Effect of Sowing Dates under Different Environmental Conditions on Yield and Quality Characters of Some Flax Genotypes

El-Refaey, R. A. [1]; El-Seidy, E. H. [1]and EL-DEEB, I. A. E. [2]
[1]Faculty of Agriculture Tanta
[2]Agriculture Research Center

Received on: 12 /5/2010 ***Accepted: 10/7/ 2010***

ABSTRACT

The objective of this investigation was to study the effect of some sowing dates under different environmental conditions on yield and quality characters of some flax genotypes during two winter seasons (2006/07 and 2007/08). The study was carried out, using a randomized complete block design, with four replications. In the first season (2006/07), twelve flax genotypes were sown in each trial, where the first experiment was sown in October 25th, the second one occurred in November 10th (control) and the third trial was sown in November 25,th. These trials were repeated in the second season (2007/08) at two locations; i.e., Etay El-Baroud Res. Station, Behera Governorate ,and El-Gemmeiza Res. Station, Gharbia Governorate. The flax genotypes under study were Giza 8, sakha1, Sakha2, Sakha3, Marlin, Escalina, S.533/39/5/11, S420/140/5/11, S.413/1/3/2, S.426/32/6/5, S.435/11/10/3 and S.436/3/6/5. Highly significant differences were detected between the two seasons for all studied straw characters, except for total length. The mean squares for sowing dates were highly significant for all characters under study. Statistical analysis pointed out that the mean squares for seasons were significant for number of capsules/plant and seed yield /plant. Also, the mean squares for locations were highly significant for all seed characters, except for seed and oil yields. The mean squares of seasons and locations were highly significant for all studied characters, except for fiber yield /faddan.

Etay El-Baroad location ranked the first and surpassed the other location for stem diameter, straw yield / plant and fruiting zone length, while, El-Gemmiza location was superior over the first one for total length, technical length and straw yield/faddan.

The first sowing date (D_1) performed the highest mean values for all studied characters The flax genotypes significantly differed among each other in straw traits, where Sakha 1 ranked the first and achieved the highest estimates for straw yield /plant, as well as per faddan. While, the flax genotype, Sakha 3, recorded the tallest total length and the largest stem diameter. However, the two flax genotypes, Escalina and S.436/3/6/5, gained the maximum estimates for technical length and stem diameter ,respectively. Moreover, the flax genotypes were highly significant for all traits under study. Sakha 1 had the superiority for number of capsules/plant, seed yield /plant and oil yield (kg/fad.). While, Sakha 2 was the best for seed index. Sowing dates significantly affected all technological characters and there were significant differences among the flax genotypes for all traits. The flax genotypes, Sakha 1 and Sakha 3 ,performed the highest fiber yield /faddan, Escalina was the best for fiber length, Marlin for the highest fiber percentage, while, Sakha3 exceeded the other genotypes in fiber fineness.

Key word: flox, location, souing date.

INTRODUCTION

Flax (*Linum usitatissimum* L.) is still the major fiber crop in Egypt. It is known as long as pharaoh civilization and it was grown as a fiber crop in southern Egypt. It is planted as an oil crop in some regions and in the Mediterranean Sea regions. It is grown as a dual purpose crop for either fibers, extracted from stem by retting, or oil obtained from seeds by pressing. The fine fibers are used in textile manufacturing for making clothes and the shortest ones are used for making twins, ropes, excellent paper and cigar filters. The fresh linseed oil is used as an edible product for humans and in some medical pur poses. After boiling, it is used in many industries, such as paints, inks and varnish. In Egypt, during the last few years, new genotypes were released, characterized by high seed yield ability and best quality, duc to improved different cultural practices for this crop, with respect to varietal differences. Kineber (1991) showed that, straw and seed yields, as well as their components significantly differed among flax cultivars., Sharma *et al* (1995), El-Sweify and Mostafa (1996), Kineber and El-Kady (1998) and Mostafa and Ashmawy (2003) reported that genotypes significantly differed in all characters of flax. As to sowing date, Mohamed *et al* (1998) observed that yield attributes; viz .,number of capsules/plant, number of seeds/capsule, seed yield/plant and 1000-seed weight, were higher in the first date of sowing (21st October). Also, they observed that the oil content was higher at the first and the second dates when sown on 11th November, while, the lowest oil yield was obtained with sowing on 21st November, Moreover, seed yield varied from 0.09 t/ha ,with sowing on 10 th November, to 0.51 (t/ha) with sowing on 11th November, Therefore, the present

investigation was planned to study the effect of sowing dates under different environmental conditions on straw yield, seed yield, seed technology and their related characters of twelve flax genotypes.

MATERIALS AND METHODS

Three separate experiments were carried out in 2006/07 winter season and repeated in 2007/08 winter season at two locations (Etay-Elbaroud and El-Gemmeiza) Agricultural Research Stations, A.R.C., in each season. Twelve flax genotypes were evaluated in each experiment. The first experiment was sown on October 25th, the second on November 10th and the third on November 25th. The studied twelve flax genotypes are listed in Table (1).

