EFFECT OF SEEDING RATES, PLANTING METHODS AND PHOSPHOROUS FERTILIZER SOURCES ON YIELD AND ITS COMPONENETS OF SAKHA 2 FLAX CULTIVAR

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ABSTRACT: Two field experiments were conducted at the Farm of Etay El-Baroud Agricultural Research Station during 2002/2003 and 2003/2004 seasons to study the effect of seeding rates, planting methods as well as different sources of phosphorous fertilizer on the productivity of Sakha 2 flax cultivar. The results indicated that increasing seed rate up to 85 kg/fed. significantly increased most of the studied traits particularly plant height, technical length, fiber length, fiber percentage, fiber fineness and biological and straw yields. Results revealed that drilling method was superior to other planting methods and gave the maximum values for most of the studied characters. Results indicated also that most of the studied characters were significantly increased with 200 g bio-phosphorous + 15.5 kg P_2O_5/fed except fiber fineness which showed a significant reduction by the application of this treatment. The statistical analysis showed that there a significant positive correlation between straw and seed yields and their attributes, besides that path coefficient analysis revealed that plant height, stem diameter and fiber length directly and indirectly influenced straw yield. Principal component analysis divided characters of flax into two components accounted for about 94% of total variability, the first component contributed by about 88% and included stem diameter, fiber length, fiber percentage, seed index oil percentage and fiber fineness, while the second component accounted for about 6% and contained plant height, technical length, number of capsules/plant and number of seeds/capsule.

Keywords: **Flax, bio-phosphorus, fiber fineness, seeding rate planting method.**

INTRODUCTION

Flax (*Linum usitatisimum* L) is one of the ancient important known crop grown for its fiber and oil. It is locally used in textile industry. Linseed oil is one of the oldest commercial oils used in food and besides it still one of the most important oils used in painting and varnish industry. Flax ranks the second after cotton as a fiber crop in Egypt, and plays an important role in the national income and one of the main export crops. Researchers have paid great efforts to increase quantity and to improve the quality of flax. Plant density and planting methods as well as phosphorous fertilizer are among the factors affecting flax production and fiber quality. Keneber (2003) and Zedan (2004) reported that seeding rate and methods of planting are very important factors limiting flax production. The effect of phosphorous fertilizer on flax productivity and fiber quality have been tested by several investigators, Chaube and Dwivedi (1995) and Kineber *et al.* (1997) who indicated that 15 kg P_2O_5/fed. is required to produce maximum straw and seed yields. On the other hand El-Shimy and Moawed, (2000), El-Shimy *et al.* (2001) and El-Deeb (2002), reported that biological fertilizer supply plants with their requirement of phosphorous and reduce the expensive mineral fertilizer consequently reduce production cost and pollution rates in both soil and water.

Direct selection of yield on individual plant basis is mostly misleading. Hence the plant breeders attempt to improve yield directly through the improvement of its associated characters. Correlation between yield and its components is usually practiced in this regard.

The present investigation aimed to study the effect of mineral and biological phosphorous fertilizers, and the optimum seeding rate of Sakha 2 flax cultivar under different planting methods and to determine the most important variables and their relative contribution to flax straw and seed yields.

MATERIALS AND METHODS

Two field experiments were conducted at the Farm of Etay El-Baroud Agricultural Research Station during 2002/2003 and 2003/2004 growing seasons to study the effect of three seed rates

65, 75 and 85 kg/fed., hree planting methods manual broadcast after irrigation, manual broadcast before irrigation and drilling in rows 15 cm apart, and four treatments of P fertilizers i.e. control, bio-P (bacellus megaterium) 200 g/fed, Calcium super phosphate 15.5 kg P_2O_5 /fed. and 200g bio + 15.5 kg P_2O_5/fed. The split-split plot design with four replications was used since the three seeding rates were allocated in the main plots while, planting methods were allocated in the sub-plots and P fertilizer treatments in the sub-sub-plots. Flax planted in plots 6 m^2. All other cultural practices were applied as recommended for the variety.

