

EFFECT OF ENVIRONMENTAL CONDITIONS ON YIELD AND ITS QUALITY OF TWO FLAX CULTIVARS

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ABSTRACT

Field experiments were conducted during 2001/2002 and 2002/2003 seasons in seven locations representing flax growing regions in Egypt, namely Sakha in Kafr El-Sheikh Governorate, El-Gemmeza in El-Gharbia Governrote, Kafr El-Dowar in El-Behaira, Shirbeen in El-Dakahlia Governorate; Kafr Saad in Damietta Governorate, Diyarb-Nigm in El-Sharkia Governorate and Shebeen El-Kanater in El-Kalubia Governorate. Two flax genotypes (Sakha 1 and Belinka) were evaluated in these location with regard to straw and seed yield and yield components as well as some technological characters.

The combined analysis of variance for the seven locations and two seasons was done. Results could be summarized as follows:

The cultivar Sakha 1 significantly exceeded the cultivar Belinka in fruiting zone length, straw yield per plant and per feddan, number of capsules per plant, number of seeds per plant, seed yield per plant and per feddan, oil percentage and oil yield per feddan. The inverse was true in technical stem length, fiber yield per feddan, fiber length, total fiber percentage, fiber fineness and iodine value.

El-Dakhliia location was superior the other six locations in technical stem length, fruiting zone length, straw yield per fed., number of capsules per plant, number of seeds per plant, seed yield per plant and seed yield per feddan, fiber yield per feddan, fiber length, total fiber percentage, oil percentage and oil yield per feddan.

The highest fiber fineness and iodine value, were obtained in Kafr El-Sheikh. Significant increases were recorded in the second season for: technical stem length, fruiting zone length, straw yield per plant and per feddan, number of capsules, number of seeds per plant, seed yield per plant and per fed., fiber yield per plant, and oil yield per fed. But the highest iodine value was recorded in the first season.

Season had no significant effect on fiber yield per feddan, fiber length, total fiber percentage, fiber fineness and oil percentage.

Interaction between genotypes and location and between genotypes and seasons significantly affected on most studied characters.

The highest straw, seed and oil yields per feddan were produced by Sakha 1 grown in El-Dakhliia, whereas the fiber yield per feddan was produced by Belinka grown in El-Dakahlia.

The present results show clearly that El-Dakahlia location is superior to other locations in producing high yields of seed and fiber.

INTRODUCTION

Flax (*Linum usitatissimum* L.) belong to family linaceae, which is a traditional source of fiber and oil. It is the most important bast of fiber crop in A.R.E. for its fiber and seed production. It plays a great role in developing the national economy by exportation and local fabrication. Moreover, many industries had been established on its fiber and seed yields. The flax area in Egypt was about 30.000 feddan in 2003/2004 season. this crop is cultivated

on a wide range of environmental conditions such as soil types and climatic conditions. The literature concerning the present investigation as follows, Friederich (1968), concluded that from 8 trials at various sites, in Netherlands, fiber flax gave average yield of straw of 6.62 ton/ha. This was lower than useful because of wet weather in the season of investigation. Youssef (1975) and Hella (1978), in Egypt found great diversities in seed yield per plant for the same variety dominating the whole area. Kineber (1991) and Mostafa (1994) indicated that the genotypes significantly differed in all characters studied. The present investigation aims to evaluate the two genotypes (Sakha 1 and Belinka) in the seven main flax growing region, i.e. El-Beheira; El-Gharbia, El-Dakahlia, Kafr El-Sheikh; Damietta; El-Sharkia and El-Kalubia Governorates. The objective of the investigation is to find out the ideal variety for each flax region. The main flax variety Sakha 1 which is very common and wide spread is grown as a check variety.

MATERIALS AND METHODS

Fourteen experiments were carried out to evaluate two flax cultivars in relation to yield and its quality under seven environmental conditions. The main objectives of this investigation were to study the effect of different locations in A.R.E. on yield characters, fiber quality and seed quality of two flax cultivars (commercial variety Sakha 1 a dual purpose and introduction variety Belinka a fiber type). Two field experiments were carried out at each of Kafr El-Dowar in El-Beheira Governorate, El-Gemmeza in Gharbia Governorate, Shirbeen in El-Dakahlia Governorate, Sakha in Kafr El-Sheikh Governorate, Kafr Saad in Damietta Governorate, Diyarb-Nigm in El-Sharkia Governorate and Shebeen El-Kanater in El-Kalubia Governorate during 2001/2002 and 2002/2003 seasons.

