J. Agric. Sci. Mansoura Univ., 32 (10): 8055 - 8062, 2007

EFFECT OF DIFFERENT NPK TREATMENTS ON YIELD AND YIELD COMPONENTS OF TWO FLAX VARIETIES

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ABSTRACT

Two field experiments were conducted at Gemmeiza Res. Station, Gharbia Governorate, Agric. Res. Center during the two successive seasons of 2005/06 and 2006/07 to study the eight NPK treatments i.e., 1- control (zero), 2- 45 kg N/fed, 3- 15kg P_2O_5/fed, 4- 24 kg K_2O/fed, 5- 45 kg N + 15 kg P_2O_5/fed, 6- 45 kg N + 24 kg K_2O_5/fed, 7- 15 kg P_2O_5 + 24 kg K_2O/fed and 45 kg N +15 kg P_2O_5 + 24 kg K_2O/fed on yield and yield components of the two flax varieties Sakha 3 and Sakha 1, in addition to simple correlation coefficients among eight flax characters.

Results obtained can be summarized as follow:

The flax variety Sakha 3 achieved maximum estimates in straw yield/fed as well as per plant, plant height, technical length and stem diameter when compared with Sakha 1. At the same time, Sakha 1 surpass Sakha 3 in fruiting zone length, seed yield/fed as well as per plant, no. of capsules/plant, no. of seeds/capsule and no. of apical branches. Moreover, application treatment. of NPK at the levels 45 kg N + 15 kg P_2O_5/fed produced maximum mean values of straw and seed characters under this study.

The correlation coefficients among straw yield/plant exhibited significant positive correlations with each of plant height, technical length, stem diameter, no. of capsules/plant, no. of seeds/capsule and no. of apical branches. Also, no. of capsules/plant exhibited significant positive correlations with each of no. of seeds/capsule and no. of apical branches.

INTRODUCTION

Flax (*Linum usitatissimum* L.) is one of the ancient important bast fiber crop, which grown in Egypt for fiber and oil as a main two products. This crop plays an important role in Egyptian national economy by its exportation from the excess quantity of fibers as well as the local fabrication from fiber and oil in different industry. Many investigators such as Mostafa, *et al*, (1998), Abo El-Zahab and Abo-Kaied (2000), El-Gazzar (2000), El-Shimy and Naglaa Ashry (2003) and Hussein *et al*., (2007) who mentioned that there was varietial differences regarding flax yield and its components. Concerning mineral fertilization with nitrogen, phosphorus and potassium (NPK), many workers illustrated the great role of there elements for flax plants growth, especially nitrogen and phosphorus in ancient valley land, from them Hella *et al*., (1988), Abo-Shetia et al, (1996) and El-Shimy *et al*, (2002). The interrelationships among different flax traits were studied by Zahana (1999), Abo-Kaied (2003) and Hussein *et al*, (2007).

The main target of this investigation is to study the effect of various NPK fertilization and their interaction on straw and seed characters of the two flax varieties Sakha 3 and Sakha 1 in addition to calculate the correlation coefficients among different flax characters under study.

MATERIALS AND METHODS

Two field experiments were carried out at Gemmeiza Agric. Res. Station, Agric. Res. Center, Gharbia Governorate, Egypt, during the two successive seasons 2005/06 and 2006/07 to study the effect of different NPK treatments on the flax varieties Sakha 3 and Sakha 1 owing to straw, seed and their related traits. The soil of the experimental site was clay in texture. A split-plot design with four replications was used for each trait. The main plots were randomly assigned to the two flax varieties namely Sakha 3 and Sakha 1. The sub-plot were devoted to the eight NPK treatments i.e., 1- control (zero), 2- 45 kg N/fed, 3- 15kg P_2O_5/fed, 4- 24 kg K_2O/fed, 5- 45 kg N + 15 kg P_2O_5/fed, 6- 45 kg N + 24 kg K_2O_5/fed, 7- 15 kg P_2O_5 + 24 kg K_2O/fed and 45 kg N +15 kg P_2O_5 + 24 kg K_2O_5/fed. The normal practices of growing flax were followed tell full maturity stage.

At full maturity ten guarded plants were taken at random from each sub-plot to be used for recording yield components. Straw and seed yield / fed were calculated from the whole sub-plot area basis, the following data were recorded:

I - Yield and yield components:

A-Straw yield and its related characters: Straw yield/fed (ton), straw yield/plant (g), plant height (cm), technical length (cm), stem diameter (mm), and fruiting zone length (cm).