Soil samples were collected from the experimental sites before planting and subjected to mechanical and chemical analysis and the results were presented in Table 1.

The statistical analysis was performed to the data over the two seasons according to Senedecor and Cochran (1980). Simple correlation coefficient was computed as outlined by Steel and Torri (1987) and Duart and Adams (1972). Path coefficient analysis was also used as applied by Dewey and Lu (1959) as well as principle component analysis as applied by Berenson *et al.* (1983).

Table 1: Soil chemical and mechanical analysis of the experimental site

Year	Mechanical analysis			Chemical analysis				
	Sand %	Silt %	Clay%	OM%	N ppm	P ppm	EC ds/m	pH
2002/2003	13/75	23.15	66.00	2.55	27.12	19.32	2.01	8.01
2003/2004	1277	21.39	64.30	2.73	28.00	20.15	1.99	7.80

RESULTS AND DISCUSSION

1. Straw Yield and its Related Characters

The combined data of 2002/2003 and 2003/2004 seasons for straw yield and its related characters of Sakha 2 flax variety as affected by seeding rates, planting methods and sources of P fertilizer are presented in Table 2. Data showed seeding rate of 85 kg seed/fed. gave the highest values of plant height, technical length, fiber yield/fed., biological yield/fed, and straw yield/fed compared to the other two seeding

Table 2:Some plant characters, straw yield and its attributes as affected by seeding rate, planting methods and fertilizers. (Combined analysis of 2002/2003 and 2003/2004 seasons)

Treatments	Characters							
	Plant height (cm)	Technical Length cm	Stem diameter (mm)	Straw yield g /plant	Fiber yield g/plant	Fiber yield kg/fed.	Biological yield (ton)	Straw yield ton/fed.
Seeding Rate kg/fed.								
S	114.736	100.080	2.372	1.751	0.266	470.099	3.866	3.244
65	115.518	100.527	2.308	1.718	0.263	485.245	4.019	3.403
75	116.534	101.500	2.256	1.602	0.249	498.146	4.170	3.559
85								
LSD 5%	0.630	0.636	0.023	0.018	0.003	2.872	0.020	0.017
Planting Methods: M								
M1	114.851	99.720	2.389	1.728	0.262	480.310	3.979	3.357
M2	115.440	100.858	2.336	1.692	0.259	482.175	4.007	3.393
M3	116.496	101.529	2.220	1.651	0.256	491.005	4.068	3.457
LSD 5%	0.602	0.544	0.021	0.019	0.003	2.931	0.017	0.012
Phosphorous : F								
Control	105.577	93.047	1.942	1.431	0.194	409.735	3.575	3.018
Bio-phosphorous	109.592	97.356	2.185	1.591	0.239	480.178	3.822	3.202
Mineral	118.243	100.811	2.509	1.778	0.281	510.262	4.157	3.517
Phosphorous Bio + Mineral	128.972	111.594	2.624	1.961	0.324	537.812	4.518	3.871
LSD 5%	0.530	0.510	0.032	0.027	0.005	4.173	0.014	0.013
Interaction F test								
S x M	Ns	Ns	Ns	*	*	Ns	Ns	Ns
S x F	Ns	Ns	Ns	*	*	*	*	*
M x F	Ns	*	Ns	*	*	Ns	Ns	*

M1: Broadcasting after irrigation, M2: Broadcasting before irrigation and M3: Drill seeding (15 cm).

rates (65 and 75 kg/fed.). On the other hand stem diameter, straw and fiber yields/plant were significantly decreased as seeding rate increased beyond 65 kg/fed. This could be attributed mainly to the fact that increasing the plant densities increased the competition between plants to light, root distribution, and nutrients available in the soil, consequently reduce most of plant growth characters and yield. These findings are in agreement with those reported by El-Shimy and Moawed (2000); Mostafa (2003) and Abd El-Daiem (2004).

Regarding planting methods data in Table 2 indicated that the studied characters showed significant variation among the three planting methods. Drill seeding gave the highest values of all studied characters except stem diameter, straw yield/plant and fiber yield /plant, which gave their highest values with broadcast seeding. Similar results were obtained by Kineber (2003), Abou-Zaied and Al-Azony (2003) and Zedan (2004).