The climatological normals at different regions in A.R.E. for temperature, relative humidity and rain full of six months from November to April are shown in Table (1). These records were taken from the Meteorological Section, Agricultural Research Center.

Some chemical properties for the soil of the different locations are shown in Table (2). These data were taken from Soil Survey Section, Soil Research Institute, Agricultural Research Center.

The experimental design was a randomized complete block with four replications. Combined analysis were performed for each character for the two growing seasons as described by LeClerc *et al.* (1966).

Table (1): Some climatic normals for the flax growing areas from November to April.

Month	Year	El-Beheira				El-Gharbia			
		Temp.		R.H.	R.F.	Temp.		R.H.	R.F.
		Max.	Min.	%	(mm)	Max.	Min.	%	(mm)
Nov.	2001/02	23.71	11.90	67.0	-	25.90	13.70	80.10	-
	2002/03	24.71	12.18	68.70	-	26.70	12.00	67.40	-
Dec.	2001/02	20.00	10.90	80.70	0.80	21.00	8.90	70.00	0.10
	2002/03	19.80	9.30	70.70	0.60	20.11	9.00	65.00	0.20
Jan.	2001/02	17.70	8.71	66.70	25.81	18.20	7.20	60.70	6.99
	2002/03	15.70	6.80	69.70	26.11	17.90	6.80	61.80	6.80
Feb.	2001/02	18.80	7.60	69.70	69.70	20.50	7.60	60.70	10.80
	2002/03	17.81	7.50	68.90	29.80	17.80	8.11	62.80	15.10
Mar.	2001/02	20.10	8.96	65.00	-	21.90	10.00	57.10	-
	2002/03	20.90	9.90	70.70	-	22.10	11.00	61.70	-
April	2001/02	23.71	10.10	66.70	-	26.71	12.50	60.80	-
	2002/03	24.70	11.70	69.80	-	28.70	13.80	61.71	-
		El-Dakahlia				Kafir El-Sheikh			
Nov.	2001/02	25.80	14.70	67.80	-	26.30	13.11	91.00	-
	2002/03	24.70	13.90	80.70	-	25.20	11.70	90.70	-
Dec.	2001/02	23.20	12.50	56.10	0.20	22.90	9.70	80.70	0.20
	2002/03	22.80	11.75	65.81	0.70	19.70	8.80	81.00	0.40
Jan.	2001/02	17.76	8.95	58.90	11.78	18.90	7.07	76.10	20.00
	2002/03	16.81	7.81	60.78	12.90	17.20	6.90	77.31	19.90
Feb.	2001/02	19.71	9.90	58.90	10.78	20.20	7.30	70.80	15.70
	2002/03	18.70	10.70	60.70	10.80	16.00	6.20	73.60	20.70
Mar.	2001/02	20.21	11.12	60.70	-	20.00	9.50	82.71	.*
	2002/03	21.32	12.18	62.78	-	20.80	8.90	85.70	-
April	2001/02	26.70	13.90	59.61	-	25.70	11.50	80.10	-
	2002/03	28.78	14.50	60.71	-	26.70	12.50	85.00	-
		Damietta				El-Sharkia			
Nov.	2001/02	26.71	13.90	80.70	-	28.78	16.18	58.70	-
	2002/03	29.80	12.18	77.80	-	26.90	14.30	53.70	-
Dec.	2001/02	19.80	10.01	57.80	-	26.70	12.81	65.0	-
	2002/03	18.91	9.90	63.20	-	23.67	13.80	63.20	-
Jan.	2001/02	16.71	10.00	55.70	10.70	20.10	11.81	50.70	-
	2002/03	17.81	9.80	50.00	9.00	20.80	10.71	50.30	-
Feb.	2001/02	20.11	10.70	59.70	10.71	22.71	12.01	60.71	-
	2002/03	21.20	9.80	60.78	12.80	21.70	13.18	60.00	0.88
Mar.	2001/02	23.11	13.71	61.31	-	24.31	14.15	60.38	-
	2002/03	23.90	12.50	60.75	-	25.71	15.70	59.61	-
April	2001/02	25.81	13.81	59.71	-	28.96	15.81	50.11	-
	2002/03	26.78	12.90	60.80	-	29.87	16.71	52.11	-
		El-Kalubia Governorate							
Nov.	2001/02	26.90	13.50	63.80	-				
	2002/03	27.80	14.60	64.51	-				
Dec.	2001/02	25.50	11.40	62.80	0.20				
	2002/03	25.00	11.50	60.70	0.00				
Jan.	2001/02	21.61	10.70	63.71	2.10				
	2002/03	20.78	9.95	65.80	2.00				
Feb.	2001/02	22.00	9.50	52.71	-				
	2002/03	21.67	8.95	59.81	-				
Mar.	2001/02	24.60	12.90	53.71	-				
	2002/03	25.70	12.80	60.71	-				
April	2001/02	28.90	15.71	52.71	-				
	2002/03	29.90	13.90	50.80	-				