The experiments were arranged in a randomized complete block design (RCBD), with four replications, the plot size was 6 m^2 (2x3m) at the two locations. The normal cultural practices of growing flax were followed till the maturity stage.

The studied characters were:

1. straw yield and its related characters:

1-Total length (cm).
2- Technical stem length (cm).
3- Straw yield per plant (g).
4- Straw yield per faddan (ton).

The seed yield and its related characters were:

1-Number of capsules per plant.
2- Seed index (g).
3-Seed yield per plant (g).
4- Seed yield per faddan (kg).
5-Oil yield per faddan (kg).

The technological characters were:

1- Fiber yield per faddan (kg).
2. Fiber length.
3. Fiber percentage.
4. Fiber fineness (Nm).

Statistical analysis:

Data collected were subjected to proper statistical analysis of randomized complete block design, according to the method described by Snedecor and Cochran (1967).

A combined analysis for the two seasons and locations was done, according to the procedures outlined by Le-Clerg *et al* (1966).

Homogeneity test of variance was computed by Bartlett's methods for combined analysis, It was assumed that the error variance for all locations was homogenous .The form of the combined analysis over seasons and locations and the expectations of mean squares are found in tables, inside the text. It would be expected that the sources of variations of locations, seasons and genotypes had fixed effects and the ranking of each of the best flax genotypes and favorable year and location arreld be taken into consideration. .

RESULTS AND DISCUSSION

Results of the present investigation were presented and discussed under the following principal points:

A- Straw yield and its related characters:

A-1- **Analysis of variance**.

Mean squares, from the analysis of variance for straw yield and its related traits; i.e., total length, technical length, stem diameter, straw yield/plant, and straw yield/fad. are presented in Table (2). Data obtained indicated highly significant differences between the two seasons, concerning all straw characters, except for total length. Moreover, the two locations significantly differed in the five straw characters. The interaction was only highly significant between seasons (S) and locations (L) for technical length.

The mean squares for the straw characters under study, as affected by sowing dates (D), was highly significant for all characters. The second order interaction (S x L x D) was highly significant for technical stem length, straw yield/plant and straw yield/faddan (Table 2). This could indicate that the effect of sowing dates might be changed by the change of locations and seasons with respect to these traits. While , S x L interaction was highly significant only for technical stem length, and L x D for straw yield/faddan, indicating that the effect of sowing dates on those traits could be changed from season to another and, also, from location to another.

Table 1: The pedigree of the different flax genotypes under investigation.

No.	Genotypes	Pedigree
1	Giza 8	Giza 6 x Santa Catalina
2	Sakha 1	Bombay x I. 1485
3	Sakha 2	Hera x I. 2348
4	Sakha 3	Belinka (2 E) x I. 2096
5	Marlin	Imported cultivar (Netherlands)
6	Escalena	Imported cultivar (Belgium)
7	S. 533/39/5/11	S. 420/140/5/10 x Bombay
8	S. 420/140/5/11	S. 162/12 x Bombay
9	S. 413/1/3/2	S. 5282/1 x S. 40/9
10	S. 426/32/6/5	S. 2465/2 x S. 105/2
11	S. 435/11/10/3	S. 162/12 x S. 2467/1
12	S. 421/3/6/5	S. 162/12 x S. 6/2

Regarding flax genotypes mean squares (Table 2), results illustrated that there were highly significant differences among genotypes for all traits. This could be attributed to the genetic make-up in relation to all straw traits under study. The interaction between seasons (S) and genotypes (G) and, also, L x G interaction had highly significant effects for technical length and straw yield/plant, indicating that the tested genotypes were affected by the fluctuation of both seasons and locations for these traits . Moreover, S x L x G interaction had a highly significant effect on technical length and straw yield/plant. The interaction of D x G had a highly significant for all traits, except for stem diameter and straw yield/fad., indicating that the response of the tested genotypes in the study to sowing dates could be different. The secondorder interactions (L x D x G) and (S x D x G) gave almost highly significant effects on total length, technical length and straw yield/plant. This might indicate that the effect of genotypes could the changed by the change of sowing dates and seasons.

A-2 Mean performance of straw yield and its components

The effect of seasons, locations and sowing dates on straw yield and its components of twelve flax genotypes are presented in Table (3). Data indicated that the two seasons significantly differed for all characters, except for total length. While, there were significant differences between the two locations and ,also, among the three sowing dates for all characters. However, the second location (L_2) achieved the tallest plants and the highest values of technical length and straw yield/ fad, in comparison with L_1, which means that L_2 was more adequate to perform the tallest flax plants under the experimental conditions. Moreover, the early sowing date was more suitable for obtaining the tallest flax plant's technical length and the highest stem diameters and straw yield per plant and per faddan. These findings are in agreement with those reported by El-Borhamy (2003), Abd-El Daiem (2004) and El Deeb (2006 and 2007).

Table 2: Combined analysis of variance for straw yield and its components.

