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RESPONSE OF SOME FLAX GENOTYPES TO DIFFERENT NITROGEN FERTILIZATION LEVELS IN NEWLY RECLAIMED SANDY SOIL

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ABSTRACT

Two field experiments were carried out at Ismailia Agric. Res. station Agric. Res. Center, Egypt, during the two seasons of 2000/2001 and 2001/2002 to study response of yield, yield components and fiber properties of seven flax genotypes to N levels in newly reclaimed soil. A spit plot design with four replications was used with varieties (Sakha 1, Sakha 2, S.329/2/18/7, S.402/3/5/10, S.402/21/20/3, Ariane and S.288/37/14/8) as main plots, whereas nitrogen levels (50,65 and 80 kg/fad) as sub plots in both seasons. The results obtained could be summarized as follows:

1- Flax strain (402/3/5/10) gave the highest plant height, technical length. Sakha 1 variety gave the highest straw yield per plant and per faddan while Sakha 2 variety gave the highest number of capsules/plant, seed yield/plant seed index, oil percentage and oil yield per faddan. On the other hand, Ariane ranked the first for fiber yield/faddan, fiber percentage and fiber fineness. However, it gave the lowest seed index, oil percentage and oil yield per faddan.

2-The highest straw yield/fad was obtained by applying 80 kg N/fad to sakha1 in addition, the highest seed yield per faddan oil yield/fad was obtained by applying 80 kg N/fad to Sakha 2, while the highest fiber yield/ faddan was obtained from 80 kg N/faddan with Ariane. The highest value of fiber fineness resealed from 50 kg N/faddan with Ariane.

3- Straw y ield / plant was significantly and positively correlated with each of seed yield /plant and oil percentage. Also, a significant positive correlation between seed yield /plant with number of capsules/plant, 1000-seed weight and oil percentage was recorded. These results indicated that maximization of could be achiveded by selection for these traits: (number of capsules/plant and seed index). Concerning fiber length data showed significant positive correlation with technical length. Seed index showed positive correlation with oil percentage. On the other hand, fiber fineness was significantly and negatively correlated with each of oil percentage and straw yield /plant.

Key words: Flax, Nitrogen fertilization, reclaimed sandy soil.

INTRODUCTION

Flax (*Linum usitatissimum,* L.) ranks second after cotton in the production of fibers and oil in Egypt. The extension of flax cultivation in Egypt is hambered by several factors. During the winter season the land is occupied by wheat, berseem, fababean ...etc, which need to be cultivated in best soil. Therefore, the most probable way to increase flax production may be through the use of new developed varieties of high yield potential along with application of the best agronomic practices among which nitrogen fertilization plays an important role in increasing yield of flax.

Varietal differences among flax varieties has been studied by many investigators. Mourad *et al.* (1990) and Mostafa (1994). They found that

significant differences among genotypes of flax in straw yield/plant, plant height, technical length, number of capsules per plant and seed yield/plant and per feddan. El-Shimy *et al.* (1997), evaluated fourteen flax genotypes and Mostafa *et al.* (1998) evaluated five flax genotypes. They found that significant differences among the test genotypes in seed yield, straw yield and oil yield as well as their components. Zahana *et al.* (2003) tested flax varieties i.e.,sakha1, Bombay and Belinka. They found that Belinka variety (fiber type) significantly surpassed the other varieties in fiber percentage, fiber fineness and fiber yield/fed. They also found that significant differences among the tested varieties in seed and oil yields/fed and their components.