Data in Table 2 revealed also that the application of 200 g/fed. bio-P + 15.5 kg P_2O_5/fed. produced the highest values of plant height, technical length, stem diameter, straw, fiber and biological yields followed by the application of mineral P. The relative increases in straw yield relative to unfertilized plots were about 6, 17 and 28% when flax plants were received bio-P, mineral P and bio-P + mineral P, respectively. It could be concluded that the combination of bio and mineral P increased the effectiveness and availability of the P element to the plant which is playing an important role in the metabolic processes and in turn affected the plant growth. These findings are in agreement with those reported by Mohamed (1990), El-Deeb (1998) and El-Shimy *et al.* (2001).

The interaction between the three studying factors showed significant effects on technical length, stem diameter, straw yield /plant, fiber yield/ plant, fiber yield /fed., biological yield and straw yield/fed. as shown in Table 5. technical length and stem diameter were significantly affected by the interaction between planting methods and application and the highest values were obtained with drill in raw 15 cm apart and the application of bio + mineral P (M3 x F4) for technical length, while for stem diameter, the highest value were obtained from the combination of broadcast after irrigation and the application of bio + mineral P. Whereas straw yield /fed. was significantly affected by the interaction between seeding rates and fertilization and planting method and fertilization and the highest values were obtained with (S3 x F4) and M3 x F4), respectively. While, fiber yield/plant was significantly affected by the interaction between seeding rates and planting method (S1x M2), seed rate and fertilization (S2 x F4) and planting methods and fertilization (M2 x F4). Meanwhile, the highest straw yield/plant was recorded from the interaction between seeding rates and planting method (S1 x M2) and seeding rates and fertilization (S2 x F4). Fiber yield was significantly affected by the interaction between seeding rate and phosphorous fertilizer application (S3 x F4) and the three order interaction (S3 x M3 x F4) and the greatest biological yield /fed. was recorded from the interaction between seeding rate and fertilization (S3 x F4) as shown in Table 5.

2. Seed Yield and its Related Characters

Data of seed yield and its related characters as affected by, seeding rates, planting methods and P fertilizers are presented in Table 3. Data showed that increasing seeding rate up to 85 kg/fed. gradually decreased the number of capsules /plant, number of seeds/capsule, number of seeds/plant and seed index.. These results could be attributed mainly to the competition between plants caused by the use of high seeding rate since plants compete for all nutrient elements, water, and light. These findings are in agreement with those reported by Stevenson and Wright, (1996) Abdel Wahed (2002) and Zedan (2004).

Regarding the effect of planting methods on seed yield and its attribute, it revealed that broadcast seeding after irrigation produced the highest number of capsules/ plant, number of seeds/capsule, number of seeds/plant and seed index relative to the other two methods of planting.. Data indicated also that there was no significant difference in oil and seed yield/fed. among the three methods of planting.

These results in harmony with those found by Kineber, (2003) and Zedan (2004).

Data in Table 3 showed also that the highest values of seed yield and its related characters were obtained when bio-P fertilizer (200 g/fed,.)+15.5 kg P_2O_5/fed.

Table 3: Seed yield and its attributes as affected by seeding rate, planting methods, and phosphorous fertilizers (Combined analysis of 2002/2003 and 2003/2004 seasons)