S.O.V.	df	Total length	Technical length	Stem diameter	Straw yield/plant	Straw yield/fad.
Season (S)	1	1.906	7.574**	0.358**	0.123**	0.089**
Location (L)	1	462.615**	24.507**	0.081**	0.292**	0.049**
S x L	1	7.402	10.419**	0.006	0.007	0.001
Rep/ S x L	12	3.249	0.073	0.043**	0.034**	0.040**
Sowing date (D)	2	3214.933**	457.251**	0.114**	47.082**	3.611**
S x D	2	3.078	5.044**	0.007	0.034**	0.004**
L x D	2	1.503	17.561**	0.006	0.004	0.002**
S x L x D	2	3.096	5.855**	0.007	0.015**	0.003**
Error	24	3.593	0.047	0.007	0.003	0.001**
Genotypes (G)	11	1242.611**	3058.512**	1.273**	2.635**	3.497**
S x G	11	3.062	0.291**	0.006	0.017**	0.007**
L x G	11	2.860	0.804**	0.008	0.018**	0.974
S x L x G	11	4.815	0.447**	0.007	0.012**	0.002
D x G	22	3.115**	0.878**	0.007	0.061**	0.002
S x D x G	22	4.102**	0.733**	0.007	0.015**	0.001
L x D x G	22	2.940*	0.760**	0.007	0.015**	0.001
Error	396	1.997	0.051	0.008	0.002	0.002

*,**: Significant and highly significant at 0.05 and 0.01 levels of probability,respectively.
ns: Not significant.

Table 3: Mean performance of straw yield and its components as affected by two seasons ,two locations and three sowing dates treatments (combined data).

Character	Season		*L S D*	Location		*L S D*	Sowing dates			*L S D*
	S_1	S_2		L_1	L_2		D_1	D_2	D_3	
Total length (cm)	120.153	120.268	ns	119.315	121.107	0.343	124.776	118.985	116.872	0.397
Technical length (cm)	98.676	98.446	0.039	98.355	98.767	0.039	100.24	98.239	97.204	0.045
Stem diameter (mm)	2.176	2.226	0.015	2.213	2.189	0.015	2.219	2.211	2.173	0.017
Straw yield (g/plant)	1.933	1.962	0.221	1.970	1.925	0.221	2.379	2.055	1.407	0.010
Straw yield (t/fad.)	4.534	4.559	0.050	4.520	4.574	0.050	4.665	4.579	4.397	0.007

ns: Not significant

With respect to genotypes effect on total length trait, results obtained in Table (4) showed that the studied genotypes significantly differed in their means performance. The flax variety, Sakha 3, ranked the first and surpassed the other genotypes, concerning the total length (127.510 cm), while, the shortest flax plants were recorded by S. 436/3/6/5 (111.687 cm). Escalina ranked the first genotype and surpassed the other genotypes for technical stem length (112.022 cm), while, the shortest technical length was recorded by S 436/3/6/5(86.860cm). The flax genotypes significantly differed for stem diameter, where the most thick plants were recorded by S. 436/3/6/5 (2.446 mm) ,but, the thinnest plants were obtained by Sakha 3 (1.949 mm) The remaining flax genotypes occupied the intermediate position between them. The flax variety, Sakha 1, accomplished the highest mean performance of straw yield/plant (2.228 g) and significantly exceeded the remaining genotypes, followed by Sakha 2 (2.140g), while, the lowest estimate was obtained by Escalina (1.533 g). While, straw yield/faddan of Sakha 1 ranked the first (4.88 ton/fad.) and surpassed all the remaining flax genotypes. The descending order, afterwards, was S. 426/32/6/5 (4.818ton/fad.), while, the lowest was estimate obtained by Marlin (4.160 ton/fad.). It is worthy to note that the differences among these flax genotypes might be mainly due to the genetic make up for each one.

The variations for these traits, among flax genotypes, were previously reported by El-Borhamy (2003), Abd-El Daiem (2004), Chloupek and Hrstkova (2005) and El Deeb (2006 and 2007).

B-Seed yield and related characters:

B-1- Analysis of variance:

Mean squares showed in the analysis of variance for seed yield and its components; i.e., number of capsules/plant, seed index (1000-seed weight), seed yield/plant, seed yield/fad and oil yield/faddan, are presented in Table (5).

Data illustrated that either number of capsules/plant or seed yield/plant highly significantly differed, as affected by seasons and locations, while, there was a highly significant difference between the two locations concerning seed index. The interaction between seasons (S) and locations (L) had a highly significant effect for number of capsules/plant and seed yield/plant. This could indicate that the effect of seasons and locations might be changed from season to season and from location to another for these traits. Regarding sowing dates (D) effect, results further indicate that all five seed yield characters were significantly affected by the three sowing dates under study. The interaction, S x L x D, had a significant effect on number of capsules/plant and only a significant one on seed index. For the firstorder interactions, S x D and L x D, the results indicated that the effect of sowing dates for these traits could be changed by changing either season or location. For the secondorder interaction ,S x L x D, the results indicated that the effect of sowing dates could be changed by changing locations or seasons, with respect to these traits. These results are in agreement with those obtained by Abou-Zaied (1997), Mohamed *et al* (1998), Rossini and Casa (2003) and El-Deeb and Abd- El Fatah (2006).