Concerning the effect of nitrogen fertilization. Momtaz *et al.* (1981) and Hella *et al.* (1988) noticed that increasing nitrogen level up to 144 kg/ha increased total plant height, straw yield per plant and per feddan, fiber yield per faddan, fiber length, fiber percentage, number of capsules / plant, seed index and seed yield per plant and per faddan, while fiber fineness was decreased as N level was increased. El Nimr (1997) reported that increasing nitrogen level from 45 to 70 kg N/ faddan caused a significant increase in yield of straw, seed and fiber/fed and their components. On the other hand, fiber fineness was decreased. Along with the aforementioned results El-Azouni (1998) in sandy soil reported similar results when N level was increased from 60 to 90 kg/faddan. Badwal *et al.* (1971) obtained that positive correlation coefficients between seed yield and each of capsules number, 1000 - seed weight. They also indicated that capsules number and 1000-seed weight were the most important yield components and the best criteria for selecting high yielding lines in linseed. Younan (1974) concluded that seed and straw yield in flax could be improved by selecting for capsules number and plant height. Satapathi *et al.*,(1987) reported that number of capsules/plant, seeds/capsule and seed weight showed positive correlation with seed yield. Mishra and Singh (1992) showed that seed yield was positively correlated with number of capsules/plant and 1000-seed weight. The main objectives of this study was to study the response of seven flax varieties to nitrogen levels in sandy soil.

MATERIALS AND METHODS

Two field experiments were carried out at Ismailia Agricultural Research station, Agricultural Research Center, Egypt, during the two seasons of 2000/2001 and 2001/2002 to study yield response and fiber properties of seven flax genotypes to N levels in newly reclaimed soil (sandy soil). A spit plot design with four replications was used with varieties (Sakha 1, Sakha 2, S.329/2/18/7, S.402/3/5/10, S.402/21/20/3, Ariane and S.288/37/14/8) as main plots and nitrogen levels (50,65 and 80 kg/fad) as sub plot. In both seasons the sub plot size was 3x3 meters (9 m^2). Nitrogen fertilizer was applied in the form of ammonium sulphute (20.5 % N) and was added at six doses at two weeks intervals the first dose was applied at sowing. Flax was sown on November 13 and 15 in the first and second season, respectively. Flax seeds were drilled in rows 20 cm apart at the rate of 60 kg. /fed. Other cultural practices were followed as usual. The soil type was sandy soil with coarse sand 74.00 and 74.87%, fine sand 35.11 and

35.75%, silt 3.44 and 4.22%, clay 2.52 and 2.49%, organic matter of 0.05 and 0.45 %, available nitrogen 6.81 and 6.51 ppm and pH value of 7.41 and 7.21 in the first and second seasons, respectively.

At full maturity ten guarded plants were taken at random from each plot to study the following treats:

I- Yield and its related characters:

1- Plant height (cm) 2-Technical stem length (cm)
3- Fruiting zone length (cm) 4- Number of capsules/plant
5- Number of seeds / capsule 6- Straw yield / plant (g)
7- Straw yield / fad (ton) 8- Fiber yield/fad (kg)
9- Seed yield / plant (g) 10 -Seed yield / fad (kg)

II- Seed quality:

1- Seed index (weight of 1000 seeds in grams)
2- Seed oil percentage. It was determined as mentioned by Comstock and Culbertson method (1958)
3- Oil yield (kg/feddan)

III- Fiber quality:

1- Fiber length (cm) 2- Fiber percentage (%)
4- Fiber fineness in metrical number (Nm) according to Radwan and Momtaz (1966).

Analysis of variance was computed according to Sndecor and Cochran (1982) and means were compared by least significant differences (LSD) at 5% level, combined analysis was performed for all characters over two seasons (Le Clerg *et al.* 1966).

All possible coefficients of the simple correlation were calculated according to the formula suggested by Sndecor and Cochran, 1982.

RESULTS AND DISCUSSION

1- Yield and its components:

1.1-Varietal effects:

Combined analysis of the two seasons 2000/2001 and 2001/2002 Table (1) revealed that significant differences among flax cultivars for plant height, technical length, fruiting zone length, number of capsules/plant, straw yield/plant, straw yield/fad, fiber yield/fad, seed yield/plant and seed yield/faddan, while differences among varieties in number of seeds/capsule were not significant Flax strain (402/3/5/10) gave the tallest plant (92.45 cm) and the highest technical length (78.32 cm) as well as the fruiting zone length. While, S.(282/37/14/8) gave the shortest plant height (74.94 cm) and technical length (61.73 cm). Sakha1 variety gave the highest straw yield/plant (1.86 g) as well as per fad (2.479 ton), while Sakha2 variety gave the highest number of capsules/plant (7.03), seed yield/plant (0.43 g) as well as per faddan (576.14 kg). On the other hand, Ariane ranked first for fiber yield/fad with on average of (398.60 kg). The superiority of Ariane could be attributed to its fiber type category. The present results are mainly due to differences in the genetical constitution of the tested genotypes under study. Similar findings were reported by Mourad *et al.* (1990), Mostafa (1994), El Shimy *et al*(1997) and Zahana *et al.* (2003).