R.H. = relative humidity %

R.F. = Rain fall in mm

Each plot was 6 m² (2.0 x 3.0 m). Seeds were sown broad casting. The normal cultural practices of growing flax were followed till the harvesting time for each cultivar. Flax plants were harvested early in the morning by hand. Flax straw was left for air drying then retting was carried out after

removing the capsules (threshing process). At full maturity a sample of ten representative plants were taken at random for each plot to study yield per plant and its components, viz: characters studied for yield and its components were as follows:

- A. Yield and yield components:
 - I. Straw yield and its related characters:
 - 1. Technical stem length (cms).
 - 2. Fruiting zone length (cms).
 - 3. Straw yield/plant (g).
 - 4. Straw yield/feddan (ton).
 - II. Seed yield and its related characters:
 - 1. Number of capsules/plant.
 - 2. Number of seeds/plant.
 - 3. Seed yield/plant (g).
 - 4. Seed yield/feddan (ton).
- B. Technological characters:
 - 1. Fiber yield/plant (g).
 - 2. Fiber yield/feddan (ton).
 - 3. The mean length of fibers (cms).
 - 4. Total fiber percentage.
 - 5. Fiber fineness, in metrical number (Nm).
 - 6. Oil percentage.
 - 7. Oil yield /fed. (kg).
 - 8. Iodine value.

Statistical analysis:

All data were statistically analyzed by the analysis of variance method according to Snedecor and Cochran (1982) and differences between means were tested by L.S.D. Combined analysis was performed as described by LeClerg *et al.* (1966).

Table (2): Some chemical properties of the experimental sites.

Variables		EI- Beheira	EI- Gharbia	EI- Dakahlia	Kafr EI- Sheikh	Damiett a	EI- Sharkia	EI- Kalubia
pH	2002	7.8	7.90	7.8	8.2	7.8	8.7	8.12
	2003	7.6	8.1	7.9	8.1	7.9	8.1	8.42
Organic matter %	2002	4.5	1.05	1.98	2.3	1.12	1.92	1.68
	2003	3.8	1.12	2.10	2.5	1.38	2.07	2.20
Available (ppm)	P 2002	30.0	23.60	25.60	20.2	18.70	6.00	18.90
	2003	27.20	21.30	24.78	18.90	19.52	14.00	17.20
Available (ppm)	K 2002	235.0	420.00	381.541	220.0	218.70	146.07	230.09
	2003	245.6	390.70	370.80	270.70	209.71	229.07	219.10
Available (ppm)	N 2002	30.00	40.39	38.67	29.00	27.50	50.00	21.00
	2003	32.80	38.70	39.67	30.70	28.90	70.00	23.90

RESULTS AND DISCUSSION

A. Yield and yield components:

I. Straw yield and its related characters:

Results in Table 3 present the means of technical stem length, fruiting zone length, straw yield per plant and per feddan as affected by genotype, location and season.

