EVALUATION OF SOME FLAX GENOTYPES FOR SEED AND OIL YIELDS AND QUALITY

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Abstract

Sowing oil flax genotypes became a vital target for Egypt to meet the increasing demand for flax seed and oil for edible use and industrial purposes. This investigation was carried out at Sakha Agric. Res. Station during 2008/2009 and 2009/2010 seasons to evaluate 12 flax genotypes, namely Sakha1, Sakha3 and Giza 9 (local varieties), Eriana, Sofia, Sosana and Marlin (imported varieties) along with the promising strains 541/C/3, 541/D/10, 2467/1, 2419/1 and strain 22, for seed and oil yields and their related quality characteristics. Results showed significant differences among the studied flax genotypes in all traits. The new promising strain 22 gave the highest values for no. of capsules/plant, no. of seeds/plant, seed yield/plant, seed yield/fed (890.3 kg) and oil yield/fed (428.5 kg). However, the imported variety Marlin gave the lowest value for seed yield/plant, seed index, seed yield/fed. (315.9 kg) and oil yield/fed. (119.8 kg). The oil content of flaxseed ranged from 34.39% (Sosana variety) to 48.17% in strain 22, and protein content ranged from 16.62% (strain 22) to 23.22% in Sofia variety. Specific gravity of flaxseed oil ranged from 0.917 for Sakha1 to 0.927 for Sofia variety, while unsaponifiable matter (%) ranged from 0.904% for strain 22 to 1.501% for Sofia variety. On the other hand, Eriana had the highest acid and peroxide values (2.764 and 1.948), while strain 22 had the lowest values (0.540 and 0.451). Saponification value ranged from 189.6 for Sakha1 to 195.8 for Sofia variety, while iodine value ranged from 173.5 for strain 22 to 198.0 for Sofia variety. The percentage of saturated fatty acids (Palmitic and stearic) of flaxseed oil ranged from 9.64% for Marlin to 15.60% for strain 22. Sofia variety had the lowest oleic acid content (16.70%), while S.541/C/3 was the highest in this trait (22.28%). Linoleic acid content ranged from 13.33%, for Eriana to 20.36% for S.541/C/3, lenolenic acid ranged between 43.61% for S.541/C/3 and 58.19% for Eriana variety. Simple correlation coefficients showed that seed yield, oil yield and oil% and each of saponification value, palmitic, stearic, oleic and linoleic acids were significantly and positively correlated, but negatively correlated with protein%, iodine value and lenolenic acid. Highly significant and negative correlation between protein and oil contents (r =-0.770). Oleic acid was significantly and positively correlated with linoleic acid (r = 0.620), but negatively correlated with linolenic acid (r =-0.582). Linolenic acid was significantly and positively correlated with iodine value (r =0.918). As a conclusion, strain 22 proved to be superior in seed and oil yields with better quality. It would released as a new oil flax variety.

Keywords: Flax genotypes, Oil and protein contents, Oil properties, Fatty acids

INTRODUCTION

Flax (*Linum usitatissimum* L.) is a dual purpose crop that is grown for fiber and oil production. In Egypt the area allocated for flax production decreased during the last two decades, resulting in a gap between production and consumption. So huge amount of flax seed is imported to meet the increasing demand for edible and industrial purposes. To minimize such a gap, there is a necessity to increase seed yield per unit area of land through planting the high yielding, flax seed genotypes parallel with adopting optimal cultural practices.

Many investigators obtained higher levels of varietal differences in seed yield and its related traits. Dubey (2001), El-Kady and Abd El-Fatah (2009) and El-Kady *et. al.* (2010), stated that flax genotypes significantly differed in seed yield and its related traits.

Bajpai *et. al.* (1985), Adugna and Labuschagne (2003), Morris (2007) and Ibrahim (2009) found that oil content ranged from 32.9 to 50.0%, while protein content of flaxseed represented about 10-24.9% on a whole seed basis. Kochhar (2002) and Abou Zaid and Ghaly (2008) reported that specific gravity at (20 ^{0}C) in flaxseed oil ranged from 0.927 to 0.932, unsaponifiable matter 1.5%, iodine value 170 to 203 and saponification value 188 to 196.