Moreover, the flax genotypes highly significantly differed from each other for each of the seed yield traits. The interaction between seasons and genotypes (S x G) had a highly significant effect on number of capsules/plant and seed index, as weight of seeds. This might indicate that the tested genotypes behaved in a different way by changing seasons for these traits. The secondorder interactions , seasons x locations x genotypes, seasons x sowing dates x genotypes and locations x sowing dates x genotypes appeared to be highly significant for number of capsules/plant and seed index, indicating that each factor behaved in a

Table 4: Mean performance of flax genotypes for straw yield and its components.

Genotype	Total length (cm)	Technical stem length (cm)	Stem diameter (mm)	Straw yield (g/plant)	Straw yield (ton/fad)
Giza 8	114.418	92.528	2.389	1.758	4.194
Sakha 1	122.005	94.452	2.084	2.228	4.888
Sakha 2	117.896	93.396	2.217	2.140	4.734
Sakha 3	127.510	110.843	1.949	1.705	4.217
Marlin	124.734	108.829	1.960	1.591	4.160
Escalina	126.172	112.055	2.064	1.533	4.324
S533/39/5/11	125.000	99.905	2.147	2.030	4.755
S420/140/5/11	122.197	98.468	2.241	2.051	4.715
S413/1/3/2	116.285	94.713	2.342	2.097	4.629
S426/32/6/5	116.419	93.302	2.259	2.035	4.818
S435/11/10/3	118.207	97.379	2.319	2.087	4.348
S436/3/6/5	111.687	86.860	2.446	2.113	4.743
L.S.D (0.05)	0.566	0.090	0.036	0.019	0.015

different way by changing the other factors involved in the interaction. Meanwhile, L x G interaction had a highly significant effect on number of capsules/plant, seed index and oil yield/faddan. This would indicate that the tested genotypes behaved in a different way by changing locations for these traits. The interaction between sowing dates and genotypes was highly significant for number of capsules/plant, seed index and seed yield/faddan, indicating that the response of the tested genotypes in the study to sowing dates, used, could differ.

B-2- Mean performance of seed yield and its components:

Data in Table (6) revealed that each of seasons, locations and sowing dates significantly differed in relation to number of capsules/plant. The highest mean performance of this character was achieved in the second season (S_2), the first location (L_1) and the second sowing date (D_2)., The differences between the two mean values of both seasons did not reach the level of significance for seed index, seed yield/fad. and oil yield. On the other hand, there was a significant difference between either the two locations or the three sowing dates, regarding seed index trait. It could be noticed that Etay El-Baroud (L_1) recorded the highest seed index (9.438 g.), in comparison with El-Gemmeza (L_2) with a mean value of 7.868 g., In addition, the greatest mean performance for this trait (8.764g.) occurred with sowing flax in November 10th (D_2). The mean performance for seed yield per plant, in the second season, was higher (0.359 g) than in the first one (0.341g). In addition, Etay El-Baroud gained more seed yield/plant (0.338 g) and surpassed El-Gemmeiza location (0.004). Sowing flax seeds in November 10th (D_2) was more suitable to perform the highest seed yield/plant (0.407 g). The differences in the mean values of either the two seasons or the two locations under study did not reach the level of significance, concerning seed yield/fad .But, there was a significant difference among the three sowing dates. The highest mean performance (609.815 kg) for this character was obtained by sowing flax in November 10th (D_2). Data in Table(6), also, showed significant differences among the three sowing dates for oil yield per faddan, but, no significant difference in oil yield/fad. was observed, as affected by seasons or locations. There was a slight increment in oil yield/fad. when flax seeds were sown in November10th (232.402 kg), in comparison with the first sowing date in October 20th (232.229 kg), while, delaying sowing date until November 25th caused a somewhat reduction (229.669 kg) in this case.. These results are in agreement with those obtained by Abou –Kaied (1992), Mostafa (1994) and Kineber (2003).

The flax genotypes significantly differed among each other concerning seed index character (Table 7). It ranged from 5.304 g (for Escalina) to 10.579 g for Sakha 2. The flax genotypes, which were very close to Sakha 2 in this case, were Sakha 1 (10.335 g), Giza 8 (10.133 g) and S. 533/39/5/11 (10.038 g). Moreover,the flax genotypes under study significantly differed in seed yield/plant, their mean performance values ranged from 0.241 g(for Escalina) to 0.448 g for Sakha 1 (Table 7). Meanwhile, the remaining flax genotypes, in this case, occupied the intermediate position between the lowest and the highest mean values. It might be mentioned ,here, that Sakha 2 ranked the second (0.428 g) in a descending order after Sakha 1, but, the minimum mean performance of this trait was obtained by Marlin (0.278 g),

Table 5: Combined analysis of variance for seed yield and its related characters.

