COMPARISON OF YIELD, ITS COMPONENTS, PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF TWELVE FLAX GENOTYPES

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ABSTRACT

Two field experiments were carried out at Sakha Agric. Res. Station, during 2006/2007 and 2007/2008 seasons to investigate the performance of twelve flax genotypes namely Giza 6, Giza 8, Sakha 1 and Sakha 2 (dual purpose type); Belinka, Escalinea, Ilona, Sakha 3, Sakha 4 and strain 113 (fiber purpose type) and strain 16 and strain 22 (oil purpose type).

Results of the combined analysis of the two seasons showed that significant differences were observed among the flax genotypes in all characters of yield and its components, physical properties and chemical composition of flaxseeds. The imported Escalina variety gave the highest value for technical stem length. Whereas, the strain 22 gave the highest values for stem diameter, upper branching zone length, no. of capsules/plant and no. of seeds/plant. Sakha 2 ranked first and achieved the highest estimates for seed yield/plant and per feddan, while, strain 113 gave the lowest value in seed yield/fed. On the other hand, Sakha 1 variety gave the highest values in straw yield per plant as well as per fed. Physical properties of the twelve tested flaxseed genotypes varied from one genotype to the other. Giza 6, Sakha 1, strain 16 and strain 22 gave the highest values for length, width and thickness, while Sakha 2 and Ilona varieties had the highest values of volume of 1000 seeds (cm^3) and relative density (g/cm^3), respectively.

The highest values in moisture content and ash were found in strain 16, whereas strain 22 gave the highest value for oil content. On the other hand, the imported Belinka variety gave the highest values of crude protein, crude fiber and total carbohydrate, while the lowest values of crude protein and crude fiber obtained from strain 22.

Positive highly significant correlation coefficient were found between seed yield/fed. and all related characters, upper branching zone length, no. of capsules/plant, no. of seeds/plant and seed index. Negative highly significant correlation coefficient were detected between crude protein and seed yield and its related characters and oil content.

INTRODUCTION

Flax (*Linum usitatissimum* L.) is one of the oldest crops cultivated for its seeds and fibres. All parts of the plant have extensive and varied uses. The two products of flaxseed are oil and meal. The oil content of the seed generally varies from 33 to 45%. The oil from flaxseed is one of the richest of α-linolenic acid and is used mainly as drying oil in paints, varnishes, other industrial and pharamaceutical applications. The oil extracted from unheated seeds is used for food purposes. Many investigators obtained higher levels of varietal differences in yield and its components of flax in many regions of growing flax in the world. Verma and Pathak (1993); El-Nakhlawy (1995), Dubey (2001), Kineber and El-Sayed (2004) and Kineber *et al.* (2006) indicated that the flax genotypes significantly differed in yield and its components.

Physical properties of different genotypes of flaxseed were carried out to figure out the natural and quality of flaxseed samples. However, seed dimensions, volume, of 1000 seeds (cm^3) and relative density (g/cm^3) of flaxseed were preformed to figure out the engineering aspects and handling conditions that should be considered for the flaxseed. Juliano *et al.* (1990).

Several studies were carried out to estimate the chemical composition of flaxseed i.e. moisture %, oil %, crude protein, crude fiber, ash and carbohydrate. In this respect many results were obtained by Afify *et al.* (1994); Fahmy *et al.* (1996); Kenasehuk and Rashid (1999), El-Kady (2000) and El-Sweify *et al.* (2003).

The present investigation was carried out to determine the yield and its components, physical properties and chemical composition of flaxseed genotypes under this study.

MATERIALS AND METHODS

The present investigation was carried out at Sakha Agric. Res. Station, Kafr El-sheikh, Egypt, during the two successive

season 2006/2007 and 2007/2008 to evaluate twelve flax genotypes, as shown in the following Table (1).

The genotypes were planted in randomized complete block design, with four replications. The preceding crop was maize (*Zea mays* L.) in both seasons.

Table (1): The pedigree of the different genotypes used in the investigation.