Treatments	Characters Number of Capsules/plant	Number of Seeds/capsules	Seed yield g/plant	Seed Index	Oil yield kg/fed.	Seed Yield kg/fed.
Seeding Rate kg/fed.(S)						
65	9.068	6.117	0.402	7.29	233.45	619.57
75	8.954	6.074	0.399	7.26	231.71	616.73
85	8.794	5.915	0.390	7.20	231.10	615.59
LSD 5%	0.013	0.028	0.003	0.02	1.33	2.89
Planting Methods(M)						
M1	9.011	6.094	0.403	7.29	232.31	618.31
M2	8.931	6.038	0.393	7.25	232.55	617.82
M3	8.874	5.974	0.393	7.21	231.39	615.76
LSD 5%	0.016	0.028	0.003	0.01	NS	NS
Phosphorous Fertilizer: F						
Control	8.406	5.503	0.327	6.82	206.98	558.86
Bio-phosphorous	8.827	5.943	0.375	7.12	231.62	621.96
Mineral Phosphorous	9.225	6.275	0.434	7.51	242.30	640.92
Bio + Mineral	9.297	6.421	0.454	7.56	247.43	647.46
LSD 5%	0.016	0.033	0.003	0.02	1.49	3.60
Interaction F test						
S x M	*	*	NS	NS	NS	NS
S x F	*	*	*	*	NS	NS
M x F	*	*	*	*	NS	NS

were applied followed by the application of mineral-P and the lower values were obtained when no P fertilizers were applied. This could be attributed to the fact that bio-P application enhanced the availability of the mineral P to the plants due to the interaction effect between these two phosphorous sources than the application of each separately. These findings are in agreement with those reported by El-Gazar (1997) and El-Sheimy *et al.* (2001).

The effect of the interaction between the seeding rates, planting methods and P fertilizers on seed yield and related characters are presented in Table 5. Data indicated that significant effects for the 2nd order interaction of P fertilization planting methods and seeding rates (F x M x C) on number of capsules /plant, number of seeds/ capsules and seed index, while the 1st order interaction of P fertilization and planting methods (F X M), as soon as, interaction between P fertilization and seeding rates (F X C) had a significant effect on number of capsules/plant, number of seeds /capsule, seed yield/plant and seed index .in addition planting methods and seeding rates interaction (M x C) had a significant effect on number of capsules/plant and number of seeds/capsule.

The highest values for number of capsules/ plant (9.297), number of seeds/capsule (6.421) and seed index (7.563 g) were obtained by bio + mineral P combined with drilling method and seeding rates of 65 kg seeds/fed. (F4 X M3 X C1). On the other hand, the maximum seed yield/plant) (0.454g) was obtained by bio + mineral-P combined with seeding rate 85 kg seeds/fed.

3. Technological Characters

Some of the technological characters as affected by seeding rates, planting methods and P fertilization (average of the two seasons 2002/2003 and 2002/2004) are presented in Table 4. Data reveled that the seeding rates, planting methods, and phosphorus fertilization were significantly varied in their effects on the studied technological characters. On the other hand, fiber percentage and economic yield/fed. did not show any significant variation under the different planting methods.

Regarding, seeding rates, data in Table 4 revealed that fiber length, fiber percentage, fiber fineness and economic yield significantly increased with increasing seeding rates from 65 to 85 kg seeds/fed the respective mean values obtained by 85 kg seeds/fed were about 77.111 cm, 15.289%, 173.814 nm and about 1114 kg/fed, respectively. In the opposite direction, oil percentage was decreased with increasing seeding rates. These data are quite similar to those reported by Abd El-Wahed (2002) and Zedan (2004).

Data in Table 4 indicated also that drilling method gave highest values of fiber length (76.957 cm) and fiber fineness (173.977 nm) when compared with broadcasting (either after or before irrigation) methods. On the other hand, broadcasting method (before irrigation) gave highest oil percentage (37.639 %). While, fiber percentage and economic yield /fed. did not show any significant effects due to the different planting methods. Similar results detected by Kineber (2003) and Zedan (2004).

The effects of phosphorus fertilizers application are also presented in Table 4. Results indicated that bio-P application at the rate of 200 g/fed. + Calcium super phosphate (15.5 kg P_2O_5/fed) caused highest estimates in fiber length, fiber percentage, oil percentage and economic yield/fed with the means of 83.349 cm, 16.743 %, 38.198 % and 1185.723 kg/fed, respectively but fiber fineness gave the largest value without fertilization being mean value (175.794 nm). Meanwhile, the mineral-P at the level of 15.5 kg P_2O_5/fed. recorded the second values in the above mentioned characters except fiber fineness .on the other hand, the minimum estimates for fiber length, fiber percentage, oil percentage and economic yield/fed. and the maximum value for fiber fineness were obtained by the untreated control (without any P application) with the mean values of 70.240 cm, 13.618%, 37.011%, 968.610 kg/fed and 175.794 nm, respectively these results are in harmony with those reported by Kineber *et al.* (1997) and El-Shimy *et al.* (2001).

