total effect (accepted , removed and residual)							100 %

2- Relationship between oil yield (Y_2) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Table 4 present the r-values between oil yield and N, P, K and their interactions. These values indicated that there was highly significant positive correlation between oil yield and N, P, NP, NK, PK and NPK with r-values being 0.607, 0.329, 0.636, 0.488, 0.305 and 0.556, respectively. On the other hand, the correlation coefficient between oil yield and K was not significant.

b- Multiple regression:

The estimate of R^2 for independent variables N, P, K, NP, NK, Pk and NPK in oil yield was cleared in Table 4. The all variables (accepted and removed) were contributed by 50.7% from the total variation of oil yield. The residual value was 49.3%, which indicated that some other characters were probably not, included this study.

c- Stepwise regression analysis :

Table 4 also show that the stepwise analysis develops a sequence of full model equation by accepting two variables from seven. Theses variables were NP an N with relative contributions (R^2) were 40.5 and 5.3%, respectively. On the other side, the R^2 for removed variables were 4.9% from the total variance of oil yield.

Table 4: Simple correlation, multiple regression and stepwise regression analysis for oil yield kg/fad (Y2) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation	Y2X1	Y2X2	Y2X3	Y2X4	Y2X5	Y2X6	Y2X7
Coefficient between Xi	Y2N	Y2P	Y2K	Y2NP	Y2NK	Y2PK	Y2NPK
And Y2 and its	0.607	0.329	0.120	0.636	0.488	0.305	0.556
Significant of t tailed	0.000	0.001	0.143	0.000	0.000	0.003	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y =118.065 +1.148x1 +.397x2 - .0865x3 + .03004x4 + .01495x5 + .05258x6 -.00146x7						
Relative contributions (R^2) for all variables according full model regression							50.7 %
Prediction equation according to stepwise.	Y= a + bX4 + bX1 Y=166.460 + .02485x4 + .620x1						
Relative contributions (R^2) for accepted variables according stepwise regression							45.8 %
X4 Nitrogen X Phosphorus fertilization.							40.5 %
X1 Nitrogen fertilization.							5.3 %
Relative contributions (R^2) for removed variables according stepwise regression							4.9 %
Residual value							49.3 %
Total effect (accepted , removed and residual)							100 %

3- Relationship between straw yield (Y_3) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

The simple correlation values (r) between straw yield and its attribute are shown in Table 5. The estimates indicated that there was highly significant positive correlation between straw yield and N, P, NP, NK, PK and NPK with r-values 0.765, 0.261, 0.720, 0.618, 0.261 and 0.640, respectively. On the other hand, the correlation coefficient between straw yield and K was not significant.

b- Multiple regression analysis:

Results in Table 5 indicated that the relative contribution for all independent variables N, P, K, NP, NK, PK and NPK in the total variation of the straw yield was 68.8%. On the other side, the residual value was 31.2%, which indicated that the most characters were, included this study.

c- Stepwise regression analysis:

Table 5 clear that the stepwise analysis was accepted three variables out of seven were significantly to variation of straw yield of flax. These accepted variables were N, NP and K with relative contributions were 58.5,6.6 and 2.1%, respectively. On the other hand, the R^2 for removing variables in the total variance of straw yield was 1.6%.

Table 5: Simple correlation, multiple regression and stepwise regression analysis for straw yield ton/fad (Y3) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation Coefficient between Xi And Y3 and its Significant of t tailed	Y3X1	Y3X2	Y3X3	Y3X4	Y3X5	Y3X6	Y3X7
	Y3N	Y3P	Y3K	Y3NP	Y3NK	Y3PK	Y3NPK
	0.765	0.261	0.134	0.720	0.618	0.261	0.640
	0.000	0.009	0.116	0.000	0.000	0.009	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y= -1.013 +.06527x1+.108x2 +.07342x3 -.00161x4-.00126x5 -.00280x6+.00005105x7						
Relative contributions (R^2) for all variables according full model regression							68.8 %
Prediction equation according to stepwise.	Y= a + bX1+ bX4 + bX3 Y= 1.195 + 0.01672x1 + 0.0003697x4 + 0.0055x3						
Relative contributions (R^2) for accepted variables according stepwise regression							67.2 %
X1 Nitrogen fertilization.							58.5 %
X4 Nitrogen X Phosphorus fertilization.							6.6 %
X3 Potassium fertilization.							2.1 %
Relative contributions (R^2) for removed variables according stepwise regression							1.6 %
Residual value							31.2 %
Total (accepted , removed and residual)							100 %