B- Seed yield and its related characters: seed yield / plant (g), number of capsules/plant, number of seeds/capsule and number of apical branches and seed yield/fed (kg),

Analysis of variance was computed according to Snedecor and Cochran (1982) and means were compared by least significant differences (LSD) at 5% level. Homogeneity test (Bartlett, test) was performed for error terms of each season before using combined analysis. Combined analysis was performed for all characters over two seasons (Le Clerg *et al.,* 1966).

Estimates of correlation coefficient (r) among different flax characters were calculated according to (Svab 1973) as follow: $r_{xy} = Sp_{xy} / (SS_x . SS_y)^{0.5}$ where: Sp_{xy} is the phenotypic covariance between two traits, SS_x phenotypic standard deviation of the first character and SS_y phenotypic standard deviation of the second character.

RESULTS AND DISCUSSION

I- Yield and yield components:

A. Straw yield and its related characters:

Averages of straw and its related characters for two flax varieties as affected by different NPK treatments from the combined analysis over two seasons are presented in Table (1). Analysis of variance showed significant differences between the mean values of the two flax varieties, concerning straw yield/fed as well as per plant and technical length, while plant height, stem diameter and fruiting zone length traits did not reach the level of significance. The eight NPK treatments significantly differed in all the six straw characters which similar results was also mentioned by Momtaz *et al* (1989)

Table 1. Averages of straw yield and its related characters for two flax varieties as affected by different NBK treatments (combined analysis of the two seasons).

Varieties	NPK	Straw yield/fed.(ton)	Straw yield/plant(gm)	Plant height (cm)	Technical Length (cm)	stem diameter (mm)	Fruiting zone length(cm)
Sakha3	1	3.30	1.164	77.73	67.70	1.92	8.000
	2	5.33	1.487	93.89	82.54	2.58	11.350
	3	4.91	1.251	91.49	81.13	2.48	10.360
	4	4.58	1.350	89.90	79.23	2.37	10.675
	5	5.43	1.431	96.91	84.95	2.79	11.963
	6	4.31	1.106	87.93	78.91	2.31	9.013
	7	4.08	1.294	84.98	76.98	2.22	10.025
	8	3.49	1.281	81.06	71.65	2.14	9.412
Means		**4.43**	**1.296**	**87.98**	**77.88**	**2.35**	**10.100**
Sakha1	1	2.99	0.951	75.59	65.39	1.74	8.938
	2	5.06	1.250	92.94	81.09	2.48	11.850
	3	4.67	1.200	88.25	75.62	2.31	12.625
	4	4.33	1.125	85.85	74.50	2.25	11.350
	5	5.51	1.339	96.50	81.60	2.73	14.900
	6	4.03	1.119	83.30	74.36	2.16	10.200
	7	3.79	0.958	80.48	70.31	2.04	10.162
	8	3.46	1.100	79.00	68.81	1.88	10.187
Means		**4.23**	**1.130**	**85.24**	**73.96**	**2.20**	**11.277**
	Mean for NPK treatments						
1		3.15	1.06	76.66	66.54	1.83	8.94
2		5.19	1.37	93.41	81.81	2.53	11.60
3		4.79	1.23	89.87	78.37	2.39	11.49
4		4.46	1.24	87.88	76.86	2.31	11.01
5		5.47	1.39	96.71	83.28	2.76	13.43
6		4.17	1.11	85.61	76.64	2.23	10.11
7		3.93	1.13	82.73	73.64	2.13	10.09
8		3.48	1.19	80.03	70.23	2.01	9.80
L.S.D. 0.05 level ofsignificance for:							
Varieties (V)		**0.16**	**0.150**	**NS**	**3.600**	**NS**	**NS**
NBK		**0.30**	**0.210**	**1.740**	**2.530**	**0.110**	**2.58**
V x NBK		**0.43**	**0.290**	**NS**	**3.57**	**0.16**	**3.65**

NS = non-significant.