Genotypes	Classification	Source
Giza 6	D	Giza 4 x Maroc
Giza 8	D	Giza 6 x Santa Catalina 6
Sakha 1	D	Bomby x I. 1485
Sakha 2	D	I. 2348 x Hera
Belinka	F	Imported from Holland
Escalina	F	Imported from Holland
Ilona	F	Imported from Holland
Sakha 3	F	Belinka 2E x I. 2096
Sakha 4	F	Belinka R_3 x I. 2569
strain 113	F	I. 2195 x Belinka
strain 16	O	Giza 8 x S2419/1
strain 22	O	I. 370 x I. 2561

D, Dual purpose type
F, Fiber purpose type
O, Oil purpose type

Seeds of each flax genotype were sown on Nov. 12th and 15th in 2006 and 2007 seasons, respectively. Plot size was 6 m^2 (1.5 x 4 m) in 12 rows, 4 meters long and 12.5 cm apart. The conventional cultural practices for flax at North Delta region were applied. The central eight rows in each plot were harvested and left one week for complete air-drying to determine seed and straw yields per plot and then adjusted to seed and straw yields per feddan, random samples of ten g uarded plants were taken to study yield per plant and its components at the end of the season. This characters studied for **yield and its components** were as follows:

1. Technical stem length (cm).
2. Stem diameter (mm).
3. Straw yield per plant (g).

4. Straw yield per feddan (ton).
5. Upper branching zone length (cm.).
6. Number of capsules per plant.
7. Number of seeds per plant.
8. Seed yield per plat (g).
9. Seed index (1000-seeds weight) (g).
10. Seed yield per feddan (kg).

Physical properties of flaxseed genotypes:

Seed dimensions (mm):

Were estimated using the average of length and weight of 25 seeds as described by Adair *et al.* (1973).

Volume of 1000 seeds:

Was measured by absolute displacement method **Kramer and Twigg (1962).**

Relative density:

Was calculated according to **Kramer and Twigg (1962)** method and using the following equation:

$$\text{Relative density} = \frac{\text{The weight of 1000 seeds (gm)}}{\text{The voluem of 1000 seeds (cm}^3\text{)}} = \text{g/cm}^3$$

Chemical composition of flaxseed genotypes:

Moisture content, oil content, crude protein, crude fiber and ash were determined according to the method described by **A.O.A.C. (1990).** The data were statistically analyzed for each season and the homogeneity of experimental error, in both seasons, was tested according to **Snedecor and Cochran (1982).** Then, the combined analysis of the two seasons was done and treatment means were compared by Duncan's multiple range test (**Duncan, 1955**). Correlation was performed according to **Singh and Chaudhary (1977)**

RESULTS AND DISCUSSION

1. Yield and its components:

Mean values of yield and its components for twelve flax genotypes from the combined analysis over two seasons are presented in Table (2). Analysis of variance revealed significant

differences between means of the twelve flax genotypes for technical stem length; stem diameter, straw yield per plant and per feddan. Escalina variety showed the highest mean value for technical stem length (94.8 cm), followed by strain 113 (92.7 cm), Sakha 3 (92.4 cm) and Sakha 4 (91.8 cm). On the other hand, strain 22 ranked the lowest one in technical stem length (59.8 cm). the highest mean values of straw yield per plant (1.522 g) and per feddan (4.945 ton) were found in Sakha 1 variety followed by strain 16 (1.400 g and 4.827 ton), respectively, while strain 22 and Giza 6 variety had the lowest values from straw yield per feddan (3.256 and 3.877 ton), respectively. The means of stem diameter ranged from 1.729 to 2.476 mm. Sakha 4 variety gave the thinnest plants.

The differences between the tested genotypes could mainly be attributed to the differences in their genetical constitution and their response to the environmental conditions. Flax genotypes differed significantly in all seed characters i.e., upper branching zone length, no. of capsules per plant, no. of seeds per plant; seed yield per plant; seed index and seed yield per feddan.