4- Relationship between fiber yield (Y_4) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Results in Table 6 show that there was highly significant positive correlation between fiber yield of flax and N, K NP, NK and NPK with r-values were 0.782, 0.210, 0.556, 0.690 and 0.564, respectively. On the other hand, the relation between P, PK and fiber yield was not significant.

Table 6: Simple correlation, multiple regression and stepwise regression analysis for fiber yield ton/fad (Y4) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation Coefficient between Xi And Y4 and its Significant of t tailed	Y4X1	Y4X2	Y4X3	Y4X4	Y4X5	Y4X6	Y4X7
	Y4N	Y4P	Y4K	Y4NP	Y4NK	Y4PK	Y4NPK
	0.782	0.026	0.210	0.556	0.690	0.155	0.564
	0.000	0.410	0.030	0.000	0.000	0.083	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y=-.326+.01781x1+.02955x2+.01889x3-.000614x4-.000366x5-.000785x6+.00001642x7						
Relative contributions (R^2) for all variables according full model regression							69.4 %
Prediction equation according to stepwise.	Y= a +bX1+bX3 Y=0.334+0.003115x1+0.00138x3						
Relative contributions (R^2) for accepted variables according stepwise regression							.5 %
X1 Nitrogen fertilization.							61.1 %
X3 Potassium fertilization.							4.4 %
Relative contributions (R^2) for removed variables according stepwise regression							3.9 %
Residual value							30.6 %
Total effect (accepted , removed and residual)							100 %

b-Multiple regression:

Table 6 clear that the R^2 between fiber yield of flax and all N, P, K, NP, NK and NPK were 69.4%. On the other hand, the residual was 30.6% which mean that the most characters were included this study.

c- Stepwise regression analysis:

Data in Table 6 indicated that the stepwise analysis developed a sequence of multiple regression equation by excluding 5 variables from the full model equation with R^2 was 3.9%. Table 6 also show that the accepted variables were N and K with relative contribution were 61.1 and 4.4% in the total variation of fiber yield, respectively.

Finally these results are in agreement with those obtained by Nie *et al,* (1994) and Kineber *et al,* for seed, oil, straw and fiber yield of flax.

II - Quality characters as affected by N, P, K, NP, NK, PK and NPK fertilization:

This part includes the relationship between quality characters as dependent variables and each of N, P, K, NP, NK, PK and NPK fertilization as independent variables. The quality characters in this study were N uptake in seed (Y_5), N uptake in straw (Y_6), P uptake in seed (Y_7), P uptake in straw (Y_8), K uptake in seed (Y_9) and K uptake in straw (Y_{10}).

1- Relationship between nitrogen uptake in seed (Y_5) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Simple correlation coefficient between nitrogen uptake in seed and NPK and their interactions was cleared in Table 7. Results showed that there was highly significant positive correlation between N uptake in seed and each of N, NP, NK and NPK with r-values were 0.773, 0.596, 0.578 and 0.507, respectively. On the other hand, the relation between N uptake and each of P, K and PK was not significant.

b- Multiple regression:

Table 7 for full module regression revealed that the all independent variables were contributed by R^2 being 62%. On the other hand, residual was 38%, which mean that some other characters probably not included this study.

c- Stepwise regression analysis:

Table 7 revealed that one variable out of the seven was accepted as significantly contributing to variation in nitrogen uptake in seed. This variable was nitrogen (N) with relative contributions was 59.8% from the total variation in the N uptake in the seed.

Results indicated that the stepwise analysis developed the multiple regression equation by eliminating six variables from the full model equation with relative contribution being 2.2%.