Flaxseed oil is used primarily as a drying oil in paints, varnishes, oil clothing, printer ink and pharmaceutical applications. It contains a relatively high content of linolenic acid from 12 to 72% of total fatty acids, Salama et al. (1996), Siemens and Daun (2005) and Abou Zaid and Ghaly (2008).

Adugna and Labuschagne (2003) found significant negative associations between oil and protein contents, iodine value and stearic acid, iodine value and oleic acid and between oleic and linolenic acids. However, only iodine value showed a significant positive link with linolenic acid. Linoleic acid showed significant negative correlation with linolenic acid.

The present study was conducted to evaluate some flaxseed genotypes for seed yield and its related traits, oil and protein contents, oil properties and fatty acid composition of oil.

MATERIALS AND METHODS

The present investigation was carried out at Sakha Agric. Res. Station, Kafr El-Sheikh Governorate, ARC, Egypt during the two successive seasons of 2008/2009 and 2009/2010 to evaluate twelve flax genotypes, for seed and oil yields and quality. These genotypes were:

Sakha1 : a dual purpose type selected from cross Bombay x I.1485 (local variety)

Sakha3 : a fiber purpose type, selected from cross Belinka 2E x I.2096 (local variety).

Giza9 : a fiber purpose type, selected from cross S20/140/S/10 x Bombay (local variety).

Eriana : a fiber purpose type, imported variety from Belgium

Sofia : a fiber purpose type, imported variety from Holland.

Sosana : a fiber purpose type, imported variety from Holland.

Marlin : a fiber purpose type, imported variety from Holland.

S.541/C/3 : a dual purpose type selected from cross Giza 8 x S2419/1 (promising).

S.541/D/10 : an oil purpose type selected from cross S.2419/1x148/6/1 (promising).

S.2467/1 : an oil purpose type, selected from Hira 17134-1 India (promising).

S.2419/1 : an Oil purpose type, selected from I. Humpata Hungary (promising).

S.22 : an oil purpose type, selected from cross I.370xI.2561 (promising).

The five promising strains used in this study were selected from the breeding materials of Fiber Crops Res. Dep. as a part of the breeding program to develop new flax varieties.

The experiments were laid out in a randomized complete block design, with four replications. Seeds of all flax genotypes were sown on Nov. 12th and 15th in 2008 and 2009 seasons, respectively. Each plot included 12 rows, 4 m long and 12.5 cm apart. Plot size was 6 m^2 (1.5m x 4m). The conventional cultural practices for flax at North Delta Region were applied.

At maturity, a sample of ten representative plants was taken at random from each plot to determine seed yield and its related traits, viz., upper branching zone length (cm), number of capsules/plant, number of seeds/plant, number of seeds/capsule, seed yield/plant (g) and seed index as a weight of 1000-seeds (g). After harvest, the seed yield per plot was recorded and, then converted into seed yield/fed. (kg). Oil yield kg/fed. was estimated by multiplying seed yield kg/fed x oil percentage.

Chemical analysis:

Seed samples were taken at random from each plot and grounded to fine powder to pass through 2 mm mesh for chemical analysis, i.e., oil content and crude protein content according to procedures outlined in A.O.A.C. (1990).

Solvent extraction was used for extracting oil from flaxseeds using petroleum ether 40-60 °C in Soxhlet apparatus, the method described in the A.O.A.C. (1990).

Oil analysis:

Oil properties, i.e. specific gravity, unsaponifiable matter (%), acid value, peroxid value, saponification value and iodine value were determined according to the method described in the A.O.A.C. (1990).

Determination of fatty acids by Gas Liquid Chromatographic (GLC):

Flaxseed oil were saponified according to the method outlined by A.O.A.C. (1990), the liberated fatty acids were methylated according to Stahl (1965) then methyl esters fatty acids were identified by using Gas Liquid Chromatographic technique (GLC).

The data were statistically analyzed for each season and the homogeneity of experimental error, of 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. Seed yield and its related characteristics:

Mean values of seed yield and its related characteristics for flax genotypes from the combined analysis over two seasons are given in Table 1. The analysis of variance revealed significant differences among means of the twelve flax genotypes for upper branching zone length, no. of capsules/plant, no. of seeds/plant, no. of seeds/capsule, seed yield/plant, seed index, seed yield/fed. and oil yield/fed.