Data illustrated that strain 22 ranked the first and achieved the highest estimates of upper branching zone length (22.578 cm); no. of capsules per plant (17.409) and no. of seeds per plant (148.81). Meanwhile, the lowest estimates were obtained by Ilona variety in upper branching zone length (8.805 cm), Belinka variety in no. of capsules per plant (8.049) and strain 113 in no. of seeds per plant (60.19).

The data revealed that, strain 16 had the highest values of seed yield per plant (1.417 g) and seed index (10.811 g), followed by Sakha 2 variety (1.354 g and 9.705 g), respectively. On the other hand, Escalina variety ranked the lowest one in seed yield per plant (0.247 g) and seed index (4.008 g).

Illustrated data in Table (2) indicated that Sakha 2 had the highest value of seed yield per feddan (890.86 kg) followed by strain 22 (864.96 kg) and strain 16 (856.17 kg) while, Escalina and strain 113 had the lowest values (339.50 kg) and (348.35 kg), respectively. The superiority of such genotypes could be due to their adaptation and high values of some yield components, i.e. upper branching zone length. The results are in harmony with those obtained by Verma and Pathak (1993), El-Nakhlawy (1995), Dubey (2001), Kineber and El-Sayed (2004) and Kineber *et al.* (2006).

Table (2): Mean values of yield and its components for twelve flax genotypes (combined analysis over 2006/2007 and 2007/2008 seasons).

Characters \ Genotypes	Giza 6	Giza 8	Sakha 1	Sakha 2	Belinka	Escalina	Ilona	Sakha 3	Sakha 4	strain 113	strain 16	strain 22	General mean
Technical stem length, cm.	85.6 d	87.1 d	90.5 c	90.2 c	91.6 bc	94.8 a	91.0 bc	92.4 b	91.8 bc	92.7 bc	90.1 c	59.8 e	88.1
Stem diameter, mm	2.364 b	2.352 b	1.963 d	2.363 b	1.814 f	1.770 fg	1.900 e	1.796 f	1.729 g	1.807 f	2.271 c	2.476 a	2.050
Straw yield/plant, g	1.286 c	1.282 c	1.522 a	1.388 b	0.971 d	1.241 c	1.266 c	0.839 e	0.713 f	1.001 d	1.400 b	1.368 b	1.190
Straw yield/fed., ton	3.877 h	4.011 g	4.945 a	4.310 d	4.150 ef	4.086 fg	4.560 c	4.213 e	4.070 fg	4.188 e	4.827 b	3.256 i	4.208
Upper branching zone length, cm	19.096 c	20.855 b	16.411 d	17.613 d	9.909 f	8.541 f	8.805 f	12.528 e	11.601 e	11.609 e	19.520 c	22.578 a	14.922
Number of capsules/plant	12.611 c	12.316 c	15.470 b	15.744 b	8.049 ef	7.824 f	8.264 ef	10.018 d	9.818 d	9.043 de	15.250 b	17.409 a	11.818
Number of seeds/plant	105.23 d	101.98 d	137.29 bc	141.33 ab	63.29 fg	61.52 g	62.45 fg	70.30 ef	71.86 e	60.19 g	131.01 c	148.81 a	96.27
Seed yield/plant, g.	0.887 d	0.900 d	1.272 b	1.354 a	0.305 ef	0.247 f	0.322 e	0.346 e	0.340 e	0.330 e	1.417 a	0.998 c	0.727
Seed index	8.436 e	8.828 d	9.2667 c	9.705 b	4.815 hi	4.008 j	5.164 g	4.916 h	4.726 i	5.153 g	10.811 a	7.034 f	6.905
Seed yield/fed. kg.	683.15 c	674.07 c	868.25 b	890.86 a	369.09 d	339.50 e	390.31 d	407.43 d	395.38 d	348.35 e	856.17 b	864.96 b	590.63

Means designated by the same latter in row are not significantly different at 5% level according to Duncan's multiple range test.