1= (NPK= Zero) 2= 45 kg N/fed 3= 15 kg P_2O_5/fed 4=24 kg K_2O/fed
5=45 kg N+15 kg P2O5/fed 6= 45 kg N +24 kg K2O/fed
7= 15 kg P2O5+24 kg K2O/fed 8= (N=45, P=15 and K=24Kg/fed)

The flax variety Sakha 3 recorded highest estimates and surpass Sakha 1 in straw yield/fed (4.43 and 4.23 ton), straw yield/plant (1.296 and 1.130 g), plant height (87.98 and 85.24 cm), technical length (77.88 and 73.96 cm) and stem diameter (2.35 and 2.20 mm) for Sakha 3 and Sakha 1,

respectively. The superiority ratios for Sakha 3 over Sakha 1 were 4.73, 14.69, 3.21, 5.30 and 6.82% in relation to straw yield/fed, straw yield/plant, plant height, technical length and stem diameter, respectively. At the same time, Sakha 1 achieved higher fruiting zone length (11.277 cm) than average obtained by Sakha 3 (10.100 cm) with the superiority percentage of 11.65%. Many investigators found varietal differences in straw characters such as Mostafa *et al*., (1998) El-Gazzar (2000), Abo-El-Zahab and Abo-Kaied (2000), El-Shimy and Naglaa Ashry (2003) and Hussein *et al*., (2007).

Regarding different NPK fertilizer treatments effect, results indicated that the maximum averages obtained by applying flax plants with 45 kg N + 15 kg P2O5/fed (treatment no. 5), the mean values were 5.47 ton for straw yield/fed, 1.39 g for stem diameter and 13.43 cm for plant height, 83.28 cm for technical length, 2.76 mm for stem diameter and 13.43 cm for fruiting zone length. On the other hand, the untreated control recorded the lowest estimates with the respective mean values of 3.15 ton fed., 1.06 g, 76.66 cm, 66.54 cm, 1.83 mm and 8.98 cm for the same traits arrangement which mentioned before. The superiority percentages for the mean values obtained by applying NPK treatment no. 5 over the control (no. 1) were 73.65, 31.13, 26.15, 25.16, 50.82 and 49.55% for straw yield/fed, straw yield/plant, plant height, technical length, stem diameter and fruiting zone length, respectively. Moreover, the NPK treatment number 2 which only contain nitrogen element (45 kg N/fed) ranked second after the treatment no. 1 in relation to all straw characters under study, this indication that flax plant require more nitrogen quantity in comparison with the two other ones (phosphorus and potassium) to be created high straw characters. These results are in harmony with those obtained by Abo-Shetia *et al*., (1996), Mostafa *et al*., (1998), El-Shimy *et al*., (2002), Zahana (2004) and Abdel-Dayem (2007). It can be concluded that the flax variety Sakha 3 ranked first and surpass Sakha 1 in straw characters. The maximum estimates of all six studied straw traits recorded by applying flax plant with 45kg N + 15 P_2O_5/fed.

Variety x NPK interaction had significant effect on straw yield/fed, straw yield/plant, technical length, stem diameter and fruiting zone length, this means that these two factors under study done their effect dependently. The highest mean values for all straw traits recorded by Sakha 3 combined with the NPK treatment no. 5 (45 kg N + 15 kg P2O5/fed) and also by Sakha 1 concerning fruiting zone length character.

B. seed yield and its related characters:

From Table (2), results revealed significant differences between the mean values for the two flax varieties Sakha 3 and Sakha 1, in addition to NPK fertilizer treatment regarding all seed characters under study. The flax variety Sakha 1 recorded highest averages in all seed traits and exceeded Sakha 3 in this case, the mean values obtained by both flax varieties were 651.43 and 616.10 kg for seed yield/fed, 0.331 and 0.287 g for seed yield/plant, 6.85 and 5.35 for no. of capsules/plant, 5.87 and 5.58 for no. of seeds/capsule in addition to 9.68 and 8.10 for no of apical branches in relation to Sakha 1and Sakha 3, respectively. The superiority rations for Sakha 1 over Sakha 3 in the same characters previously arrangement were

5.64, 15.33, 28.04, 5.20 and 19.51%, respectively. This finding are in agreement with those obtained by El-Gazzar (2000), Abo-El-Zahab and Abo-Kaied (2000), Zedan (2004) and Hussein *et al*., (2007).

Table 2. Averages of seed yield and its related characters for two flax varieties as affected by different NBK treatments (combined analysis of the two seasons).