Data in Table 5, reveled that the 1st order interaction between (M x F) and the 2nd order interaction between (S x M x F) had significant effect on fiber fineness and oil percentage, while the 1st order interaction (S x F) had significant effect on fiber length and fiber fineness and (S x M) interaction had significant affect on fiber fineness traits. The highest fiber fineness (176.32 nm) was obtained by the second order interaction between F1 (without fertilization), planting method M3 (drilling method) and seeding rate S3 (85 kg seeds/fed) in addition to the maximum oil percentage (38.47%) was obtained with applying F4 (bio-P 200 g/fed. +15.5 kg P_2O_5 /fed) planting method M1 (broadcasting after irrigation) and the lowest seeding rate S1 (65 kg seeds/fed) on the other hand, the tallest fiber length (83.88 cm) was obtained by the 1st order interaction between F4 (bio-P 200 gm/fed.+15.5 kg P_2O_5 /fed) with seeding rate S3 (65 kg seeds /fed).

Table 4: Technological characters as affected by seeding rate, planting methods, and phosphorous fertilizers (Combined analysis of 2002/2003 and 2003/2004 seasons)

Treatments	Characters				
	Fiber length (cm)	Fiber %	Fiber fineness (N.m)	Oil %	Economic yield (kg)
Seeding Rate kg/fed.					
65	76.651	15.259	173.504	37.692	1079.578
75	76.823	15.286	173.651	37.549	1101.776
85	77.111	15.289	173.814	37.531	1114.007
LSD 5%	0.138	0.021	0.027	0.044	16.790
Planting Methods:					
M1	76.709	15.280	173.273	37.602	1088.518
M2	76.918	15.268	173.720	37.639	1100.098
M3	76.957	15.286	173.977	37.531	1106.745
L.S.D. 5%	0.203	NS	0.036	0.058	NS
Phosphorous Fertilizer					
Control	70.240	13.618	175.794	37.011	968.610
Bio-phosphorous	74.792	15.010	174.579	37.372	1088.460
Mineral Phosphorous	79.066	15.741	173.059	37.783	1151.081
Bio + Mineral	83.349	16.743	171.194	38.198	1185.723
LSD 5%	0.224	0.027	0.062	0.048	20.265
Interaction F test					
S x M	NS	NS	*	NS	NS
S x F	*	NS	*	NS	NS
M x F	NS	NS	*	*	NS
S x M X F	NS	NS	*	*	NS

M1: Broadcasting after irrigation, M2: Broadcasting before irrigation and M3: Drill seeding (15 cm).

Table 5: Significance, highest value and combination of the interaction effects between seeding rates (S), planting methods(M) and phosphorous fertilizers (F) on some flax characters in combined analysis of 2002/2003 and 2003/2004 seasons

Characters	S x M	Value	S x F	Value	M x F	Value	S x M x F	Highest value
<u>Straw yield and related characters:</u>	-	-	-	-	M3xF4	112.704	-	-
Technical length (cm)	-	-	-	-	M1xF4	2.638	-	-
Stem diameter (mm)	S1xM1	1.778	S2xF4	2.002	-	-	-	-
Straw yield /plant (g)	S2xM2	0.271	S2xF4	0.331	M2xF4	0.330	-	-
Fiber yield /plant (g)	-	-	S3xF4	550.395	-	-	S3xM3xF4	551.026
Fiber yield /fed. (kg)	-	-	S3xF4	4.710	-	-	-	-
Biological yield (kg)	-	-	S3xF4	4.067	M3xF4	3.936	-	-
Straw yield/ fed. (ton)								
<u>Seed yield and related characters</u>:								
Number of capsules/plant	S1xM1	9.142	S1xF4	9.339	M2xF4	9.308	S1xM3xF4	9.363
Number of seeds/capsule	S1xM1	6.149	S1xF4	6.429	M3xF4	6.445	S1xM3xF4	6.481
Seed yield/plant (g)	-	-	S3xF4	0.454	M3xF4	0.453	-	-
Seed Index	-	-	S2xF4	7.574	M3xF4	7.599	S2xM3xF4	7.628
<u>Technological characters:</u>								
Fiber length (cm)	-	-	S3xF4	83.877	-	-	-	-
Fiber fineness (nm)	S3xM3	174.102	S3xF1	175.930	M3xF1	176.184	S3xM3xF1	176.320
Oil percentage	-	-	-	-	M2xF4	38.293	S1xM1xF4	38.475