Flax variety Sofia showed the highest mean value for upper branching zone length (17.35 cm), followed by strain 22 (14.29 cm), while S22 gave the highest mean values for no. of capsules/plant (8.28) and for no. of seeds/plant (56.44). On the other hand, Eriana variety and S.541/C/3 ranked the lowest (4.08) and (23.28), respectively.

It could be noticed from Table 1 that Sakha 3 variety gave the highest mean value for no. of seeds/capsule (7.17), followed by strain 22 (6.99). On the other hand, S.541/D/10 achieved the highest estimates of seed yield/plant (0.407 g), seed index (11.39 g), while strain 22 was superior for seed yield/fed. (890.3 kg) and oil yield/fed. (428.5 kg), followed by S.541/D/10 (857.0 kg) and (354.2 kg), respectively. Meanwhile, the lowest estimates were obtained by Marylin variety in seed yield/fed. (315.9 kg) and Sosana variety in oil yield/fed. (111.7 kg). The superiority of such genotypes may be due to the high values of some related characters i.e. no. of capsules per plant, no. of seeds/plant and seed yield/plant. The differences between the tested flax genotypes could mainly be attributed to the differences in their

genetical constitution and their different response to the environmental conditions. Dubey (2001), Kineber and El-Kady (2002), Kineber and El-Sayed (2004), El-Kady and Abd El-Fatah (2009) and El-Kady *et al.* (2010) reported varietal differences in their studies for seed yield and its components.

2. Oil and Protein contents and oil properties:

Mean values for oil and protein contents as well as oil properties of flax genotypes overall 2008/2009 and 2009/2010 seasons are shown in Table 2. Significant differences in all traits among flax genotypes were found which exhibit wide variability in most parameters.

Concerning oil content (Table 2), strain 22 gave the highest mean value of seed oil content (48.17%), followed by S.2467/1 and S. 541/D/10, 41.56% and 41.38% respectively. On the other hand imported varieties Sosana and Sofia gave the lowest oil content, 34.39% and 36.87%, respectively. Crude protein content ranged between 16.62% for strain 22 and 23.22% for Sofia variety. Similar differences in oil and protein contents of flaxseed genotypes, ranging from 32.67% to 50.0% and from 10.0% to 24.9%, respectively, were reported by Kineber and El-Sayed (2004), Morris (2007), El-Kady and Abd El-Fatah (2009).

Oil quality data are presented in Table 2. The imported variety Sofia recorded the highest values of specific gravity and unsaponifiable matter 0.927 and 1.501%, respectively, while S2467/1 had the lowest value for the specific gravity (0.915) and strain 22 for the unsaponifiable matter (0.904%).

Flaxseed oil extracted from imported variety Eriana represented the highest contents of acid value (2.764) and peroxide value (1.948), while strain 22 oil was the lowest in both properties recording 0.540 and 0.451, respectively.

It is worthy to mention that saponification value gives an idea about the nature of the chain length of fatty acids. The data revealed that the saponification value of flaxseed oil ranged between 189.6 and 195.8 for Sakha1 and Sofia varieties, respectively.

Iodine number of oil is an indicator of its drying ability and it expresses the magnitude of the unsaturated fatty acid content in flaxseed oil. Data in Table 2, show that the iodine value of flaxseed oil ranged from 173.5 for strain 22 to 198.0 for Sofia variety. The results of oil properties agreed with those obtained by El-Kady (1995), El-Nakhlawy (1987 and 1995), Kenaschuk and Rashid (1999), Kochhar (2002) and Abou Zaid and Ghaly (2008).

Table 1 . Mean values of seed and oil yields and yield components of tested flax genotypes; combined data of 2008/2009 and 2009/2010 seasons.