Table 1.straw yield ,seed yield,fiber yield and their related charactars of flax as affected by genotypes and nitrogen fertilizer levels (combined analysis of the two seasons).

Varieties	Notrogen Levels	Plant height (cm)	Technical Length (cm)	Fruiting zone length(cm)	No.of capsules/plant	No.of seeds/ capsule	Straw yield/plant(g)	Straw yield/fed.(ton)	fiber yield/fed.(kg)	Seed yield/plant(g)	Seed yield/fed.(kg)
Sakha 1	50 kg	85.18	73.25	11.93	4.68	5.72	1.45	2.003	297.04	0.25	449.01
	65 kg	88.08	75.16	12.68	5.58	6.85	1.97	2.526	396.58	0.33	543.31
	80 kg	90.83	76.40	14.37	6.93	7.75	2.17	2.908	474.00	0.45	619.21
	Means	88.03	74.94	13.06	5.73	6.77	1.86	2.479	389.21	0.34	537.18
Sakha 2	50 kg	80.83	71.08	11.12	5.53	6.00	1.36	1.950	275.97	0.33	485.10
	65 kg	84.57	72.57	12.00	7.05	7.13	1.80	2.427	371.33	0.42	586.24
	80 kg	86.50	73.53	12.97	8.50	7.92	2.22	2.719	435.04	0.55	657.09
	Means	83.90	72.39	12.03	7.03	7.02	1.79	2.369	360.78	0.43	576.14
329/2/18/7	50 kg	80.18	68.27	11.92	4.33	5.20	1.22	1.930	235.07	0.19	405.31
	65 kg	82.87	70.03	12.83	5.40	6.22	1.48	2.331	311.89	0.30	502.51
	80 kg	85.17	71.58	13.58	6.28	7.25	1.79	2.563	380.09	0.41	595.61
	Means	82.74	69.96	12.78	5.34	6.22	1.50	2.275	309.02	0.30	501.14
402/3/5/10	50 kg	85.68	75.75	12.93	4.90	5.35	1.22	1.982	259.25	0.21	404.50
	65 kg	92.96	78.77	14.22	5.80	6.45	1.57	2.341	332.89	0.32	505.32
	80 kg	95.68	80.43	15.22	6.82	7.18	1.80	2.632	396.91	0.40	588.53
	Means	92.45	78.32	14.12	5.84	6.33	1.53	2.318	329.68	0.31	499.45
402/21/20/3	50 kg	83.92	70.08	13.82	4.70	5.12	1.25	1.949	243.24	0.20	415.21
	65 kg	87.52	72.45	15.07	5.43	6.25	1.62	2.410	331.38	0.30	514.41
	80 kg	90.25	73.78	16.47	6.65	7.23	1.94	2.679	401.31	0.36	602.60
	Means	87.23	72.10	15.12	5.59	6.20	1.60	2.346	325.31	0.29	510.74
Ariane	50 kg	88.25	75.83	10.42	4.82	6.40	0.84	1.765	293.87	0.15	318.54
	65 kg	89.12	77.29	11.83	5.65	7.41	1.15	2.170	405.14	0.23	410.32
	80 kg	91.22	78.60	12.92	6.55	8.08	1.40	2.400	496.80	0.28	476.11
	Means	88.86	77.24	11.82	5.91	7.30	1.13	2.112	398.60	0.22	401.66
282/37/14/8	50 kg	70.92	59.08	12.02	4.45	5.45	1.08	1.821	293.68	0.22	418.10
	65 kg	75.35	61.97	13.38	5.37	6.58	1.27	2.215	332.47	0.30	511.31
	80 kg	78.55	64.13	14.42	6.82	7.42	1.57	2.535	423.60	0.42	600 22
	Means	74.94	61.73	13.27	5.48	6.48	1.31	2.190	339.92	0.31	509.88
Mean for N levels	50 kg	82.25	70.48	12.02	4.74	5.61	1.20	1.916	266.87	0 22	413.58
	65 kg	85.78	72.61	13.17	5.75	6.70	1.55	2.346	354.53	0.31	510 49
	80 kg	88.31	74.06	14.24	6.91	7.55	1.84	2.634	429.68	0.41	591.34
L.S.D. 5% level of significance for:											
Vaneties (V)		2.92	2.31	2.05	0.30	Ns	0.12	0.05	17.91	0.22	21 21
Notrogen Levels(N)		1.78	1.33	Ns	1.03	Ns	0.21	0.04	15.13	0 08	31 30
V x N		Ns	Ns	Ns	0.22	Ns	Ns	Ns	11.31	0.13	Ns