Table 7: Simple correlation, multiple regression and stepwise regression analysis for nitrogen uptake in seed yield kg/fad (Y5) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation Coefficient between Xi And Y5 and its Significant of t tailed	Y5X1	Y5X2	Y5X3	Y5X4	Y5X5	Y5X6	Y5X7
	Y5N	Y5P	Y5K	Y5NP	Y5NK	Y5PK	Y5NPK
	0.773	0.107	0.058	0.596	0.578	0.110	0.507
	0.000	0.171	0.303	0.000	0.000	0.163	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y=4.667+.235x1+.110x2 -.0745x3 + .0002568 x4 +.00291 x5 + .004019 x6-.000122x7						
Relative contributions (R^2) for all variables according full model regression							62 %
Prediction equation according to stepwise.	Y= a +bX1 Y=7.703 + 0.246x1						
Relative contributions (R^2) for accepted variables according stepwise regression X1 Nitrogen fertilization.							.8 % 59.8 %
Relative contributions (R^2) for removed variables according stepwise regression							2.2 %
Residual value							38 %
Total effect (accepted , removed and residual)							100 %

2- Relationship between nitrogen uptake in straw (Y_6) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Table 8 presented that there was highly significant positive correlation between N uptake in straw and each of N, K, NP, NK, Pk and NPK with r-values were 0.845, 0.307, 0.648, 0.802, 0.263 and 0.689, respectively. Results also indicated that the relation between N uptake in straw and phosphorus fertilization was not significant.

Table 8: Simple correlation, multiple regression and stepwise regression analysis for nitrogen uptake in straw yield kg/fad (Y6) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation Coefficient between Xi And Y6 and its Significant of t tailed	Y6X1	Y6X2	Y6X3	Y6X4	Y6X5	Y6X6	Y6X7
	Y6N	Y6P	Y6K	Y6NP	Y6NK	Y6PK	Y6NPK
	0.845	0.091	0.307	0.648	0.802	0.263	0.689
	0.000	0.211	0.003	0.000	0.000	0.009	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y=-.6892+0.335x1+0.582x2+0.380x3-.0115x4-.00695x5-.0155 x 6 + .0003133x7						
Relative contributions (R^2) for all variables according full model regression							86.1 %
Prediction equation according to stepwise.	Y= a +bX1+bX3 Y=6.039+.08016x1+.03639x3						
Relative contributions (R^2) for accepted variables according stepwise regression X1 Nitrogen fertilization. X3 Potassium fertilization.							.9 % .4 % 9.5 %
Relative contributions (R^2) for removed variables according stepwise regression							5.2 %
Residual value							13.9 %
Total effect (accepted, removed and residual)							100 %

b- Multiple regression:

Table 8 show that the R^2 for all N, P, K, NP, NK, PK and NPK in nitrogen uptake in straw was 86.1%. On the other hand, results recorded that the residual was 13.9% which mean that the most characters were included this study.

c- Stepwise analysis:

Results of stepwise analysis in Table 8 show that 2 variables out of 7 were accepted a significantly to variation of N uptake in straw. These variables were N and K with relative contribution (R^2) were 71.4 and 9.5% of the total variation of N uptake in straw, respectively.

3- Relationship between phosphorus uptake in seed (Y_7) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Table (9) present that N, NP, NK and NPK were most closely correlated with P uptake in seed with r-values were 0.894, 0.788, 0.662 and 0.662, respectively. Results also cleared that there was significant positive correlation between P and PK and P uptake in seed with r-values were 0.250 and 0.212, respectively. On the other hand, the relation between P uptake in seed and K fertilizer was not significant.