Variables / Genotype	Upper branching zone length, cm	No. of capsules/plant	No. seeds/plant	No. of seeds/capsule	Seed yield/plant, g	Seed index, g	Seed yield/fed., kg	Oil yield/fed., Kg
Sakha1	10.66 d	4.18 e	26.19 d	5.89 de	0.220 cd	8.35 b	593.2 de	243.0 d
Sakha3	6.64 f	3.51 ef	25.18 d	7.17 a	0.146 e	6.25 d	468.4 f	180.9 f
Giza 9	9.00 e	2.70 f	16.25 f	6.20 cd	0.118 ef	7.21 c	543.1 e	210.8 e
Eriana	12.76 c	4.08 e	25.79 d	6.46 bed	0.161 de	5.68 e	401.3 fg	159.4 fg
Sofia	17.35 a	5.44 cd	32.36 bc	6.12 cde	0.138 ef	4.01 f	367.2 gh	135.3 gh
Sosana	14.63 b	6.93 b	34.70 b	6.66 abc	0.127 ef	4.08 f	324.8 h	111.7 h
Marlin	9.14 e	2.83 f	18.83 ef	6.67 abc	0.077 f	4.19 f	315.9 h	119.8 h
541/C/3	13.55 bc	5.46 cd	23.28 de	4.55 g	0.270 bc	11.20 a	640.1 cd	250.5 d
541/D/10	12.71 c	6.09 c	36.74 b	5.85 de	0.407 a	11.39 a	857.0 a	354.2 b
2467/1	13.49 bc	6.94 b	34.20 b	4.98 fg	0.299 b	8.61 b	722.8 b	300.3 c
2419/1	12.53 c	5.08 d	27.35 cd	5.50 ef	0.236 c	8.83 b	676.3 bc	269.5 d
Strain 22	14.29 b	8.28 a	56.44 a	6.99 ab	0.379 a	6.61 d	890.3 a	428.5 a
General mean	12.23	5.13	29.78	9.09	0.215	7.20	525.0	203.7

Means designated by the same letter in each column are not significantly different at 5% level according to Duncan's Multiple Range Test.

Table 2 . Mean values for seed oil content, protein content and oil properties of studied flaxseed genotypes; combined data of 2008/2009 and 2009/2010 seasons.

Genotype	Oil %	Crude protein%	Oil properties					
			Specific gravity	Unsaponifiable matter%	Acid value	Peroxid value	Saponification value	Iodine value
Sakha1	40.96 b	19.02 g	0.917 de	1.080 ef	1.218 f	0.679 g	195.8 a	177.3 g
Sakha3	38.54 de	19.90 def	0.922 bc	1.254 cd	0.736 g	0.481 i	192.3 cd	182.7 f
Giza 9	38.81 d	19.60 efg	0.924 ab	1.044 f	1.471 d	0.973 e	191.5 de	184.9 e
Eriana	38.59 de	20.60 cd	0.920 cd	1.279 bc	2.764 a	1.948 a	189.9 f	197.9 a
Sofia	36.87 f	23.22 a	0.927 a	1.501 a	1.870 b	1.860 b	189.6 f	198.0 a
Sosana	34.39 g	21.85 b	0.927 a	1.334 b	1.545 c	1.383 d	190.8 ef	188.9 c
Marlin	37.94 e	21.06 bc	0.922 bc	1.229 cd	1.595 c	1.561 c	190.0 f	194.3 b
541/C/3	39.15 d	19.26 fg	0.919 cd	1.215 d	1.161 f	0.604 h	193.9 b	177.3 g
541/D/10	41.38 b	20.54 cd	0.924 ab	1.124 e	1.359 e	0.909 f	190.8 ef	185.2 e
2467/1	41.56 b	20.31 cde	0.915 e	0.930 g	1.451 d	0.940 ef	192.7 c	185.8 d
2419/1	39.87 c	20.11 def	0.923 ab	1.040 f	0.796 g	0.605 h	193.9 b	182.8 f
Strain 22	48.17 a	16.62 h	0.925 a	0.904 g	0.540 h	0.451 i	195.7 a	173.5 h
General mean	39.69	20.17	0.922	1.161	1.376	1.033	192.2	185.7

Means designated by the same letter in each column are not significantly different at 5% level according to Duncan's Multiple Range Test.

3. Fatty acid composition:

The analysis of fatty acid composition presented in Table 3 revealed that flax genotypes differed significantly in their contents of all tested fatty acids. The percentage of total saturated fatty acids (plamitic and stearic) ranged from 9.64% for Marlin variety to 15.60% for strain 22. The decrease in saturated fatty acid content in flaxseed oil usually is more preferable, beside the increase in unsaturated ones, due to suitability of the former oil in painting industry.