II. Physical properties of flaxseed genotypes:

Mean values of physical properties of different flaxseed genotypes from the combined analysis over two seasons 2006/2007 and 2007/2008 are presented in Table (3). Analysis of variance revealed significant differences between means of the twelve flaxseed genotypes for length (mm); width (mm); thickness (mm); volume of 1000 seeds (cm^3) and relative density (g/cm^3). Giza 6 and Giza 8 varieties showed the highest mean value of length (5.990 mm and 5.960 mm), respectively , followed by Sakha 1 (5.393 mm) and Sakha 2 (5.233 mm), whereas the strain 113 gave the shortest length (3.605 mm). The means of flaxseed genotypes for width (mm) ranged from 1.483 to 3.404 mm. Sakha1 gave the highest value (3.404 mm), followed by Giza 6 variety (3.019 mm), while strain 113, Sakha 3 and Belinka gave the lowest values (2.115, 2.327 and 2.329 mm), respectively. The highest flaxseed genotypes of thickness were obtained from local variety Sakha 1 (1.005 mm) followed by Giza 6, strain 16, strain 22 and Giza 8 with no significant difference between these genotypes, whereas the imported Belinka variety gave the lowest value (0.604 mm).

Data presented in Table (3) indicated that flaxseed dimensions, (length, width and thickness, mm) are in agreement with those reported by Vaughan (1970), who found that flaxseed is oval in shape and 4-6 mm in length. Furthermore, Dybing and Lay (1981) mentioned that flaxseed is oval, flat and somewhat beaked, having average dimensions of 2.5 mm x 5 mm x 1 mm., El-Kady (2000) and El-Emary *et al.* (2006) mentioned that dimensions of flaxseed cultivars ranged between (4.20-5.67 mm), (2.02-2.57 mm) and (0.42-0.92 mm), respectively.

Volume of 1000 seeds (cm^3) for Sakha 2 and strain 16 gave the highest values 9.176 and 9.151 cm^3, respectively, whereas four fiber types varieties Ilona, Escaline, Sakha 4 and Sakha 3 gave the lowest values 4.010, 4.011,4.019 and 4.055, respectively. The highest values of relative density were recorded in Ilona and Sakha 3 varieties (1.288 and 1.213 g/cm^3, respectively) while Giza 6 gave the lowest value in this respect (0.974 g/cm^3). These results are in the same trend of those reported by El-Kady (2000).

Table (3): Mean values of physical properties of twelve flaxseed genotypes (combined analysis over 2006/2007 and 2007/2008 seasons).

Characters \ Genotypes	Giza 6	Giza 8	Sakha 1	Sakha 2	Belinka	Escalina	Ilona	Sakha 3	Sakha 4	strain 113	strain 16	strain 22	General mean
Length (mm)	5.990 a	5.960 a	5.393 b	5.233 bc	4.069 d	2.996 f	4.206 d	4.011 d	4.015 d	3.605 e	5.046 c	5.149 bc	4.639
Width (mm)	3.019 b	2.770 c	3.404 a	2.487 d	2.329 de	1.996 f	1.483 g	2.327 de	2.392 d	2.115 ef	2.380 d	2.769 c	2.456
Thickness (mm)	0.999 a	0.994 a	1.005 a	0.983 a	0.604 c	0.966 a	0.994 a	0.911 ab	0.913 ab	0.840 b	0.999 a	0.997 a	0.934
Volume of 1000 seeds (cm^3)	8.666 b	8.519 b	8.041 c	9.176 a	4.527 e	4.011 f	4.010 f	4.055 f	4.019 f	4.549 e	9.151 a	7.053 d	6.315
Relative density (g/cm^3)	0.974 g	1.036 ef	1.153 cd	1.045 e	1.064 e	0.999 fg	1.288 a	1.213 b	1.176bcd	1.133 d	1.183 bc	0.987 g	1.104

Means designated by the same latter in row are not significantly different at 5% level according to Duncan's multiple range test.

III. Chemical composition characters:

As shown from Table (4), there are significant differences in all chemical composition characters between flaxseed genotypes studied which exhibited a wide variability in most parameters.