Ns = non-significant.

Table 2.Seed quality and fiber quality of flax as affected by genotypes and nitrogen fertilizer levels (combined analysis of the two seasons).

Varieties	Notrogen Levels	Seed quality			Fiber quality		
		seed index (g)	Oil percentage (%)	Oil yield (kg/fed	Fiber length (cm)	Fiber percentage (%)	Fiber fineness
Sakha 1	50 kg	8.78	37.56	168.65	71.32	14.83	169.42
	65 kg	9.50	38.40	208.63	73.27	15.70	160.02
	80 kg	9.98	39.22	242.85	74.55	16.30	149.48
	Means	9.42	38.39	206.71	73.05	15.61	159.64
Sakha 2	50 kg	9.55	39.08	189.56	68.30	14.08	156.68
	65 kg	10.27	40.47	237.25	70.77	15.30	149.23
	80 kg	10.73	41.23	270.92	71.65	16.00	143.45
	Means	10.18	40.26	232.58	70.57	15.13	149.85
329/2/18/7	50 kg	8.09	37.25	150.98	66.55	12.18	182.66
	65 kg	8.88	38.02	191.05	68.12	13.38	170.43
	80 kg	9.31	38.82	231.25	69.65	14.83	161.92
	Means	8.76	38.03	191.09	68.11	13.46	171.74
402/3/5/10	50 kg	7.85	38.12	154.20	73.60	13.08	179.92
	65 kg	8.56	38.94	196.77	76.78	14.22	169.32
	80 kg	9.02	39.88	233.53	78.48	15.06	160.70
	Means	8.48	38.91	194.83	76.29	14.13	169.98
402/21/20/3	50 kg	8.04	38.35	159.23	68.25	12.48	179.65
	65 kg	8.93	39.18	201.44	70.42	13.75	169.82
	80 kg	9.27	39.91	240.50	71.87	14.98	157.33
	Means	8.75	39.14	200.39	70.18	13.74	168.93
Ariane	50 kg	4.53	34.65	111.01	73.88	18.65	204.54
	65 kg	5.13	35.60	146.07	75.23	18.67	189.55
	80 kg	5.59	36.34	173.02	76.83	20.70	177.53
	Means	5.08	35.60	143.37	75.25	18.67	190.54
282/37/14/8	50 kg	8.20	37.19	155.49	57.13	14.48	185.98
	65 kg	8.84	37.94	193.99	59.93	15.01	169.37
	80 kg	9.40	38.59	231.62	62.25	16.71	158.83
	Means	8.81	37.91	193.70	59.77	15.40	171.39
Mean for N levels							
	50 kg	7.86	37.49	155.59	68.58	13.97	179.89
	65 kg	8.59	38.36	196.48	70.65	15.15	168.25
	80 kg	9.04	39.11	231.96	72.15	16.37	158.46
L.S.D. 5% level of significance for:							
Varieties (V)		0.31	0.60	10.03	1.53	0.80	7.93
Nctrogen Levels(N)		0.43	0.93	11.31	1.32	0.63	8.03
V x N		Ns	Ns	8.51	Ns	0.73	5.31

Ns = non-significant.