S1=65 kg seeds/fed., S2=75 kg/fed. and S3=85 kg/fed. M1=Broadcasting after irrigation, M2=Broadcasting before irrigation and M3=drilling F1=Control, F2=Bio-P, F3=Mineral P and F4=Mineral + Bio

Correlation Studies

Simple correlation coefficients among straw yield /fed. and its most related characters are presented in Table 6 the intcrrclationships between straw yield and its attributes i.e. plant height, technical length, stem diameter and fiber length were positive and highly significant (0.912, 0.877, 0.721 and 0.090) respectively. Since all characters were positively correlated so these results are indicating that selection practiced for the improvement of any of a set of correlated characters, would automatically improve the other even through direct selection for its improvement has not been made.

Table 6: Correlation analysis among straw yield and its related characters

Characters	X1	X2	X3	X4
Plant height X1	1.000			
Technical length X2	0.961**	1.000		
Stem diameter X3	0.814**	0.739**	1.000	
Fiber length X4	0.944**	0.896**	0.887**	1.000
Straw yield/fed. Y	0.912**	0.877**	0.721**	0.904**

Table 7: Correlation analysis among seed yield and its related characters

Characters	X1	X2	X3	X4
Capsules/plant X1	1.000			
Seeds/capsule x2	0.933**	1.000		
Seed Index X3	0.931**	0.914**	1.000	
Oil percentage X4	0.798**	0.785**	0.832**	1.000
Seed yield/fed. Y	0.862**	0.856**	0.892**	0.784**

Seed yield / fed. exhibited highly significant correlation with number of capsules /plant, number of seed/capsule, seed index and oil percentage (0.682, 0.856, 0.982 and 0.784, respectively) Table 7. Another correlation has to be considered is that between oil percentage, number of capsules/ plant, number of seed/ capsule and seed index with correlation coefficient (r) values of 0.798, 0.785 and 0.832, respectively. number of capsules/plant and number of seeds /capsule had the greatest influence on seed index with r value of 0.931 and 0.914 respectively .on the other hand, number of capsules /plant was significantly correlated with number of seeds/ capsules with r value 0.933 the previous results are of great value for the flax agronomists and breeders to improve quality and production of seed yield in flax these findings are similar to those reported by Zahana (1999), El-Deeb (2002) and Mostafa and Ashmawy, (2003).

Path Coefficient Analysis

Path coefficient procedures was used in this study to assess the relative importance of variables contributing both directly or indirectly for flax (straw and seed) yield and its related character over the two seasons of the study.

The results of direct and indirect effects of straw yield factors and their relative contribution to the straw yield are shown in table 8 and diagrammatically illustrated in figure 1. Results revealed that fiber length showed maximum direct effect towards straw yield /fed. Recording the highest relative contribution of 35.91% to the total variation of straw yield. Plant height ranked second recording 20.4% followed by stem diameter accounted for 11.73% contributing to straw yield variation .the results also clarified that stem diameter had the greatest indirect effect to straw yield variation (12.96%). Our results indicated that the effect of technical length was insignificant upon straw yield variation. The total relative contribution of all studied characters to the overall variation in straw yield was 87.22%. The residual effect of the other straw yield factors in this was 12.78%. It is clear that this residual effect has slight magnitude and showed very small contribution to the straw yield variation and also to the other characters which were probably not included into this model. These results are in agreement with those obtained by Zahana (1999).