S.O.V.	df	Number of capsules/ plant	Seed index (g)	Seed yield (g/plant)	Seed yield (kg/fad)	Oil yield (kg/fad)
Seasons	1	33.816**	0.001ns	0.051**	180.127	43.598
Locations	1	744.508**	355.161**	0.084**	240.155	87.727
S x L	1	28.719**	0.088	0.006**	231.007	72.087
Rep/ SxL	12	0.114	0.170**	0.071**	349.160	91.08**
Sowing dates (D)	2	661.544**	2.375*	0.536**	647921.388**	449.636**
S x D	2	1.520**	0.160**	0.001	332.451	5.109
L x D	2	7.734**	0.209**	0.001	41.660	25.778
S x L xD	2	1.385**	0.165*	0.001	32.694	49.772
Error	24	0.070	0.030	0.001	559.718	36.847
Genotypes (G)	11	784.551**	170.632**	0.180**	840267.211**	160450.224**
S x G	11	1.215**	0.519**	0.002	1349.067	77.171
L x G	11	11.108**	2.274**	0.003	662.259	227.247**
S x L x G	11	1.182**	0.498**	0.001	552.088	87.499
D x G	22	3.399**	0.297**	0.001	4334.382**	29.271
S x D x G	22	0.862**	0.101**	0.001	1052.632	50.246
L x D x G	22	0.843**	0.288**	0.001	396.0321	36.475
Error	396	0.075	0.026	0.001	788.133	55.275

*,**: Significant and highly significant at 0.05 and 0.01 levels of probability, respectively.
ns: Not significant.

Table 6: Mean performance of seed yield and its components under two seasons, two locations and three sowing dates.

Character	Season		L S D	Location		L S D	Sowing date			L S D
	S_1	S_2		L_1	L_2		D_1	D_2	D_3	
Number of capsules	21.258	21.743	0.047	22.637	20.364	0.047	20.414	23.644	20.443	0.055
Seed index (g)	8.652	8.654	ns	9.438	7.868	0.031	8.653	8.764	8.541	0.036
Seed yield (g/p)	0.341	0.359	0.0041	0.004	0.338	0.005	0.342	0.407	0.302	0.0046
Seed yield (kg/fad)	547.298	548.416	ns	548.502	547.211	ns	539.137	609.815	494.618	4.974
Oil yield (kg/fad)	231.158	231.709	ns	231.824	231.043	ns	232.229	232.402	229.669	1.272

ns = Not significant.

Furthermore, the flax genotypes significantly differed in relation to seed yield/faddan the flax genotype ,S 533/39/5/11, was superior over the other genotypes and ranked the first in its mean performance of seed yield/faddan (786.150 kg), followd by Sakha 1 (645.894 kg) and Sakha 2 (623.685 kg), but, the lowest mean value (337.274 kg) was obtained by Escalina. Besides, the maximum mean performance of oil yield/faddan was accomplished by Sakha 1 (289.667 kg/fad.), followed by Sakha 2 (282.250 kg/fad.), in a descending order, and the lowest oil yield/faddan was obtained by Marlin (134.484 kg/fad.). The remaining genotypes gave intermediate values (Table 7).

C-Fiber yield and related characters:

C-1- Analysis of variance:

Mean squares, given in the analysis of variance, for technological characters; i.e., fiber yield (kg/fad), fiber length (cm), fiber percentage (%) and fiber fineness (Nm), are presented in Table (8). Data available for seasons and locations showed significant and highly significant differences for all traits, but no significant difference was found in fiber yield/feddan.

The interaction between seasons (S) and locations (L) had a highly significant effect on fiber percentage and only a significant one on fiber fineness.

Concerning sowing date effects, all the technological traits, under study, had highly significant differences as affected by such date. The interaction between seasons and sowing dates had a highly significant effect, only, for fiber length. In addition, L x D interaction and the secondorder interaction, S x L x D , also, had significant effects on, only, fiber length. Furthermore, flax genotypes highly significantly differed in all fiber traits . Either S x G , L x G or the secondorder interaction (S x L x G) had a highly significant effect on fiber length, fiber percentage and fiber fineness. The fiber length and fiber percentage traits were highly significantly different, as affected by D x G interaction. However, the fiber length trait was highly significantly affected by S x D x G and S x L x D x G interactions (Table 8).

C-2- Mean performance of technological characters:

Mean performance of these traits, as affected by seasons, locations and sowing dates, are presented in Table (9). Results indicated that fiber yield/faddan was significantly affected by sowing dates, while, either seasons or locations had no significant effect on the other traits. The maximum mean performance of the former character was recorded by growing flax at the early sowing date (D_1), while, remarkable reduction happened in the mean values with delaying sowing date towards the latest one (D_3). Moreover, fiber yield/faddan ranged from 849.39 to 766.322 kg/faddan and D_2 occupied the intermediate position between D_1 and D_3. Data of fiber length revealed significant differences between the two seasons, locations and sowing dates. The tallest fibers were achieved by S_2 L_2

Table 7: Mean performance of flax genotypes for seed yield and its components.