1.2- Nitrogen effects:

The effect of nitrogen levels on yield and yield components of flax is presented in Table (1). The results showed that increasing genotypes nitrogen level from 50 to 80 kg/fad significantly increased plant height (88.31 cm), technical length (74.06 cm), number of capsules (6.91), straw yield/plant (1.84 g), straw yield/fad (2.634 ton), seed yield/plant (0.41 g), seed yield/fad (591.34 kg) and fiber yield/faddan (429.68 kg). On the other hand, flax plants received 50 kg. N/fed gave significantly the lowest values of plant height (82.25 cm), technical length (70.48 cm), fruit zone length (12.02 cm), number of capsules/plant (4.74), number of seeds / capsule (5.61), straw yield/plant (1.20 g), straw yield/fad (1.916 ton), seed yield/plant (0.22 g), seed yield/fad (413.68 kg) and fiber yield/fad (266.12 kg), reflecting the important role of nitrogen in building up protoplasm and proteins, which induce cell division and merastemic activity and increase cell number and size which finally increased flax growth and its yield. Similar findings were reported by Momtaz *et al.*(1981), Hella *et al.*,(1988), El Nimr *et al.*(1997) and El Azouni (1998).

1.3-Interactions effects:

Table (1) showed that the interaction between varieties and nitrogen levels were not significant for all the studied traits except for number of capsules/plant, fiber yield/fad and seed yield/plant. This indicates that the response of flax varieties to nitrogen level was not similar with respect to those characters. The highest fiber yield 496.80 kg/fed resulted from variety Ariane fertilized with 80 kgN/fed.

2- Seed quality:

2.1-Varietal effects:

The results reported in Table (2) showed that seed index, oil percentage and oil yield/fad were significantly influenced by varieties. Sakha 2 gave the highest seed index (10.18 g), oil percentage (40.26 %) and oil yield per faddan (232.58 kg).The higher oil yield/fad of Sakha 2 may due to its higher seed yield and seed oil content. The lowest seed index (5.08 g), oil percentage (35.6) and oil yield per fad (143.37 kg) resulted from Ariana. Similar results were obtained by Mostafa *et al.*(1998) and Zahana *et al.*(2003).

2.2- Nitrogen effects:

The results reported in Table (2) indicated that seed index, oil percentage and oil yield were significantly affected by nitrogen levels. There was a gradual increase in these traits as N level increased. The highest values of seed index (9.04 g), oil percentage (39.11%) and oil yield/fad (231.96 kg) were obtained with the higher nitrogen level of (80kg N /fad), while the lowest values of seed index (7.86 g), oil percentage (37.49%) and oil yield/fad (155.59 kg) were obtained at the lower level of 50 kg N /fad. The increase in oil yield may be due to the increase in seed yield and oil percentage accompanying N application. Similar results were obtained by Momtaz *et al.* (1981, Hella *et al.* (1988), El Nimr *et al.* (1997) and El-Azouni (1998).

2.3-Interactions effects:

Nitrogen level x variety interaction had a significant effect only on oil yield per fad. Sakha 2 with 80 kg N/fad gave the highest oil yield per faddan (270.92 kg).

3- Fiber quality:

3.1-Varietal effects:

Data presented in Table (2) showed significant differences among flax varieties in fiber length, fiber percentage and fiber fineness among flax varieties, S.402/3/5/10 was superior over the other genotypes concerning fiber length (76.29 cm) followed by Ariane (75.25 cm), Sakha 1 (73.05 cm), Sakha 2 (70.57 cm), S.402/21/20/3 (70.18 cm), S.329/2/8/7 (68.11cm) and S.282/37/14/8 (59.77 cm) in a descending order. Regarding fiber percentage, results indicated that Ariane genotype had the highest values of fiber percentage (18.67%) so, it ranked first in fiber yield/fad, while, Sakha 1 gave fiber percentage (15.61%) followed by S. 282/37/14/8 (15.40%), Sakha 2 (15.13 %), S.402/3/5/10 (14.13 %), S.402/21/20/3 (13.74 %) and 329/2/18/7 (13.46 %). It is worth noting that Ariane genotype surpassed the other genotypes in fiber fineness (190.54) followed by S.329/2/18/7 (171.74), S.282/37/14/8 (171.39), S.402/3/5/10 (169.98), S.402/21/20/3 (168.93), Sakha 1 (159.64) and Sakha 2 (149.85) in a descending order. these results are in harmony with those of El Deed (1998), Mostafa *et al.* (1998) and Zahana *et al.*(2003).