Table (3): Means of straw and seed yields and its related characters on affected by genotypes, locations and seasons.

Variables	Technical stem length (cm)	Fruiting zone length (cm)	Straw yield per plant (g)	Straw yield per feddan (ton)	No. of capsules per plant	No. of seeds per plant	Seed yield per plant (g)	Seed yield per feddan (tons)
Genotype (G)	**	**	**	**	**	**	**	**
Sakha 1	87.08	10.00	0.955	4.070	23.72	179.72	4.640	0.679
Belinka	88.44	7.02	0.775	4.007	5.78	43.79	0.223	0.326
Location (L)	**	**	**	**	**	**	**	**
El-Beheira	86.28	8.20	0.813	3.99	14.93	112.70	0.955	0.493
El-Gharbia	91.33	9.88	0.865	4.188	16.83	127.38	1.055	0.513
El-Dakahlia	92.23	10.95	0.893	4.350	19.08	144.60	1.210	0.540
Kafr El-Sheikh	87.88	8.35	0.835	4.023	14.65	110.90	0.930	0.508
Damietta	84.23	6.85	0.840	3.935	11.80	89.38	0.740	0.488
El-Sharkia	82.55	7.13	0.823	3.605	12.38	93.63	0.780	0.455
El-Kalubia	89.82	8.20	0.930	4.108	13.65	103.48	0.850	0.523
L.S.D. at 0.05	0.655	0.179	0.018	0.028	1.121	11.860	0.010	0.037
Seasons (S)	**	**	**	**	**	**	**	**
2001/2002	87.44	8.31	0.85	3.979	14.395	109.13	0.910	0.485
2002/2003	88.08	8.71	0.88	4.103	15.100	114.38	0.953	0.520
Interaction								
L X G	**	**	**	**	**	**	**	**
L x S	**	**	**	NS	**	NS	NS	**
S x G	**	**	**	**	**	**	**	**
L x S x G	**	**	**	**	**	**	**	**

*, ** and NS indicate $P < 0.05$, $P < 0.01$ and not significant respectively.

Effect of genotype:

Results indicated a highly significantly effect of genotype on technical stem length, fruiting zone length, straw yield per plant and per feddan on the average of seven locations combined over the two seasons of experimentation. It is clear that the highest technical stem length was (88.44 cm), which was recorded by Belinka variety. On the other hand, the commercial variety Sakha 1 gave the highest value for fruiting zone length (10.00 cm), straw yield per plant (0.955 g) and straw yield per fed. (4.070 ton). The present results are mainly due to the differences in the genetical make up of the genotypes and agree with those reported by Hella *et al.* (1986); Kineber (1991 and 1994), Mostafa (1994); Kineber and El-Kady (1996) and (1998) and Kineber and Eman El-Kady (2002).

Effect of location:

The data in Table 3 show clearly that technical stem length, fruiting zone length; straw yield per plant and per feddan varied markedly in the seven

different locations. The two seasons average over all genotypes showed that the highest technical stem length (92.23 cm), fruiting zone length (10.95 cm) and straw yield per feddan (4.350 ton) were produced in El-Dakahlia. On the other hand, El-Kalubia produced the highest value for straw yield per plant (0.930 g). The differences among the seven locations were highly significant. These differences indicated that the environmental conditions of the seven locations are quite different as indicated by the climatological normals in Table 1 and the analysis of the chemical soil properties in Table 2. The present results show clearly that El-Dakahlia location is superior to other location in producing fiber flax. Similar results were reported by Yousef (1975), El-Kalla and El-Kassaby (1982), Kineber (1991) and Mostafa (1994).

Effect of season:

Results in Table 3 show a highly significant difference in all characters under studied of the over all average combined over the tested genotypes and the seven locations. The averages of technical stem length, fruiting zone length, straw yield per plant and per fed. were superior in the second season compared in the first one. These great differences were mainly due to the different climatic conditions as shown in Table 1. The climatic conditions in the second season favoured a higher straw yield and its related characters compared with the first one. Similar results were reported by Kineber (1991) and Mostafa (1994).

II. Seed yield and its related characters:

Results in Table 3 present the means of number of capsules per plant, number of seeds per plant, seed yield per plant and seed yield per feddan as affected by genotype, location and season.