Genotype	Number of capsules	Seed index (g)	Seed yield (g/p)	Seed yield (kg/fad)	Oil yield (kg/fad)
Giza 8	23.836	10.133	0.359	546.259	238.255
Sakha1	25.278	10.335	0.448	645.894	289.667
Sakha2	25.196	10.579	0.428	623.685	282.250
Sakha3	16.042	6.050	0.296	368.398	138.953
Marlin	14.846	5.661	0.278	357.454	134.484
Escalina	14.102	5.304	0.241	337.274	142.140
S533/39/5/11	23.825	10.038	0.393	786.150	272.167
S420/140/5/11	22.387	8.750	0.351	597.858	263.357
S413/1/3/2	23.815	9.161	0.327	560.607	255.280
S426/32/6/5	22.535	9.335	0.370	588.693	252.590
S435/11/10/3	22.941	9.041	0.317	557.746	246.650
S436/3/6/5	23.203	9.449	0.391	604.264	261.408
L.S.D (0.05)	0.109	0.064	0.014	11.255	2.980

and D_2, their mean values were 95.386 cm, in the second season, 96.250 cm in the second location and 96.266 cm, in the second sowing date, respectively. Data of fiber percentage revealed significant differences between the two seasons, the two locations and the three sowing dates. The highest fiber percentage was obtained in the first season (18.015%), in the first location (18.046%) and in the second sowing date (17.756%). Also, fiber fineness was affected by seasons, locations and sowing dates, and data showed a significant difference within each of such factors. The fibers obtained from the second season were higher in fineness than in the first one. Meanwhile, the first location produced a remarkable superiority in fiber fineness (174.529 Nm) and in the first sowing date (174.836 Nm.).

The mean performance of flax genotypes under this study, in respect to fiber yield/faddan, are presented in Table (10). Data illustrated that the flax variety,Sakha 1 (878.600 kg/faddan), ranked the first and significantly surpassed all the remaining flax genotypes. Whereas, the lowest fiber yield/faddan was obtained by S. 435/11/10/3 (731.557 kg/fad.). These genotypes were significantly different, concerning fiber length trait. The introduced flax fiber variety, Escalina, recorded the tallest fibers (108.774 cm). The imported flax variety; namely, Marlin, performed the highest mean performance of fiber percentage (20.344%), when compared with the other flax genotypes, followed by Sakha 3 (19.862%), but, the lowest fiber percentage was obtained by S. 435/11/10/3 (16.155%). On the other hand, the flax variety Sakha 3, ranked the first (181.414 Nm) and surpassed all the remaining flax genotypes, in relation to fiber fineness. The descending order of this trait was as follows: Marlin (181.186 Nm), and the coarsest fibers were obtained by S. 436/3/6/5 (161.696 Nm) (Table 10).

Table 8: Analysis of variance for fiber yield and fiber quality.

S.O.V.	df	Fiber yield	Fiber length	Fiber percentage	Fiber fineness
Seasons	1	102.305 ns	0.261*	106.260**	929.794**
Locations	1	170.597 ns	451.95**	122.082**	3726.307**
S x L	1	129.798 ns	0.000	110.374**	3.799*
Rep/ SxL	12	158.673 ns	0.332**	0.139 **	1.075 ns
Sowing dates(D)	2	336518.316**	164.517**	5.786**	1335.039**
S x D	2	179.767 ns	0.543**	0.042 ns	0.214 ns
L x D	2	137.899 ns	0.467**	0.008 ns	1.262 ns
S x L xD	2	168.409 ns	0.504**	0.019 ns	0.649 ns
Error	24	158.399 ns	0.055	0.026	0.772
Genotypes (G)	11	123921.726**	2994.15**	93.682**	2952.988**
S x G	11	163.643 ns	0.793**	1.436**	3.11**
L x G	11	155.195 ns	2.849**	1.371**	15.329**
S x L x G	11	162.168 ns	0.740**	1.27**	3.225**
D x G	22	153.694 ns	0.295**	0.024**	0.0951 ns
S x D x G	22	155.755 ns	0.223**	0.017 ns	0.818 ns
S x L x D x G	22	160.797 ns	0.235**	0.015 ns	0.800 ns
Error	396	168.302	0.100	0.023	0.780

*,**: Significant and highly significant at 0.05 and 0.01 levels of probability, espectively.
ns: Not significant.

Table 9: Mean performance of fiber yield and fiber quality under two seasons , two locations and three sowing dates treatments.

Character	Season		*L S D*	Location		*L S D*	Sowing date			*L S D*
	S_1	S_2		L_1	L_2		D_1	D_2	D_3	
Fiber yield (kg)	811.311	810.469	ns	810.346	811.434	ns	849.39	816.958	766.322	1.980
Fiber length (cm)	95.343	95.386	0.042	94.479	96.250	0.042	94.417	96.266	95.411	0.049
Fiber percentage (%)	18.015	17.156	0.029	18.046	17.126	0.029	17.409	17.756	17.594	0.033
Fiber fineness (Nm)	170.715	173.256	0.159	174.529	169.442	0.159	174.836	171.488	169.633	0.184

ns: Not significant.