Table 9: Simple correlation, multiple regression and stepwise regression analysis for phosphorus uptake in seed yield kg/fad (Y7) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation Coefficient between Xi and Y7 and its significant of t tailed	Y7X1	Y7X2	Y7X3	Y7X4	Y7X5	Y7X6	Y7X7
	Y7N	Y7P	Y7K	Y7NP	Y7NK	Y7PK	Y7NPK
	0.894	0.250	0.061	0.788	0.662	0.212	0.662
	0.000	0.012	0.296	0.000	0.000	0.029	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y=.929+.04359x1+.03963x2+.01040x3-.000301x4-.0000802x5-.000278 x6+.000002469x7						
Relative contributions (R^2) for all variables according full model regression							86.7 %
Prediction equation according to stepwise.	Y= a +bX1+bX2 Y=1.519+.03593x1+.02007x2						
Relative contributions (R^2) for accepted variables according stepwise regression X1 Nitrogen fertilization. X2 Phosphorus fertilization.							1 % 9 % 6.2 %
Relative contributions (R^2) for removed variables according stepwise regression							0.6%
Residual value							13.3 %
Total effect (accepted , removed and residual)							100 %

b-Multiple regression:

Table 9 clear that the coefficient of determination R^2 for all independent variables was 86.7%. Results also reported that the residual value was 13.3%, which revealed that the most characters were, included this study.

c-Stepwise regression analysis:

Results in Table 9 indicated that stepwise analysis improved a sequence of multiple regression equation by discarding 5 variables from the full module equation.

The accepted variables were N and P fertilization with relative contribution being 79.9 and 6.2 % in the total variation of P uptake in seed, respectively. On the other hand, the all-5 removed variables were contributed by 6% from the total variation of P uptake in seed.

4- Relationship between phosphorus uptake in straw (Y_8) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Table 10 clear that there was highly positive correlation between P uptake in straw and P, K, PK and NPK with r-values were 0.381, 0.367, 0.502 and 0.336, respectively. On the other side, the r-values indicated that the relation between P uptake in straw and N, NP and NK, were not significant.

Table 10: Simple correlation, multiple regression and stepwise regression analysis for phosphorus uptake in straw yield kg/fad (Y8) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation Coefficient between Xi And Y8 and its Significant of t tailed	Y8X1	Y8X2	Y8X1	Y8X4	Y8X5	Y8X6	Y8X7
	Y8N	Y8P	Y8K	Y8NP	Y8NK	Y8PK	Y8NPK
	-0.109	0.381	0.367	0.175	0.169	0.502	0.336
	0.165	0.000	0.000	0.059	0.065	0.000	0.001
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y=-1.786+.07572x1+.173x2+.106x3-.00331x4-.00203x5-.00421 x6 + .00008673x7						
Relative contributions (R^2) for all variables according full model regression							41.4 %
Prediction equation according to stepwise.	Y= a +bX6 Y=2.162+0.00031x6						
Relative contributions (R^2) for accepted variables according stepwise regression X6 Phosphorus x Potassium fertilization.							.2 % 25.2 %
Relative contributions (R^2) for removed variables according stepwise regression							16.2 %
Residual value							58.6 %
Total effect (accepted , removed and residual)							100 %

b-Multiple regression:

Results of multiple regression in Table 10 revealed that the relative contribution R^2 for all variables in P uptake in straw of flax was 41%. The analysis also cleared that the residual value was 58.6%. These results indicated that some other important characters were not included this study.

c- Stepwise analysis:

Table 10 relieved that one variable was accepted significant contributing to the variation of P uptake in straw. This variable was PK with R^2 being 25.2% from the total variation of P uptake in straw. On the other hand, the R^2 for the removed variables was 16.2%.

5- Relationship between potassium uptake in seed (Y_9) and each of N, P, K, NP, NK, PK and NPK fertilization:

a-Simple correlation:

Table 11 present r-values between K uptake in seed and N, P, K and their interactions. These relations were most closely positive correlated with N, NP, Nk and NPK with r-values being 0.899, 0.791, 0.694 and 0.687, respectively. Results also indicated that the relation between K uptake in seed and each of P and Pk were significant with r-values being 0.230 and 0.223, respectively. On the other hand, the r-value between K uptake in seed and K fertilizer was not significant.