Regarding moisture content in seeds, strain 16, Escalina and Sakha 1 varieties recorded the highest values 6.01%, 5.98% and 5.81%, respectively. On the other hand, Sakha 2, strain 22 and Giza 8 gave the lowest values 5.19%, 5.29% and 5.33%, respectively. These results are in agreement with those obtained by Patterson (1989) who found that the maximum moisture content levels for safe storage of linseed must be equal or lower than 10.5%. However, El-Kady (1995 and 2000) and Siemens and Daun (2005) reported that moisture content of flaxseed varied from (5.12 to 5.73%) depending on the variety. strain 22 showed the highest mean value of oil content (48.55%), followed by Sakha 2 and Giza 8 varieties 43.04% and 42.90%, respectively. On the other hand, imported variety Belinka ranked the lowest one in oil content (36.08%), several studies .. were conducted on the oil content of different linseed varieties. They were 34.3%-47.6% as reported by Oomah and Kenaschuk (1995), Lukaszewicz *et al.* (2004) and Abd El-Fatah and El-Essawy (2006), while in Canadian flaxseed cultivars contained 44.2-48.3% oil, Kenaschuk and Rashid (1999).

Dealing with crude protein content and crude fiber of flaxseed genotypes, it can be seen from Table (4) that Belinka flaxseed variety contains the highest values 26.03% and 6.50% followed by imported fiber type variety Escalina 25.18% and 5.74% for these two characters, respectively, while strain 22 ranked the lowest one in crude protein 15.53% and crude fiber 3.51%. Similar results were obtained by Oomah and Mazza (1995), El-Kady (2000) and Kineber and El-Sayed (2004), they found that values of crude protein of flaxseed ranged between (16.30% to 24.90%) and for crude fiber (5.14% to 15.26%).

For ash content, the data given in Table (4) revealed a significant difference between flaxseed genotypes, where Escalina variety had the highest value of ash content (4.22%), followed by strain 16 (4.19%) and Sakha 3 variety (4.16%), while, strain 113 give the lowest value (3.61%). Similar findings were reported by Madhusudhan and Singh (1983), El-Kady (2000) and El-Kady and Kineber (2004), they mentioned that flaxseed varietal differences in ash content and ranged between (2.60% to 6.31%).

Table (4): Mean values of chemical composition of twelve flaxseed genotypes (combined analysis over 2006/2007 and 2007/2008 seasons).

Characters \ Genotypes	Giza 6	Giza 8	Sakha 1	Sakha 2	Belinka	Escalina	Ilona	Sakha 3	Sakha 4	strain 113	strain 16	strain 22	General mean
Moisture content	5.68 ab	5.33 c	5.81 ab	5.19 c	5.52 bc	5.98 a	5.74 ab	5.77 ab	5.79 ab	5.46 bc	6.01 a	5.29 c	5.63
Oil content	42.40 cd	42.90 bc	41.50 e	43.04 b	36.08 i	38.08 h	38.65 gh	38.57 h	39.20 fg	39.56 f	41.90 de	48.55 a	40.87
Crude protein	20.28 e	20.00 e	21.86 d	18.70 f	26.03 a	25.18 ab	23.88 c	24.10 bc	23.43 c	23.69 c	20.78 de	15.53 g	21.96
Crude fiber	4.75 f	4.70 f	5.20 de	3.90 g	6.50 a	5.74 b	5.51 bcd	5.47 bcd	5.60 bc	5.33 cd	4.91 ef	3.51 h	5.09
Ash	3.87 b	3.94 b	4.04 ab	3.68 c	3.91 b	4.22 a	4.05 ab	4.16 a	3.95 b	3.61 c	4.19 a	3.68 c	3.94
Total carbohydrate*	33.44 bc	33.04 bc	32.55 cd	34.58 a	33.98 ab	32.52 cd	33.40 bc	33.17 bc	33.42 bc	33.15 bc	33.13 bc	32.03 d	33.20

Means designated by the same latter in row are not significantly different at 5% level according to Duncan's multiple range test.

* Total carbohydrate was calculated by difference.