Varieties	NPK	Seed yield/fed.(kg)	Seed yield/plant(g)	No.of capsules/plant	No.of seeds/capsules	No.of apical branches
Sakha3	1	543.97	0.214	3.79	5.23	4.83
	2	673.69	0.313	6.60	5.66	9.23
	3	624.63	0.287	5.28	5.86	9.88
	4	593.65	0.229	5.03	5.69	8.76
	5	705.19	0.366	6.70	6.04	10.81
	6	660.38	0.293	5.48	5.53	8.01
	7	565.75	0.290	5.01	5.33	7.00
	8	566.10	0.301	4.90	5.35	6.26
Means		**616.67**	**0.287**	**5.35**	**5.59**	**8.10**
Sakha1	1	613.83	0.226	4.05	5.05	6.70
	2	670.83	0.361	9.03	5.96	12.14
	3	644.83	0.347	7.96	6.05	10.44
	4	567.75	0.330	6.36	5.33	9.20
	5	745.28	0.378	10.98	6.86	14.79
	6	735.70	0.364	5.90	6.69	8.66
	7	613.65	0.296	5.24	5.36	7.98
	8	619.58	0.346	5.24	5.68	7.56
Means		**651.43**	**0.331**	**6.85**	**5.87**	**9.68**
	Mean for NPK treatments					
	1	578.90	0.220	3.92	5.14	5.77
	2	672.26	0.337	7.82	5.81	10.69
	3	634.73	0.317	6.62	5.96	10.16
	4	580.70	0.280	5.70	5.51	8.98
	5	725.23	0.372	8.84	6.45	12.80
	6	698.04	0.329	5.69	6.11	8.34
	7	589.70	0.293	5.13	5.35	7.49
	8	592.84	0.324	5.07	5.52	6.91

L.S.D. 0.05 level ofsignificance for:

Varieties (V)	**25.12**	**0.040**	**1.21**	**0.25**	**1.45**
NBK	**89.67**	**0.070**	**0.890**	**0.530**	**1.070**
V x NBK	**126.81**	**0.090**	**1.26**	**0.75**	**1.51**

NS = non-significant.

1= (NPK= Zero) 2= 45 kg N/fed 3= 15 kg P_2O_5/fed 4=24 kg K_2O/fed
5=45 kg N+15 kg P2O5/fed 6= 45 kg N +24 kg K2O/fed
7= 15 kg P2O5+24 kg K2O/fed 8= (N=45, P=15 and K=24Kg/fed)

Owing to different NPK treatment effect, results indicated that applying the treatment no. 5 (45 kg N + 15 kg P_2O_5/fed) produced maximum estimates in all characters i.e., seed yield/fed (725.24 kg), seed yield/plant (0.372 g), no. of capsules/plant (8.84), no. of seeds/capsule (6.45) and no. of apical branches (12.80). On the other hand, the minimum estimates in the respective seed traits which mentioned before were obtained by the untreated control with the averages of 578.90 kg/fed, 0.220 g/plant, 3.92, 5.14 and 5.77. The superiority percentages between the highest averages (treatment no. 5) and the lowest ones obtained by the control were 25.28, 69.09, 25.51, 25.49 and 21.84%. Similar results were also observed by Hella *et al*., (1988), Mostafa *et al*., (1998), El-Shimy *et al*., (2002) and Abdel-Dayem (2007).

Generally, it must be concluded that the flax variety Sakha 1 recorded highest estimates in all studied in all studied seed traits when compared with Sakha 3. Moreover, application NPK treatment 45 kg N + 15 kg P_2O_5/fed produced maximum mean values of seed characters under study.

The interaction between flax varieties and NPK treatment had significant effect on all seed characters, the highest mean values of all the five seed traits were obtained by the flax variety Sakha 1 combined with fertiled flax plants by the treatment 45 kg N + 15 kg P_2O_5/fed.

II- Correlation study:

Correlation coefficients among nine flax characters for two flax varieties as affected by different NPK fertilizer treatments (over two seasons) are presented in Table (3). Results indicated that there was significant and positive r values between straw yield /plant and each of plant height, technical length and stem diameter. The associations between plant height and each of technical length, stem diameter, seed yield/plant, fruiting zone length, no. of capsules/plant, no. of seeds/capsule and no. of apical branches showed significant and positive r values.

Table 3: Simple correlation coefficients between nine flax characters for two flax varieties as afficted by different NPK fertilizer treatments (over the two seasons).