Effect of genotype:

The two genotypes significantly differed with regard to seed characters under study (Table 3). The highest number of capsules per plant, number of seeds per plant, seed yield per plant and seed yield per feddan were recorded with the commercial variety Sakha 1 being 23.72, 179.72, 4.64 g and 0.679 ton, respectively. The lowest value for above characters were produced by the imported Belinka. It could be concluded that the commercial variety Sakha 1 was superior to Belinka variety in regard to the above characters.

The present results are mainly due to the differences in the genetical make up of the tested genotypes. Similar results were also reported by Hella *et al.* (1986); Kineber (1991 and 1994); Mostafa (1994); Kineber and El-Kady (1996) and (1998) and Kineber and Eman El-Kady (2002).

Effect of location:

The results indicated that the overall average of seed yield and its related characters combined over the two genotypes as well as both seasons was higher in El-Dakahlia than in other location with highly significant differences. It is quite evident that number of capsules per plant, number of seed per plant and seed yield per plant were lower in Damietta Governorate than in the other locations. While, seed yield per feddan was lower in El-Sharkia Governorate than the other locations, showing an opposite trend of

that obtained by straw production where, El-Dakahlia was more productive. It seems that the environmental conditions in El-Dakahlia as well as El-Gharbia are more suitable for flax seed production than in other location. Similar results were reported by Hella *et al.* (1986), Kineber (1991) and Mostafa (1994)

Effect of season:

Results presented in Table 3 show a significant effect for season on all seed yield and its characters. The overall average combined over two genotypes as well as the seven locations in the second season was significantly higher than in the first one. The averages of capsules number per plant, number of seeds per plant seed yield per plant and seed yield per fed. in the second season were 4.67%, 4.59%, 4.51% and 6.73%, respectively, higher than in the first season which indicate that the climatic conditions prevailing during the second season were more suitable for flax seed production compared with the first season. Such result is mainly due to the effect of season on the previously discussed seed yield components such as number of capsules per plant, number of seeds per plant. The present results are in good agreement with those reported by Hella (1978), Kineber (1991) and Mostafa (1994).

B. Technological characters:

Data in Table 4 show the effect of genotype, location season and their interactions on fiber yield per plant, fiber yield per feddan, fiber length, total fiber percentage, fiber fineness, oil percentage, oil yield per feddan and iodine value.

Table (4): Means of technological characters as affected by genotypes, locations and seasons.

Variables	Fiber yield, g/plant	Fiber yield, ton/fed	Fiber length, cm	Total fiber, %	Fiber fineness, nm	Oil, %	Oil yield, ton/fed	Iodine value
Genotype (G)	NS	**	**	**	**	**	**	**
Sakha 1	0.144	0.419	84.98	15.42	184.11	39.90	0.272	170.82
Belinka	0.146	0.561	85.60	19.32	236.51	32.75	0.105	177.69
Location (L)	**	**	**	**	**	**	**	**
El-Beheira	0.140	0.480	86.68	17.02	212.18	35.86	0.180	170.34
El-Gharbia	0.148	0.525	88.53	18.07	214.43	36.99	0.185	177.18
El-Dakahlia	0.153	0.550	89.56	18.24	214.67	37.49	0.210	174.98
Kafr El-Sheikh	0.143	0.480	86.25	17.40	221.76	36.51	0.190	179.83
Damietta	0.138	0.465	81.70	16.60	202.89	35.37	0.180	169.06
El-Sharkia	0.135	0.415	80.36	16.35	195.60	35.56	0.170	175.15
El-Kalubia	0.158	0.515	87.79	17.88	210.67	36.45	0.195	176.11
L.S.D. at 0.05	0.004	0.099	0.724	0.987	0.814	0.101	0.024	0.081
Seasons (S)	**	NS	NS	NS	NS	NS	**	**
2001/2002	0.143	0.489	84.76	17.27	201.68	36.32	0.183	176.49
2002/2003	0.147	0.491	85.82	17.47	218.94	36.33	0.194	172.02
Interaction								
L X G	**	**	**	**	NS	**	**	NS
L x S	NS	NS	NS	NS	NS	NS	NS	NS
S x G	**	**	NS	**	NS	**	NS	NS
L x S x G	**	**	**	**	NS	**	NS	NS

*, ** and NS indicate P < 0.05, P < 0.01 and not significant respectively.