Table 9 and figure 2 present the path analysis of the factors influencing flax seed yield/fed the results show that seed index had the largest positive direct effect recording 29.14%to the total variation of seed yield /fed followed by number of seeds /capsule accounted for 3.06% contributing to seed yield variation. However, the direct effect of number of capsules/plant and oil percentage on seed yield/. Based on these results, it could be concluded that seed index and number of seeds/capsule are the most important yield contributing characters. if other characters held constant, the improvement of any of these two traits will result in increasing seed yield.

Table 8: Direct and indirect effects of straw yield factors of Flax according to path analysis and percentage of direct effect

Characters	Direct effect	Indirect effect	Total contribution	Direct effect %
Plant height	0.2042**	0.0988	0.3030	29.723
Technical length	0.0064	0.0637	0.0701	0.932
Stem diameter	0.1173**	0.1296	0.2469	17.074
Fiber length	0.3591**	-0.1101	0.2522	52.271
Coefficient of Determination R^2			0.8111	

Table 9: Direct and indirect effects of seed yield factors of flax according to path analysis and percentage of direct effect

Characters	Direct effect	Indirect effect	Total contribution	Direct effect %
No.of capsules/plant	0.113	0.0803	0.0916	3.267
No.of seeds/capsule	0.0306	0.1192	0.1498	8.836
Seed Index	0.2914	0.1901	0.4815	84.244
Oil percentage	0.0126	0.0756	0.0882	3.643
			0.8111	

Zahana (1999) reached the same conclusion, the indirect effects of seeds index and number of seeds /capsule on seed yield variation were positive and had greatest values (19.01% and 11.92, respectively) the total relative contribution of all studies characters to the overall variation in seed yield /fed was 81.11%. The residual effect of the other seed yield factors in this study was 18.89% which means the success of the estimated correlation among seed yield and its components to account for the total variation in seed yield and also this residual effect to the other characters which were probably not included into this model these results are in harmony with Zahana (1999).

Principal Components Analysis

The results of principal component analysis are recorded in Table 10 and Fig. 3 principal components analysis grouped the ten variables namely plant height, technical length stem diameter, fiber length, fiber percentage, number of capsules/plant, number of seeds/capsules, seed index, oil percentage and fiber fineness into two main components which accounted for about 94% of the total variability in the dependence structure. Component 1 included six variable which accounted for about 88% of the total variance these variables were stem diameter, fiber length, fiber percentage, seed index, oil percentage and fiber fineness, these variables that were included into components 1 were positively correlated with the component except fiber fineness that negatively associated with component the six variables were of almost equal importance and had high communality with component 1. Component 2 included four variables, which accounted for 5.8 %of the total variance these variables were plant height, technical length, number of capsules /plant and number of seeds /capsule the four variables were positively correlated with the component and had almost equal importance these results were in agreement with those obtained by Zahana (1999) and Mostafa and Ashmawy (2003).

Generally, the principal component analysis approach is one that can be used successfully for analysis of a large amount of multivariable data and it should be applied more frequently in the field of crops research interpretation of the meaning of the component isolated from a principal components analysis could be delineating areas of further researches designed to test the validity of the suggested components using principal components analysis by plant breeders has the potential of increasing the comprehension of casual relationships of variables and can help to the nature and sequence of traits to be selected in a breeding program.