Characters	1	2	3	4	5	6	7	8
1= Straw yield/plant(gm)								
2= Plant height (cm)	0.769 **							
3=Technical Length(cm)	0.782 **	0.974 **						
4= Stem diameter	0.796 **	0.986 **	0.966 **					
5= Fruiting zone length(cm)	0.474	0.751 **	0.617 *	0.724 **				
6= Seed yield/plant(gm)	0.252	0.521 *	0.465	0.523 *	0.720 **			
7= No.of capsules/plant	0.386	0.718 **	0.589 *	0.691 **	0.927 **	0.756 **		
8= No.of seeds/capsules	0.351	0.600 *	0.535 *	0.598 *	0.720 **	0.722 **	0.741 **	
9= No.of opical branches	0.413	0.824 **	0.713 **	0.789 **	0.933 **	0.703 **	0.936 **	0.770 **

***,** Significant at 0.05 and 0.01 levels of probability, respectively.**

The r values between technical length and each of stem diameter, fruiting zone length, no. of capsules/plant and no. of apical branches were significant and positive. The interrelationships between stem diameter and each of fruiting zone length, seed yield/plant, no. of capsules/plant, no. of seeds/capsule and no. of apical branches appeared to be significance ant positively correlated, also between fruiting zone length and each of seed yield/plant, no. of capsules/plant, no. of seeds/capsule and no. of apical branches. The correlation coefficients between no. of capsules/plant and either no. of seeds/capsule or no. of apical branches were significant and positive in addition to between no. of seeds/capsule and number of apical branches. These results are in agreement with those reborted by Abo El-Zahab *et al.,* (1994), Zahana (2004) and Abo-Kaied *et al.,* (2006).

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تـأثير معـاملات مختلفـة مـن النيتـروجين والفسـفور والبوتاسـيوم علـى المحصـول ومكوناته لصنفين من الكتان

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قسم بحوث محاصيل الالياف – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بالجميزة – مركز البحوث الزراعية خلال الموسمين المتعاقبين 2006/2005 ، 2007/2006 وذلك لدراسة تأثير ثماني معاملات من السماد النيتروجيني والفسفاتي والبوتاسي وهذه المعاملات هي 1- الكونترول (صفر) ، 2- 45كجم ن ، 3- 15كجم فو$_2$أ$_5$ ، 4- 24 كجم أكسيد البوتاسيوم ، 5- 45كجم ن+15كجم فو$_2$أ$_5$ ، 6- 45كجم ن +24كجم أكسيد البوتاسيوم ، 7- 15كجم فو$_2$أ$_5$ 24كجم أكسيد البوتاسيوم ، 8- 45كجم ن+15كجم فو$_2$أ$_5$ +24كجم أكسيد البوتاسيوم/فدان . وتأثير هذه المعاملات على المحصول ومكوناته لصنفين من الكتان هما سخا 3 ،سخا 1 ، بالإضافة إلى تقدير معامل الارتباط بين ثماني صفات – ويمكن تلخيص النتائج المتحصل عليها فيما يلي :

A. حقق صنف الكتان سخا 3 أعلى التقديرات لمحصول القش للفدان وللنبات ، وارتفاع النبات ،والطول الفعال ، وسمك الساق ، وذلك بالمقارنة بالصنف جيزة8 . وفي نفس الوقت

B. تفوق الصنف سخا 1 على الصنف سخا 3 في صفات طول المنطقة الثمرية ، ومحصول البذور للفدان وللنبات ، وعدد الكبسولات للنبات ، وعدد البذور للكبسولة ، وعدد الأفرع القمية –

C. ادت المعاملة السمادية 45كجم ن+15كجم فو$_2$أ$_5$ للفدان أعطت أعلى قيم متوسطات لكل صفات القش والبذرة تحت الدراسة .

D. كان معامل الارتباط موجب ومعنوي بين محصول القش للنبات وكل من ارتفاع النبات ، والطول الفعال ، وسمك الساق ، وعدد الكبسولات لنبات ، وعدد البذور بالكبسولة ، وعدد الأفرع القمية ، وكان أيضا قيم معامل الارتباط موجبة ومعنوية بين عدد الكبسولات للنبات وكل من عدد البذور بالكبسولة ، وعدد الأفرع القمية.

توصي هذه الدراسة بزراعة الصنف سخا3 اذا كان الغرض من الزراعة الحصول على محصول الياف عالي الكم والجودة اما اذا كانت الزراعة بغرض الحصول على محصول بذرة وزيت فيوصى بزراعة الصنف سخا1 ويتحقق ذلك بمعاملة سمادية 45 كجم نيتروجين + 15 كجم فو2 أ5 للفدان