Effect of genotype:

Results show that the tested genotypes varied really in all above characters except fiber yield per plant. The highest value of fiber yield per fed. fiber length, total fiber percentage and fiber fineness as an overall average combined over the seven locations and over both seasons were recorded with Belinka variety with 0.561 ton., 85.60 cm, 19.32% and 236.51 nm, respectively. The results of fiber yield per feddan are coincidental with these of straw yield per feddan.

On the other hand, oil percentage, oil yield per feddan and iodine value were significantly affected by genotype. Results showed above characters as an overall average combined over the seven locations and both seasons reached its maximum by Sakha 1 in a descending order with an oil percentage of 39.90% and 0.272 ton/fed. for oil yield per feddan, whereas the highest iodine value was produced by Belinka variety. It could be concluded that the tested varieties were different in oil quality, due to the differences in their genetical constitution. Similar results were also reported by Kineber (1991) and (1994), Mostafa (1994); Kineber and El-Kady (1996) and (1998) and Kineber and Eman El-Kady (2002).

Effect of location:

Results in Table 4 show that location significantly affected fiber yield per plant, fiber yield per feddan, fiber length; total fiber percentage, fiber fineness, oil percentage, oil yield per feddan and iodine value. The overall average of all above characters combined over the two tested genotypes and over both seasons showed that El-Dakahlia location was significantly superior to other locations in fiber yield per feddan fiber length; total fiber percentage; oil percentage and oil yield per feddan. On the other hand, El-Kalubia was also superior to the other locations in fiber yield per plant. It is clear from the table that fiber fineness and iodine value were the highest values in Kafr El-Sheikh location. The differences among the seven location were highly significant. These differences indicated that the environmental conditions of the seven locations are quite different as indicated by the climatological normals in Table 1 and the analysis of the chemical soil properties in Table 2. The present results show clearly that El-Dakahlia locations is superior to other location in producing high fiber quality. Similar results were reported by Yousef (1975), El-Kalla and El-Kassaby (1982), Kineber (1991) and Mostafa (1994).

Effect of season:

Results in Table 4 show a significant effect of season on fiber yield per plant, oil yield per feddan and iodine value. Whereas, insignificant effect of season on fiber yield per feddan, fiber length, total fiber percentage; fiber fineness and oil percentage. The average fiber yield per plant, and oil yield per feddan in the second season was 2.72% and 5.67% respectively, higher than the first season, while, the average iodine value in the first season was 2.53% higher than the second season. The present results are in good

agreement with those reported by Hella (1978), Kineber (1991) and Mostafa (1994).

Interaction effect:

1.Genotype and location interaction:

Results in Table 5 indicated a highly significantly effect of the interaction between genotype and location on straw yield per feddan, seed yield per feddan, oil yield per feddan and fiber yield per feddan. It is clear that the best genotype concerning straw, seed and oil yields per feddan was the commercial variety Sakha 1 in El-Dakahlia, with an average 4.48 ton, 0.740 ton and 0.300 ton, respectively. Belinka variety in El-Sharkia produced the lowest straw and seed yields per feddan with an average of 3.525 ton, 0.290 t

Table (5): Effect of the interaction between genotypes and location on straw, seed and fiber yields per feddan.

Interaction		Straw yield ton/fed.	Seed yield ton/fed.	Fiber yield ton/fed.	Oil yield ton/fed.
Location	Genotypes				
El-Beheira	Sakha 1	4.085	0.675	0.420	0.270
	Belinka	3.895	0.310	0.540	0.100
El-Gharbia	Sakha 1	4.220	0.695	0.455	0.280
	Belinka	4.155	0.330	0.595	0.110
El-Dakahlia	Sakha 1	4.480	0.740	0.480	0.300
	Belinka	4.220	0.340	0.620	0.110
Kafr El-Sheikh	Sakha 1	4.015	0.680	0.400	0.275
	Belinka	4.030	0.335	0.565	0.105
Damietta	Sakha 1	3.715	0.630	0.355	0.250
	Belinka	4.155	0.345	0.570	0.110
El-Sharkia	Sakha 1	3.685	0.620	0.365	0.245
	Belinka	3.525	0.290	0.465	0.095
El-Kalubia	Sakha 1	4.295	0.710	0.455	0.280
	Belinka	4.065	0.335	0.575	0.110
L.S.D. at 0.05		0.098	0.127	0.039	0.011