Table 10: Principle components analysis for different plant characters (over both seasons of 2002/2003 and 2003/2004)

Plant Characters	Components	
	1	2
Plant height (cm)	0315	0.395
Technical length (cm)	0.299	0.552
Stem diameter (mm)	0.315	0.265
Fiber length (cm)	0.329	-0.133
Fiber percentage	0.329	-0.091
Number of capsules/plant	0.307	0.460
Number of seeds/capsule	0.309	0.376
Seed index	0.321	0.263
Oil percentage	0.307	-0.127
Fiber fineness	-0.329	0.070
Latent roots	8.83	0.576
Percentage variance	88.297	5.761
Cumulative variance %	88.297	94.058

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تأثير معدلات مختلفة من التقاوى وطرق الزراعة ومصادر السماد الفوسفاتى على صنف الكتان سخا ٢

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أقيمت تجربتان حقليتان خلال موسمي ٢٠٠٢/٢٠٠٣ ، ٢٠٠٣/ ٢٠٠٤ بمحطة البحوث الزراعية بإيتاى البارود- محافظة البحيرة لدراسة تأثير ثلاث معدلات من التقاوي (٦٥، ٧٥، ٨٥ كجم تقاوي / فدان)) و ثلاثة طرق زراعة (بدار بعد الري ، بدار قبل الري، تسطير على مسافات ١٥سم) و أربعة معاملات من التسميد الفوسفاتي هى (١- صفر، ٢- فوسفورين بمعدل ٢٠٠جم/فدان كمصدر للفوسفور الحيوي، ٣- كالسيوم سوبر فوسفات كمصدر للفوسفور المعدني بمعدل١٥,٥ كجم فو٢أ٥/ فدان، ٤- فوسفور معدني+

فوسفور حيوي) على محصولي القش والبذور ومكوناتهما وكــذلك الصــفات التكنولوجيــة والاقتصادية للألياف والزيت. كذلك تم استخدام بعض الأساليب الإحصائية مثل تحليل معامل المرور و تحليل المكون لدراسة العلاقة بين المحصول ومكوناته وتقدير الأهميــة النســبية لهذه المكونات.

وقد أوضحت النتائج أنه كانت هناك زيادة متدرجة و معنوية بزيادة معدل التقاوي من ٦٥ كجم/ فدان إلى ٨٥ كجم /فدان (أي زيادة الكثافة النباتية) في صــفات الطــول الكلــي والطول الفعال للنبات، محصول القش والألياف للفدان، المحصول البيولوجي للفدان، طــول الألياف ونسبتها، نعومة الألياف والمحصول الاقتصادي. بينما أدى استخدام معدل التقــاوي المنخفض (٦٥ كجم/ فدان) إلى زيادة معنوية في صفات قطر الساق، محصول النبات مــن القش والألياف، ولأهم صفات البذور المدروسة و النسبة المئوية للزيت كما أوضحت النتائج أن طريقة الزراعة في سطور علي مسافات ١٥ سم تفوقت علي الطرق الأخرى في معظــم الصفات المدروسة ما عدا نسبة الزيت كما أنه لم يكن هناك تأثير واضح لطــرق الزراعــة علي صفات محصول الزيت و البذور للفدان، نسبة الألياف والمحصول الاقتصــادي. كمــا أوضحت النتائج أيضا أن جميع الصفات المدروسة زادت زيادة معنوية بإضافة الفوسفور بن بمعدل ٢٠٠ جم/فدان مضافا إليها ١٥,٥ كجم فو ٢ أ ٥ عدا صفة نعومة الألياف التي قلــت قيمتها مع إضافة الفوسفور. كما أوضحت النتائج أن هناك تأثير معنوي واضح للتفاعل بين معدلات التقاوي وطرق الزراعة والتسميد الفوسفاتي علي معظم الصفات المدروسة. كمــا أوضحت النتائج وجود ارتباط موجب عالي المعنوية بين محصول الفدان من القش وكل من الطول الكلي والطول الفعال للنبات، قطر الساق وطول الألياف. بينما أرتبط محصول البــذور للفدان وعدد كبسولات النبات، عدد بذور الكبسولة، دليل البذرة و نســبة الزيــت ارتباطــا موجبا وعالي المعنوية. حدد تحليل معامل المرور ثلاثة عوامل هامة تؤثر فــي محصــول القش تأثيرا مباشرا وغير مباشر وهي طول النبات، قطر الساق وطول الألياف في حين كان دليل البذرة وعدد بذور الكبسولة هو الأكبر تأثيرا في تباين محصول بذور الفدان.