Illustrated data in Table (4) indicated that total carbohydrate content of flaxseed genotypes ranged from (32.03 to 34.58%). Sakha 2 had the highest value of total carbohydrate (34.58%), followed by Belinka variety (33.98%), on the other hand, strain 22 ranked the lowest value (32.03%). The differences in carbohydrate content could be related to the variation that found in the chemical composition of the tested genotypes of flaxseed. Similar results were obtained by Madhusudhan and Singh (1983) and El-Kady *et al.* (2001).

Correlation coefficients:

Simple correlation coefficients (r-values) among seed yield and its related characters and chemical composition of 12 flaxseed genotypes from combined data are presented in Table (5). Positive and highly significant correlation coefficients were found between upper branching zone length and each of no. of capsules/plant (r = 0.886), no. of seeds/plant (r = 0.862), seed yield/plant (r = 0.819), seed index (r = 0.807), seed yield/fed. (r = 0.871) and oil content (r = 0.893). On the other hand, a negative and highly significant correlation coefficient was found between upper branching length and each of moisture (r = -0.406), crude protein (r = -0.910) and crude fiber (r = -0.828), while, an insignificant negative correlation coefficient was recorded for ash and total carbohydrate.

no. of capsules/plant and no. of seeds/plant showed positive and significant correlation coefficients with seed yield/plant (r = 0.623 and 0.945), seed index (r = 0.0825 and 0.848), seed yield (r = 0.974 and 0.990) and oil content (r = 0.872 and 0.839, respectively). However, the correlation coefficients between no. of capsules/plant and no. of seeds/plant and each of moisture (r = -0.318 and -0.305), crude protein (r = -0.892 and -0.867) and crude fiber (r = -0.843 and 0.814) were negative and significant, but ash and total carbohydrate were negative and not significant.

Table (5) further revealed that seed yield/plant and seed index were highly significantly and positively correlated with seed yield/fed. (r = 0.977 and 0.912) and oil content (r = 0.691 and 0.601) In addition, seed yield/plant and seed index were negatively and highly significantly correlated with both crude protein (r = -0.745 and -0.668) and crude fiber (r = -0.700 and -0.615). On the other hand, seed yield/plant and seed index were insignificant correlated with moisture, ash and total carbohydrate.

Table (5): Simple correlations coefficients among seed yield and its related characters and chemical composition of 12 flaxseed genotypes.

Characters	no. of capsules/plant	no. of seeds/plant	Seed yield/plant	Seed index	Seed yield/fed.	Moisture	Oil content	Crude protein	Crude fiber	Ash	Total carbohydrate
Upper branching zone length	0.886**	0.862**	0.819**	0.807**	0.871**	-0.706**	0.893**	-0.910**	-0.828**	-0.149 ns	-0.211 ns
no. of capsules/plant		0.990*	0.623**	0.825**	0.974**	-0.318*	0.872**	-0.892**	-0.843**	-0.143 ns	-0.189 ns
no. of seeds/plant			0.945**	0.848**	0.990**	-0.305*	0.839**	-0.867**	-0.814**	-0.093 ns	-0.148 ns
Seed yield/plant				0.967**	0.977**	-0.195ns	0.691**	-0.745**	-0.700**	0.027 ns	0.006 ns
Seed index					0.912**	-0.166 ns	0.601**	-0.668**	-0.615**	0.080 ns	0.092 ns
Seed yield/fed.						-0.281 ns	0.803**	-0.842**	-0.787**	-0.035 ns	-0.094 ns
Moisture							-0.481**	0.535**	0.549**	0.619**	-0.279 ns
Oil content								-0.987**	-0.949**	-0.297*	-0.372*
Crude protein									0.969**	0.321*	0.208 ns
Crude fiber										0.314*	0.160 ns
Ash											-0.243 ns

*, ** and ns significant at 0.05, 0.01 levels of probability and not significant at 0.05 level of probability, respectively.

Also, a significant and positive correlation coefficient was obtained between seed yield/fed. and oil content (r = 0.808), where a significant negative correlation coefficient was found between seed yield/fed. and each of crude protein (r = -0.842) and crude fiber (r = -0.787) and its relations were insignificant and negative with moisture, ash and total carbohydrate. Moisture showed positive and highly significant correlative crude protein (r = 0.535), crude fiber (r = 0.549) and ash (r = 0.619), but it was negative and highly significant with oil content (r = -0.481) and negative and insignificant with total carbohydrate.