Table (11): Simple correlation, multiple regression and stepwise regression analysis for potassium uptake in seed yield kg/fad (Y9) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation	Y9X1	Y9X2	Y9X3	Y9X4	Y9X5	Y9X6	Y9X7
Coefficient between Xi	Y9N	Y9P	Y9K	Y9NP	Y9NK	Y9PK	Y9NPK
and Y9 and its	0.899	0.230	0.096	0.791	0..694	0.223	0.687
significant of t tailed	0.000	0.019	0.197	0.000	0.000	0.023	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y=2.285+.01683x1-.0289x2-.0226 x 3 + .00143 x4 +.0007747 x5 +.001102 x6-.0000296x7						
Relative contributions (R^2) for all variables according full model regression							87.4 %
Prediction equation according to stepwise.	Y= a+bX1+bX4+bX5 Y=1.714+0.03417x1+0.000586x4+0.0001537x5						
Relative contributions (R^2) for accepted variables according stepwise regression X1 Nitrogen fertilization. X4 Nitrogen x Phosphorus fertilization. X5 Nitrogen x Potassium fertilization.							.2 % .8 % 4 % 1 %
Relative contributions (R^2) for removed variables according stepwise regression							0.2 %
Residual value							12.6 %
Total effect (accepted , removed and residual)							100 %

b- Multiple regression:

Table 11 show that the relative contribution (R^2) for all independent variables accounted by 87.2% and the residual accounted by 12.6% which cleared that the most characters were included this study.

c-Stepwise regression analysis:

Table 11 revealed that the stepwise analysis developed a sequence of full model equation by accepting three variables from five. These variables were N, NP and NK with relative contributions (R^2) were 80.8, 5.4 and 1 %, respectively. On the other side, the all removed variables were contributed by 2% from the total variation of P uptake in seed yield.

6- Relationship between potassium uptake in straw (Y_{10}) and each of N, P, K, NP, NK, PK and NPK fertilization:

a- Simple correlation:

Table 12 cleared that there was significant positive correlation between P uptake in straw and all N, P, K, NP, Nk, PK and NPK with r-values being 0.630, 0.195, 0.347, 0.551, 0.684, 0.365 and .635, respectively.

b- Multiple regression:

Table 12 revealed that the relative contribution for all independent variables in the total variation of P uptake in straw was 61.3%. On the other hand, results indicated that the residual was 38.7%, which mean that some other characters probably not included this study.

c-Stepwise regression analysis:

Table 12 also clear that the stepwise analysis developed a sequence of multiple regression equation by removing 5 variables from the full model equation. The R^2 for all removed variables was 8.2%.

Table 12: Simple correlation, multiple regression and stepwise regression analysis for potassium uptake in straw yield kg/fad (Y10) as affected by N, P, K and their interactions over the 1999/2000 and 2000/2001 seasons.

The cases	The values						
Simple correlation Coefficient between Xi and Y10 and its significant of t tailed	Y10X1	Y10X2	Y10X3	Y10X4	Y10X5	Y10X6	Y10X7
	Y10N	Y10P	Y10K	Y10NP	Y10NK	Y10PK	Y10NPK
	0.630	0.195	0.347	0.551	0.684	0.365	0.638
	0.000	0.040	0.001	0.000	0.000	0.000	0.000
Prediction equation according to multiple regression.	Y= a + bX1 + bX2 + bX3 + bX4 + bX5 + bX6 + bX7 Y=-15.707+.799x1+1.545x2+.861x3-.0303x4-.0157x5-.0352 x 6 + .0007222x7						
Relative contributions (R^2) for all variables according full model regression	61.3 %						
Prediction equation according to stepwise.	Y= a +bX5+bX4 Y=22.068+.002308x5+.001951x4						
Relative contributions (R^2) for accepted variables according stepwise regression X5 Nitrogen x Potassium fertilization. X4 Nitrogen x Phosphorus fertilization.	.1 % .7 % 6.4 %						
Relative contributions (R^2) for removed variables according stepwise regression	8.2 %						
Residual value	38.7 %						
Total effect (accepted , removed and residual)	100 %						

The accepted variables were NK and NP with relative contribution being 46.7 and 6.4% from the total variation of P uptake in straw, respectively.