Table 3 . Identified fatty acids of studied flaxseed genotypes oil; combined data of 2008/2009 and 2009/2010 seasons.

Fatty acid composition / Genotype	Palmitic (16:0)%	Stearic (18:0)%	Oleic (18:1)%	Linoleic (18:2)%	Linolenic (18:3)%	Total Sat.%	Total unsat%
Sakha1	8.54 a	6.21 b	21.63 b	18.61 c	45.00 j	14.75 b	85.24 k
Sakha3	6.74 f	5.19 g	20.82 d	18.51 d	48.75 h	11.93 g	88.08 f
Giza 9	6.55 g	4.82 h	20.32 h	18.13 e	50.17 e	11.37 h	88.62 e
Eriana	5.69 k	4.59 j	18.20 j	13.33 l	58.19 a	10.28 j	89.72 c
Sofia	6.04 j	3.72 k	16.70 k	15.82 k	57.73 b	9.76 k	90.25 b
Sosana	6.39 h	4.72 i	20.63 e	16.50 j	51.76 d	11.11 i	88.89 d
Marlin	6.23 i	3.41 l	18.21 j	17.56 g	54.59 c	9.64 k	90.36 a
541/C/3	8.07 b	5.68 c	22.28 a	20.36 a	43.61 l	13.75 c	86.25 j
541/D/10	7.37 d	5.44 d	20.28 i	17.32 h	49.59 g	12.81 e	87.19 h
2467/1	7.09 e	5.38 e	20.53 f	16.93 i	50.07 f	12.47 f	87.53 g
2419/1	7.68 c	5.36 f	20.98 c	17.65 f	48.33 i	13.04 d	86.96 i
Strain 22	8.61 a	6.99 a	20.35 g	19.64 b	44.40 k	15.60 a	84.39 l
General mean	7.08	5.13	20.08	17.53	50.18	12.21	87.79

Means designated by the same letter in each column are not significantly different at 5% level according to Duncan's Multiple Range Test.

Furthermore, the unsaturated fatty acids, namely, oleic, linoleic and linolenic acids, form the principal components of the flaxseed oil, where they represented 84.39% for strain 22 to 90.36% for Marlin variety. In fact, oil properties, beside the industrial uses, of flaxseed oil depend upon these unsaturated fatty acids. Oleic acid content ranged from 16.70% for Sofia variety to 22.28% for S.541/C/3.

Concerning lionleic (18: 2) and linolenic (18: 3) acids, Table 3 further reveals that linoleic acid content ranged from 13.33% for Eriana to 20.36% for S.541/C/3, while linolenic acid ranged from 43.61% for S.541/C/3 to 58.19% for Eriana. The other flax genotypes gave intermediate mean values. These results indicate that the ranges of the last two acids percentages and the significant differences among the flax genotypes, under study, might give the flax breeders an advantage for selecting flax genotypes having better oils for either edible or industrial purposes. In this study,

it was obvious that both S.541/C/3 and strain 22 flax genotypes had the highest linoleic and the lowest linolenic acid values, respectively. Consequently, it can be stated that these two genotypes might provide a good breeding material for converting flax oil composition ratios that favour the production of edible oil. On the other hand, imported varieties Eriana, Sofia and Marlin, had higher contents of linolenic acid (54.59%, 57.73% and 58.19%, respectively) such high linolenic acid contents of the imported varieties made them favourable for paint and varnish industries. These results are in agreement with those obtained by El-Kady (1995), El-Sweify *et. al.* (2003), Siemens and Daun (2005) and Abou Zaid and Ghaly (2008).

4. Correlation coefficients:

Simple correlation coefficient (r-values) among the studied traits. Table 4 show that highly significant positive correlations were detected between seed yield/fed., oil yield/fed. and oil % and each of saponification value, palmitic, stearic, oleic and linoleic acids. However, such correlation was highly significant and negative with protein %, iodine value and linolenic acid.

The simple correlation was highly significant and negative between each of protein % and iodine value with saponification value, palmitic, stearic, oleic and linoleic acids, however, with linolenic acid this correlation was positive and significant r = 0.655 and r = 0.918, respectively.