As expected the simple correlation was significant and negative between oil content and each of crude protein (r = -0.984), crude fiber, (r = -0.949), ash (r = -0.297) and total carbohydrate (r = -0.372). The relationship between crude protein and both crude fiber (r = 0.969) and ash (r = 0.321) were positive and significant, but it was positive and insignificant with total carbohydrate. Crude fiber showed positive and significant correlation with ash (r = 0.314), but it was insignificant correlation with carbohydrate. Ash showed negative and insignificant with carbohydrate. These results are in agreement with those obtained by Rai *et al.* (1990), El-Nakhlawy (1995) and Kineber and El-Sayed (2004). It may be concluded from the results of the present performance of the twelve flax genotypes under investigation that varietal differences are important to be know for improving the flax genotypes by introduction of new varieties with high seed oil percentage and quality or by recombination in a breeding program.

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مقارنة المحصول ومكوناته والصفات الطبيعية والتركيب الكيماوى لبذور اثنى عشر تركيبه وراثية من الكتان

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أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بسخا موسمى ٢٠٠٦/٢٠٠٧ ، ٢٠٠٧/٢٠٠٨م حيث اشتملت كل تجربة على ١٢ تركيبة وراثية من الكتان جيزه ٦ ، جيزه ٨ ، سخا١ ، سخا ٢ (ثنائية الغرض) ، بلينكا ، اسكالينا ، ايلونا ، سخا ٣ ، سخا ٤ ، السلالة ١١٣ (ليفية الغرض) ، السلالة ١٦ ، والسلالة ٢٢ (زيتية الغرض) بهدف مقارنة صفات محصولى القش والبذور ومكوناتهما والصفات الطبيعية والتركيب الكيماوى للبذور بالإضافة إلى علاقات التلازم بين المحصول وبعض الصفات الأخرى.

وأوضحت الدراسة ما يلى:

- وجود اختلافات معنوية بين الأصناف والسلالات وكل الصفات التى تم دراستها وقد سجل الصنف المستورد اسكالينا أعلى القيم فى الطول الفعال بينما أظهرت السلالة ٢٢ أعلى القيم لصفات قطر الساق ، طول الجزء الثمرى ، عدد كبسولات/نبات ، وعدد بذور/نبات ، بينما كان الصنف سخا ٢ أعلى التراكيب الوراثية فى محصول البذور/نبات وللفدان والعكس أظهرت السلالة ١١٣ أقل القيم فى محصول البذور/فدان كما كان الصنف سخا ١ الأكثر تفوقا فى محصول القش/نبات وللفدان.
- بمقارنة الصفات الطبيعية للتراكيب الوراثية للكتان التى تم دراستها وجد أن جيزه ٦ ، سخا ١ ، السلالة ١٦ ، والسلالة ٢٢ هى الأعلى فى قيم طول وعرض وسمك البذور بينما أظهر الصنف سخا ٢ أعلى القيم لحجم ١٠٠٠ بذرة (سم^3) وقد أعطى الصنف ايلونا أكبر القيم فى الكثافة النسبية (جم/سم^3).
- أعلى قيم المحتوى الرطوبى والرماد كانت فى بذور السلالة ١٦ بينما أعطيت السلالة ٢٢ أعلى القيم لمحتوى البذور من الزيت بينما أظهر الصنف المستورد بلينكا أعلى القيم للبروتين ، والألياف والكربوهيدرات ، فى حين أن بذور السلالة ٢٢ أعطت أقل قيم للمحتوى البروتينى والألياف الخام.
- لوحظ أنه توجد علاقة معنوية موجبة بين محصول البذور/فدان وطول الجزء الثمرى وعدد كبسولات/نبات وعدد بذور/نبات ووزن ١٠٠٠ بذرة وأنه توجد علاقة معنوية سالبة بين البروتين الخام ومحصول البذرة ومكوناتها ومحتوى البذور من الزيت.