Fine Shaubey and Dwivedi (1995) in agreement with those reveal these results**.**

REFERENCES

Chaubey, A.K. and K.N. Dwivedi (1995). Effect of N.P and their interzctions on yield of flax and nutrient uptake by linseed (*Linum usitatissium*). J. Indian Soc. Soil Sci, 43(1): 72-75.

Draper, N.R. and H. Smith (1981). Applied Regression Analysis. John Wiley and Sons, NY, 407 pp.

El-Rassas, H.N.; F.L. El-Attar and M.S. El-shazly (1987). Correlation and path-coefficient analysis for some characters in grain sorghum (*Sorghum bicolor* L. *Moench*). Fayoum J. Agric. Res. and Dev., 1(1): 59-69.

El-Sayed, A.A. and T.A. Mohamed (1992). Selecting drought tolerant barley genotypes under adjusted soil moisture stress. Egypt. J. Appl. Sci., 7(6): 679-690.

Kineber, M.E.A; S.H.A. Mostafa and F. Ashmawy (1997). Response of flax variety "Giza 8" to different levels of phosphorus and ntrogen fertilization.

Mitkees, R.A; A.A . Gomaa; M.E. Hagag; G.A. Morshed and E.A.M. El-Sayed (1991). Path coefficient of components of wheat grain yield as affected by nitrogen fertilization. Agric. Res. Rev., ARC.

Nie, Z.; X.C.; F.T. Chen and X.X. Zhn (1994). Path analysis of characters correlated with seed yield technological characters of flax. Proc. 7th conf. Agron of China (114), 16(3): 25-27. Ningxia, China. (C.F. Plant Breeding Abst. 1995, 65(10): 11146).

Zedan, S.Z.A. (1994). Studies on yield and yield components on some selected genotypes in flax. Ph.D. Thesis. Fac. Agric., Al-Azhar Univ.

استخدام بعض الأساليب الإحصائية لكشف العلاقة بين بعض الصفات الكمية والنوعية للكتان ومدى تأثرها بالأسمدة الآزوتية والفوسفورية والبوتاسية وتفاعلاتها

على محمد سيد أحمد الطويل* ، كرم السيد نصار ، عادل عبده رحمو** مديحه محمود بدران****

*** المعمل المركزي لبحوث التصميم والتحليل الإحصائي- مركز البحوث الزراعية – جيزه.**

**** معهد بحوث الأراضي والمياه والبيئة – مركز البحوث الزراعية – جيزه.**

أقيمت تجربتان حقليتان في منطقة أبو حماد بمحافظة الشرقية خلال موسمي ١٩٩٩/٢٠٠٠ ، ٢٠٠٠/٢٠٠١ لدراسة علاقة التسميد النيتروجيني ، الفوسفوري ، البوتاسى ، النيتروجيني X الفوسفوري ، النيتروجيني X البوتاسى ، الفوسفوري X البوتاسى ، النيتروجيني X الفوسفوري X البوتاسى كمتغيرات مستقلة على بعض الصفات الكمية والنوعية لمحصول الكتان كمتغيرات تابعة وكان الصنف المستخدم جيزة ٨ وكانت الصفات الكمية هي محصول البذور والزيت والقش والألياف وكانت الصفات النوعية هي الممتص من النيتروجين ، الفوسفور، البوتاسيوم في كل من البذور والقش ، وقد استخدم لدراسة تلك العلاقة معامل الارتباط البسيط ومعامل الانحدار المتعدد ومعامل الانحدار المتعدد المرحلي وقد لخصت النتائج كما يلي:-

أ- الصفات الكمية:

١- أظهرت نتيجة تحليل معامل الارتباط البسيط وجود ارتباط موجب عالي المعنوية بين التسميد النيتروجيني وكل من محصول لبذور والألياف والقش والزيت وكانت قيم هذا الارتباط هي ٠,٨٥٨ ، ٠,٧٨٢ ، ٠,٧٦٥ ، ٠,٦٠٧ على الترتيب كما وجد ارتباط معنوى موجب بين التسميد الفوسفورى وكل من البذور والزيت والقش وكان التسميد الفوسفورى غير معنوي مع الألياف وقد كان الارتباط بين التسميد البوتاسي وكل من البذور ، والزيت ، والقش غير معنوي ولكنه كان معنويا مع محصول الألياف