The associations of saponification value with the palmitic, stearic, oleic and linoleic acids were significant positive while with linoelic acid was significant negative. Besides, the simple correlation was positive and highly significant between palmitic acid and stearic, oleic and linoleic acids, while such correlation was highly significant and negative with linolenic acid.

Table 4 further reveals that stearic acid was highly significant and positively correlated with oleic and linoleic acids r = 0.610 and 0.671, respectively, and not significantly correlated with linolenic acid. In addition, oleic and linoleic acids were negatively and highly significantly correlated with linolenic acid r = -0.582 and r = -0.503, respectively. On the other hand, the oleic acid content was highly significantly and positively correlated with linoleic acid r = 0.620. This kind of association reported herein supports the evidence for the possibility of selecting genotypes characterized with high seed yielding ability, high oil and protein contents and good quality of oil properties.

Such results, on the simple correlation, are in accordance with those reported by Naqvi *et. al.* (1987) El-Nakhlawy (1995), El-Hariri *et. al.* (2002), Adugna and Labuschagene (2003).

Table 4 . Simple correlation coefficients between seed and oil yields and its quality properties; combined data of 2008/2009 and 2009/2010 seasons.

Trait	Oil yield/fed. kg	Oil %	Protein %	Iodine value	Saponification value	Palmitic acid%	Stearic acid%	Oleic acid%	Linoleic acid	Linolenic acid%
Seed yield/fed. kg	0.985*	0.803**	-0.615**	-0.685**	0.566**	0.382**	0.424**	0.332**	0.333**	-0.590**
Oil yield/fed. kg	-	0.884**	-0.676**	-0.690**	0.588**	0.389**	0.441**	0.295**	0.333**	-0.579**
Oil %	-	-	-0.770**	-0.628**	0.608**	0.388**	0.431**	0.196*	0.336**	-0.505**
Protein %	-	-	-	0.782**	-0.717**	-0.389**	-0.442**	-0.404**	-0.420**	0.655**
Iodine value	-	-	-	-	-0.828**	-0.491**	-0.464**	-0.613**	-0.613**	0.918**
Saponification value	-	-	-	-	-	0.543**	0.518**	0.477**	0.534**	-0.693**
Palmitic acid%	-	-	-	-	-	-	0.907**	0.635**	0.821**	-0.276**
Stearic acid %	-	-	-	-	-	-	-	0.610**	0.671**	-0.176^{NS}
Oleic acid %	-	-	-	-	-	-	-	-	0.620**	-0.582**
Linoleic acid %	-	-	-	-	-	-	-	-	-	-0.503**

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

NS = Not significant at 0.05 level of probability.

Conclusion:

The present study emphasized the behaviour of the tested flax genotypes with respect to seed yield and its related traits, seed oil and protein contents, oil properties and the fatty acid composition of flaxseed oil. The obtained results suggest that, strain 22 was the superior in seed and oil yields and quality, that it could be released as a new oil flax variety. Also, S541/C/3 followed by S22 could be good breeding materials to improve the quality of flax oil for edible consumption.

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تقييم بعض التراكيب الوراثية للكتان لمحصولى البذرة والزيت وجودتهما

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أصبحت زراعة التراكيب الوراثية الزيتية للكتان أمرا حيويا لسد الاحتياجات المتزايدة من بذور وزيت الكتان بمصر وذلك للاستخدام الغذائى والأغراض الصناعية.

أجريت هذه الدراسة بمحطة البحوث الزراعية بسخا موسمى ٢٠٠٨/٢٠٠٩ ، ٢٠٠٩/٢٠١٠م بهدف تقييم أثنى عشر تركيبة وراثية من الكتان وهى ثلاثة أصناف محلية (سخا ١ ، سخا ٣ ، جيزه ٩) ، وأربعة أصناف مستوردة (أيريانا ، صوفيا ، سوزانا ، مارلين) وخمس سلالات مبشرة (٥٤١/ج/٣ ، ٥٤١/د/١٠ ، ١/٢٤٦٧ ، ١/٢٤١٩ ، س ٢٢) من حيث محصولى البذرة والزيت والصفات المتعلقة بجودتها.