It is clear that the best genotype concerning fiber yield per feddan was Belinka variety in El-Dakahlia location with an average 0.620 ton. On the other hand, the lowest value for fiber yield per feddan was recorded by Sakha 1 variety in Damietta. Such result indicates clearly that genotypes differed greatly in straw characters according to the location and certain genotypes may be grown in certain locations.

2.Genotype and season interaction:

Results in Table 6 indicated that straw, seed and fiber yields per feddan were significantly affected by genotype and season interaction. It is clear that, in the second season, Belinka variety produced the highest value for straw and fiber yields per feddan an average of 4.106 and 0.561 tons, respectively.

Table (6): Effect of the interaction between genotypes and seasons on straw, seed and fiber yields per feddan.

Interaction		Straw yield ton/fed.	Seed yield ton/fed.	Fiber yield ton/fed.
Season	Genotypes			
2001/02	Sakha 1	4.047	0.659	0.417
	Belinka	4.093	0.699	0.420
2002/03	Sakha 1	3.907	0.311	0.551
	Belinka	4.106	0.341	0.561
L.S.D. at 0.05		0.080**	0.104**	0.032**

*, ** and NS indicate $P < 0.05$, $P < 0.01$ and not significant respectively.

It was evident that the lowest seed yield per feddan combined over the seven locations was recorded by the commercial variety Sakha 1 in the second season. Such result indicates a marked influence of season on the performance of the genotypes.

3.Genotype, location and season interaction:

Results in Table 7 show that the second order interaction significantly affected straw, seed and fiber yields per feddan. It is clear that the highest straw yield per feddan was 4.680 ton, which was recorded with Belinka grown in Damietta location in the second season.

Table (7): Effect of the interaction among genotypes, locations and seasons.

Location	Genotype (G)	Season (S)	Straw yield ton/fed.	Seed yield ton/fed.	Fiber yield ton/fed.
El-Beheira	Sakha 1	2001/02	4.07	0.620	0.420
		2002/03	4.10	0.680	0.420
	Belinka	2001/02	3.085	0.310	0.540
		2002/03	3.94	0.310	0.540
El-Gharbia	Sakha 1	2001/02	4.22	0.640	0.480
		2002/03	4.22	0.700	0.430
	Belinka	2001/02	4.14	0.330	0.620
		2002/03	4.17	0.330	0.570
El-Dakahlia	Sakha 1	2001/02	4.47	0.730	0.500
		2002/03	4.49	0.750	0.460
	Belinka	2001/02	4.20	0.330	0.660
		2002/03	4.24	0.350	0.580
Kafr El-Sheikh	Sakha 1	2001/02	4.02	0.660	0.390
		2002/03	4.01	0.700	0.410
	Belinka	2001/02	4.00	0.320	0.580
		2002/03	4.06	0.350	0.550
Damietta	Sakha 1	2001/02	3.64	0.600	0.320
		2002/03	3.79	0.660	0.390
	Belinka	2001/02	3.63	0.290	0.500
		2002/03	4.68	0.400	0.640
El-Sharkia	Sakha 1	2001/02	3.69	0.600	0.350
		2002/03	3.67	0.640	0.380
	Belinka	2001/02	3.51	0.280	0.440
		2002/03	3.54	0.300	0.490
El-Kalubia	Sakha 1	2001/02	4.22	0.660	0.460
		2002/03	4.37	0.760	0.450
	Belinka	2001/02	4.02	0.320	0.590
		2002/03	4.11	0.350	0.560
L.S.D at 0.05			0.138**	0.179**	0.056**

*, ** and NS indicate $P < 0.05$, $P < 0.01$ and not significant respectively.