٢- أظهرت نتيجة تحليل الانحدار المتعدد أن المساهمة النسبية لكل من التسميد النيتروجيني ، الفوسفوري ، البوتاسى ، النيتروجيني X الفوسفوري ، النيتروجيني X البوتاسى ، الفوسفوري X البوتاسى ، النيتروجيني X الفوسفوري X البوتاسى كمتغيرات مستقلة مجتمعة هو ٨٠ % ، ٥٠,٧ % ، ٦٨,٦ % ، ٦٩,٤ % إسهاما في تباين محصول الحبوب والزيت والقش والألياف على الترتيب٠

٣-أظهرت نتيجة تحليل الانحدار المتعدد المرحلي أن أعلى مساهمة نسبية كانت للمتغير الأول التسميد النيتروجينى وكانت قيمها ٧٣,٧ % ، ٥٨,٥ % ، ٦٥,٥ % وذلك إسهاما في تباين محصول البذور والقش والألياف على الترتيب ومن الجهة الأخرى كانت أعلى العوامل مساهمة في محصول الزيت هو المتغير الرابع النيتروجينX الفوسفور وكانت قيمة الإسهام ٤٠,٥ %.

ب- الصفات النوعية:

1- أظهرت نتيجة تحليل معامل الارتباط البسيط وجود ارتباط موجب عالي المعنوية بين التسميد النيتروجيني وكل من الممتص من النيتروجين ، في كل من البذور والقش والممتص من الفوسفور في البذور والممتص من البوتاسيوم في كل من البذور والقش وكانت قيم معامل الارتباط هي ٠,٧٧٣ ، ٠,٨٤٥ ، ٠,٨٩٤ ، ٠,٨٩٩ ، ٠,٦٣٠ على الترتيب كما وجد ارتباط معنوى موجب بين التسميد الفوسفورى وكل من الممتص من الفوسفور في القش والممتص من البوتاسيوم في كل من البذور والقش وكان التسميد الفوسفوري غير معنويا مع الممتص من النيتروجين في كل من البذور والقش والممتص من الفوسفور في البذور كما كان ارتباط البوتاسيوم معنويا مع كل من الممتص من النيتروجين والفوسفور والبوتاسيوم في القش وكان غير معنويا مع الممتص من النيتروجين والفوسفور والبوتاسيوم في البذور.

٢- أظهرت نتيجة تحليل الانحدار المتعدد أن المساهمة النسبية لكل من التسميد النيتروجيني ، الفوسفوري ، البوتاسى ، النيتروجيني X الفوسفوري ، النيتروجيني X البوتاسى ، الفوسفوري X البوتاسى ، النيتروجيني X الفوسفوري X البوتاسى كمتغيرات مستقلة مجتمعة هو ٦٢ % ، ٨٦,١ % ، ٨٦,٧ % ، ٤١,٤ % ، ٨٧,٤ % ، ٦١,٣ % إسهاما في تباين الممتص من النيتروجين والفوسفور والبوتاسيوم في كل من البذور والقش على الترتيب.

٣- أظهرت نتيجة تحليل الانحدار المتعدد المرحلي أن أعلى مساهمة نسبية كانت للمتغير الأول التسميد النيتروجيني وكانت قيمها ٥٩,٨ % ، ٧١,٤ % ، ٧٩,٩ % ، ٨٠,٨ % إسهاما في تباين الممتص من النيتروجين في البذور والقش وتباين الممتص من الفوسفور في القش وتباين الممتص من البوتاسيوم في البذور على الترتيب. ومن الجهة الأخرى كانت أعلى العوامل مساهمة في الممتص من الفوسفور في القش هو المتغير السادس الفوسفور X البوتاسيوم وكانت قيمة الإسهام ٢٥,٢ % كما كانت أعلى العوامل مساهمة في الممتص من البوتاسيوم في القش هو المتغير الخامس النيتروجينX البوتاسيوم وكانت قيمة الإسهام ٤٦,٧ %.