ولقد أظهرت النتائج ما يلى:

لوحظ أن هناك اختلافات معنوية بين التراكيب الوراثية للكتان لكل الصفات التى درست وقد أعطت السلالة المبشرة س ٢٢ أعلى القيم لعدد الكبسولات/النبات وعدد بذور النبات ووزن بذرة/النبات ومحصول البذور/فدان (٨٩٠,٣ كجم) ومحصول الزيت/فدان (٤٢٨,٥ كجم) بينما أظهر الصنف المستورد مارلين أقل القيم لمحصول البذور/نبات ووزن ١٠٠٠ بذرة ومحصول البذور/فدان (٣١٥,٩كجم) ومحصول الزيت/فدان (١١٩,٨كجم).

أظهرت النتائج أن محتوى البذور من الزيت تراوح بين ٣٤,٣٩% للصنف المستورد سوزانا ، ٤٨,١٧% للسلالة المبشرة س ٢٢ وتراوحت النسبة المئوية للبروتين بين ١٦,٦٢% للسلالة ٢٢ ، ٢٣,٢٢% للصنف المستورد صوفيا. وتراوحت قيم الكثافة النوعية بين ٠,٩١٧ للصنف سخا ١ الى ٠,٩٢٧ للصنف صوفيا بينما تراوحت النسبة المئوية للمواد غير المتصبنة من ٠,٩٠٤ للسلالة ٢٢ الى ١,٥٠١ للصنف صوفيا ومن الناحية الأخرى أظهر الصنف أيريانا أعلى القيم لرقم الحموضة ورقم البيروكسيد (٢,٧٦٤ ، ١,٩٤٨) ، بينما أعطت السلالة ٢٢ أقل القيم (٠,٥٤٠ ، ٠,٤٥١) ــ ورقم التصبن ما بين ١٨٩,٦ للصنف سخا١ إلى ١٩٥,٨ للصنف صوفيا بينما تراوحت قيم الرقم اليودى ما بين ١٧٣,٥ للسلالة ٢٢ إلى ١٩٨,٠ للصنف صوفيا.

وقد تراوحت النسبة المئوية للأحماض الدهنية المشبعة (بالمتيك واستياريك) لزيت الكتان ما بين ٩,٦٤ للصنف المستورد مارلين الى ١٥,٦٠% للسلالة ٢٢ ، وأعطى الصنف صوفيا أقل نسبة لحماض الأوليك (١٦,٧٠%) بينما أعطت السلالة ٥٤١/جـ/٣ أعلى نسبة لهذا الحامض (٢٢,٢٨%). وقد تراوحت نسبة حامض اللينوليك ما بين ١٣,٣٣% للصنف إريانا إلى ٢٠,٣٦% للسلالة ٥٤١/جـ/٣ ، فى حين تراوح المدى لنسبة حامض اللينولينيك ما بين ٤٣,٦١% للسلالة ٥٤١/جـ/٣ ، ٥٨,١٩% للصنف إيريانا.

وقد أوضحت معاملات الارتباط البسيط بين محصول البذور ، محصول الزيت ، النسبة المئوية للزيت وكل من رقم التصبن وأحماض البالمتيك ، والأستياريك ، الأوليك ، واللينوليك والتى كانت معنوية وموجبة بينما كانت معنوية وسالبة لكل من النسبة المئوية للبروتين والرقم اليودى والنسبة المئوية لحامض اللينولينك ، فى حين كان معامل الارتباط بين نسبتى الزيت والبروتين عالى المعنوية وسالب الاتجاه بقيمة تساوى -٠,٧٧٠ وكان معامل الارتباط بين حامض الأوليك وحامض اللينوليك معنويا وموجبا وقيمته تساوى ٠,٦٢٠ وكان معنويا وسالب الاتجاه مع حامض اللينولينك بقيمة تساوى -٠,٥٨٢ وكان معامل الارتباط بين كل من نسبة حامض اللينولينك والرقم اليودى عالى المعنوية جدا وموجب الإتجاه بقيمة تساوى ٠,٩١٨.

ونظرا لتفوق السلالة ٢٢ فى محصولى البذرة والزيت وجودتهما فإنه يوصى بتسجيلها كصنف كتان زيتى.