Table 10: Mean performance of flax genotypes for fiber yield and fiber quality.

Genotype	Fiber yield (kg)	Fiber length (cm)	Fiber percentage (%)	Fiber fineness (Nm)
Giza 8	746.960	89.179	17.281	170.787
Sakha1	878.600	91.529	17.562	176.732
Sakha2	843.221	90.494	17.418	175.256
Sakha3	876.221	107.035	19.862	181.414
Marlin	873.564	105.760	20.344	181.186
Escalina	751.552	108.774	18.713	180.444
S533/39/5/11	788.525	97.291	17.866	177.984
S420/140/5/11	808.336	95.424	16.565	164.299
S413/1/3/2	803.387	91.464	16.607	162.395
S426/32/6/5	820.844	89.682	16.289	162.093
S435/11/10/3	731.557	93.865	16.155	169.534
S436/3/6/5	807.912	83.879	16.370	161.696
L.S.D (0.05)	5.044	0.126	0.060	0.354

REFERENCES

Abd-El-Daiem, M.A.M. **2004.** Evaluation of some flax genotypes under different plant densities. M. Sc. Thesis, Al-Azhar University, Cairo, Egypt.

Abo-Kaied, H.M.H. **1992.** Effect of genotype – environment interaction on yield and quality characters in flax. M. Sc. Thesis, Fac., Agric,Cairo Univ., Egypt.

Abou-Zaied, T.A. **1997.** Comparative studied of yield and technological characters of some flax varieties Ph. D. Thesis of Agric, El-Mansoura Univ., Egypt.

Chloupek, O. and P. Hrstkova. **2005.** Adaptation of crops to environment. TAG Theoretical and Applied Genetics **111**(7): 1316-1321

El-Borhamy, A.M.A. 2003. Effect of sowing densities and retting methods on yield and quality on some flax cultivars M. Sc. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta Univ., Egypt.

El – Deeb, E.E.A. **2006.** Analytical studies on some growth characters and its effect on quality and production of flax yield. Alex. Exc. J. **27** (3): 249-262.

El–Deeb, E.E.A. **2007.** Comparative study for flax varieties under different retting treatments. J. Adv. Agric. Res. 12 (1):103-112. Fac. Agric., Saba Basha, Egypt.

El-Deeb, E.E.A. and A.A. Abd-El Fatah. **2006.** Effect of sowing and harvesting dates on yield and its quality for some flax varieties. J. Agric. Sci. **31**(9):5565-5574. Mansoura Univ., Egypt.

El-Sweify, A.H.H. and S.H.A. Mostafa. **1996.** Growth yield and quality of flax as affected by genotypes, potassium fertilizers and plant densities. Egypt J. Appl. Sci. **11** (7): 116 – 133.

Kineber, M.E.A. and E.A. El- Kady. **1998.** Analytical studies on growth and its relation to yield of some promising flax strains. Proc. 8th Conf. Agron., Suiez Canal Univ. Ismailia , Egypt. 28 – 29 Nov., pp 505- 512.

Kineber, M.E.A. **1991.** Evaluation of some new promising flax varieties in relation to yield and quality. M. Sc. Thsis. Fac., Agric. Moshtohor, Zagazig Univ., Egypt.

Kineber, M.E.A. **2003.** Flax plants performance as influenced by planting methods and seeding rate. J. Agric,Res. **29** (1): 64 – 73. Tanta Univ., Egypt.

Le Clerg, E.L.,W.H. Leonard and A.G. Clark. **1966** Field Plot Technique. Burgress Publishing Co. Minneopolis, Minnesota, U.S.A.

Mostafa, S.H.A. **1994.** Yield and quality of flax as affected by variety and some environmental factors. Ph. D. Moshtohor, Fac. of Agric. Zagazig Univ. Egypt.

Mostafa S.H.A. and F. Ashmawy. **2003.** Comparative study for traits of some flax genotype using factor and cluster analysis J. Agric. Sci. 41(1):1-18. Moshtohor,Egypt.

Rossini, F. and R. Casa. **2003.** Influence of sowing and harvest time on fiber flax (*Linum usitatissimum* L.) in the Mediterranean environment. J. Agronomy & Crop Science 189, 191 – 196.

Sharma, J.J.,B.L. Kapwz and D.R. Thakur. **1995.** Performances of linseed (*Linum usitatissimum* L.) cultivars under varying dates of sowing. Kullu Valley. Himachal J. of Agric-Res. 21 (1-2):23 – 26.

Snedecor, G. A. and W. G. Cochran. (1967). Statistical Methods, Sixth edition, Iowa State College Press., Ames., Iowa. U.S.A.