On the other hand, the lowest straw yield was 3.085 ton produced by Belinka in El-Behira in the first season. On the other hand, the highest seed yield per feddan was 0.760 ton, which was recorded with Sakha 1 grown in El-Kalubia location in the second season, while the lowest seed yield was 0.280 ton produced by Belinka in El-Sharkia in the first season. Results indicated that the highest value of fiber yield per feddan was 0.660 ton, which was recorded by Belinka variety grown in El-Dakahlia location in the first season, whereas the lowest value of fiber yield per feddan was 0.320 ton, which recorded by Sakha 1 grown in Damietta location in the first season.

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تأثير الظروف البيئية على المحصول ونوعيته لصنفين من الكتان

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أجريت ١٤ تجربة حقلية خلال موسمي ٢٠٠١/٢٠٠٢م، ٢٠٠٢/٢٠٠٣م فى سبع مناطق تمثل مناطق زراعة الكتان فى مصر وهى محافظات كفر الشيخ (سخا) والغربية (الجميزة) والبحيرة (كفر الدوار) والدقهلية (شربين) ودمياط (كفر سعد) والشرقية (ديرب نجم) والقليوبية (شبين القناطر). وقد تم التقييم من حيث صفات محصول القش والألياف والبذرة والزيت ومكونات المحصول وكذلك بعض الصفات التكنولوجية لصنفى الكتان سخا ١ والصنف المستورد بلينكا - وقد أجريت عمليات الخدمة والتسميد والرئ حسب التوصيات الفنية لزراعة الكتان الموصى بها. وقد تم التحليل الإحصائى لكل موسم بكل منطقة على حده ثم أجرى التحليل الإحصائى المتجمع للجهات السبعة وكذلك للموسمين. وقد أوضحت النتائج المتحصل عليها ما يلى:

تفوق الصنف سخا ١ معنويا على الصنف المستورد بلينكا فى صفات طول الجزء الثمرى ومحصول القش والقدان وعدد كبسولات النبات وعدد بذور النبات ومحصول البذور للنبات والقدان والنسبة المئوية للزيت ومحصول الزيت للقدان.

بينما تفوق الصنف المستورد بلينكا فى صفات طول الساق الفعال ومحصول الألياف للقدان وطول الألياف والنسبة المئوية الكلية للألياف ونعومة الألياف والرقم اليودى.

تفوقت منطقة الدقهلية معنويا فى صفات الطول الفعال للساق وطول المنطقه الثمرية ومحصول القش للقدان وعدد كبسولات النبات وعدد بذور النبات ومحصول البذور للنبات والقدان ومحصول الألياف للقدان وطول الألياف والنسبة المئوية الكلية للألياف والنسبة المئوية للزيت ومحصول الزيت للقدان مقارنة بباقى المناطق الست. بينما تفوقت منطقة كفر الشيخ فى إنتاج ألياف ناعمة والرقم اليودى.

كانت الظروف الجوية السائدة خلال الموسم الثانى أفضل من الموسم الأول لصفات الطول الفعال للساق وطول المنطقه الثمرية ومحصول القش للنبات والقدان وعدد كبسولات النبات وعدد بذور النبات ومحصول البذور للنبات والقدان ومحصول ألياف النبات ومحصول الزيت للقدان ماعدا صفة الرقم اليودى كانت الأفضل خلال الموسم الأول.

لم يكن لاختلاف الموسم تأثير معنوى على صفات محصول الألياف للقدان وطول الألياف والنسبة المئوية الكلية للألياف ونعومة الألياف والنسبة المئوية للزيت.

كان تأثير التفاعل بين الأصناف والمواقع وبين الأصناف والمواسم معنويا على معظم الصفات المدروسة.

تم الحصول على أعلى محصول للقش والبذور والزيت للقدان من الصنف سخا ١ المنزرع بمحافظة الدقهلية ، بينما تم الحصول على أعلى محصول للألياف للقدان من الصنف بلينكا المنزرع أيضا بمحافظة الدقهلية.

يمكن التوصية بأن منطقة الدقهلية تعطى أفضل محصول ألياف وبذور فى كلا الصنفين.