الملخص العربى

تأثير مواعيد الزراعة تحت ظروف بيئية مختلفة على صفات المحصول وجودته لبعض التراكيب الوراثية لمحصول الكتان

رمضان على الرفاعى[1] – السيد حامد الصعيدي[1] – الديب إبراهيم عبد الله الديب[2]

[1]كلية الزراعة بطنطا

[2]مركز البحوث الزراعية

يهدف هذا البحث إلى دراسة تأثير بعض مواعيد الزراعة تحت ظروف بيئية مختلفة على إنتاجية وجودة بعض التراكيب الو راثية من الكتان ، فقد تم تنفيذ ثلاث تجارب في تصميم القطاعات الكاملة العشوائية (أربع مكـــررات) فـــي الموســـم الأول (٢٠٠٦/٢٠٠٧) حيث تم زراعة أثنى عشر تركيبا وراثيا من الكتان في كل تجربة ، وقد كانت التجربة الأولى تختص بالميعاد الأول من الزراعة (٢٥ أكتوبر) والتجربة الثانية تختص بالميعاد الثاني (١٠ نوفمبر – المقارنة) والتجربة الثالثة تم زراعتها في ٢٥ نوفمبر في موقعين مختلفين؛ الموقع الأول محطة البحوث الزراعية بايتاى البارود محافظة البحيرة) والموقع الثاني محطة البحوث الزراعية بالجميزة (محافظة الغربية) وتم تكرار هذه التجارب في الموسم الثاني (٢٠٠٧/٢٠٠٨) . و قد تـم دراســة محصول القش و الصفات المرتبطة به و محصول البذور و الصفات المرتبطة به و كذلك الـصفات التكنولوجيـة . وكانـت التراكيـب الوراثيـة هـي : جيـزة ٨ – سـخا١ – سـخا٢ – سـخا٣ – مـارلين – اسـكالينا وس ١١/٥/٣٩/٣٣ – س ١١/٥/١٤٠/٤٢٠ – س ٢/٣/١/٤١٣– س ٥/٦/٣٢/٤٢٦ – س٣/١٠/١١/٤٣٥ والسلالة ٥/٦/٣/٤٣٦ .

وكانت أهم النتائج التي تم التوصل إليها ما يلي :

-توضح النتائج المتحصل عليها من تحليل التباين ان متوسط مجموع المربعات للمواسم كانت عالية المعنوية لجميـع صـفات القش تحت الدراسة، ما عدا الطول الكلى للنبات. و بالنسبة للمواقع ، فقد كانت أيضا عالية المعنوية لكل الصفات .

- أظهرت النتائج أن مجموع مربع الانحرافات لمواعيد الزراعة كان عالي المعنوية لكل الصفات تحت الدراسة.
- كان هناك اختلافا معنويا بين المواقع حيث تفوق الموقع الأول (ايتاى البارود) في صفات سمك النبـات ومحـصول القـش للنبات عن موقع الجميزة الذي تفوق هو الأخر في الطول الكلى والطول الفعال ومحصول القش للفدان عن موقـع ايتـاى البارود.
- كانت الاختلافات واضحة ومعنوية بين التراكيب الوراثية تحت الدراسة حيث تفوق الصنف "سخا" ١في صفات القش للنبات والفدان ، بينما احتل الصنف "سخا ٣" المكانة الأولى في الطول الكلى للنبات على باقي الأصناف الأخـرى . كمـا تفـوق الصنف المستورد (سكالينا) وس ٥/٦/٣/٤٣٦ في صفتي الطول الفعال وسمك الساق على التوالي .
- أوضحت نتائج تحليل التباين أن مجموع مربع الانحرافات للمواسم كانت معنوية لصفات عدد كبسولات النبـات ومحـصول البذرة للنبات . أما متوسط مجموع مربع الانحرافات للمواقع فقد كان عالي المعنوية لكل الصفات ماعدا محـصول البـذرة للفدان ومحصل الزيت للفدان.

أوضح التفاعل بين المواقع والأصناف أن الأصناف "سخا١ و سخا٢ و س ١١/٥/٣٩/٥٣٣" أعطت أعلى قيم فـي عـدد الكبسولات ومحصول الزيت ووزن الألف بذرة على التوالي في الموقع الأول ، بينما احتل الصنف "سخا١ " والصنف "سخا٢" في عدد الكبسولات للنبات ووزن الألف بذرة ومحصول الزيت للفدان في الموقع الثاني ،كما أوضحت النتائج التي تم الحصول عليها من جدول تحليل التباين لمحصول الألياف ومواصفاته أن متوسط مجموع المربعات للموسمين والموقعين كانت معنويـة جداً لجميع الصفات ما عدا صفة محصول الالياف بالفدان ، وكان متوسط مجموع مربع الانحرافات للتفاعل بـين الموسـمين والموقعين معنوياً في نسبة الألياف ونعومتها فقط.

- كان لمواعيد الزراعة ومجموع مربع الانحرافات للأصناف تأثيرا معنوياً لجميع الصفات المدروسة حيث أعطى الـصنفان "سخا١و سخا٣" تفوقاً في محصول الالياف بالفدان، بينما احتل الصنف المستورد (إسكالينا) المرتبة الأولى في طول الألياف والصنف(مارلين) أعطى أعلى القيم في نسبة الألياف . أما بالنسبة لصفه النعومة فقد أوضح الصنف "سخا ٣" تفوقا لهـذه الصفة.