3.2- Nitrogen effects:

Data in Table (2) indicated that nitrogen levels had significant effects on fiber length, fiber percentage and fiber fineness. Increasing N level up to 80 kg/fad significantly increased fiber length by 3.57 and 1.5 cm and fiber percentage by 2.60 and 1.22% over 50 kg. N/fad, while fiber fineness gradually decreased as N level was increased indicating that there was a trend of coarseness of fiber due to increased nitrogen level until 80 kg N/fad. It seams that high nitrogen doses improved flax growth and at the same time delayed the sedimentation of cellulose substance in fiber formation, consequently would affect fineness towards heavier weight for the given length of fiber recorded as numbers. Similar findings were reported by Momtaz *et al.* (1981), Hella *et al.* (1988), El Nimer *et al.* (19970 and El Azouni (1998).

3.3- Interaction effects:

The interaction between varieties and nitrogen levels had a significant effect on fiber percentage and fiber fineness Table (2) the highest value of fiber percentage (20.70%) was obtained from 80kg applied to variety Ariane. The highest value of fiber fineness (204.54) resulted from Ariane with 50 kg N/fad.

Generally the highest straw yield/fad (2.908 ton) was obtained from sakha 1variety with 80 kg N/fad. in addition the highest seed yield per faddan (657.09 kg) and oil yield/faddan (270.92 kg) were obtained by applying 80kg N/fad to Sakha 2. while the highest fiber yield/ fad (496.80 kg) was obtained by adding 80 kg N/fad to Ariane

4- Correlation studies:

The simple correlation among twelve traits in flax are shown in Table 3.

Table 3. Simple correlation coefficient between twelve characters of flax

Characters	Seed yield/plant (g)	Plant height (cm)	Fiber length (cm)	Technical length (cm)	Fruiting zone length(cm)	No. of capsules/plant	No.of seeds/capsule	seed index (g)	Fiber fineness	Fiber percentage (%)	Oil percentage (%)
Straw yield/plant (g)	0.774*	0.389	0.381	0.373	0.222	0.521	-0.476	0.743	-0.890**	0.401	0.804*
Seed yield/plant (g)		-0.040	0.016	0.007	-0.084	0.795*	-0.372	0.787*	-0.962 **	0.402	0.851*
Plant height (cm)			0.970**	0.972**	0.319	0.141	-0.047	-0.056	-0.091	0.041	0.204
Fiber length (cm)				0.998**	0.083	0.266	0.124	-0.142	-0.139	0.222	0.148
Technical length (cm)					0.088	0.259	0.125	-0.148	-0.130	0.216	0.142
Fruiting zone length(cm)						-0.324	-0.738	0.439	0.029	-0.684	0.409
No. of capsules/plant							0.141	0.313	-0.784	0.491	0.620
No.of seeds/capsule								-0.856*	0.329	0.503	-0.675
seed index (g)									-0.750	-0.083	0.890**
Fiber fineness										-0.492	-0.846*
Fiber percentage (%)											-0.031

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

Straw yield /plant was significantly and positively correlated with each of seed yield /plant and oil percentage. Also, a significant positive correlation between seed yield /plant and number of capsules/plant, 1000-seed weight and oil percentage was recorded. These results indicated that maximization of yield may be obtained by selection for these traits (number of capsules/plant and seed index). Results also revealed that fiber length showed significant positive correlation with technical length. Seed index showed positive correlation with oil percentage. On the other hand, fiber fineness was significantly and negatively correlated with each of oil percentage and straw yield /plant. These results are in harmony with those reported by Badwal *et al.* (1971), Younan (1974), Satapathi *et al.*(1987) and Mishra and Singh(1992).

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استجابة بعض التراكيب الوراثية من الكتان لمستويات مختلفة من التسميد الآزوتي في الأراضي الرملية حديثة الاستصلاح

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أقيمت تجربتان حقليتان في محطة بحوث الإسماعيلية مركز البحوث الزراعية - مصر -خلال موسمي ٢٠٠١/٢٠٠٠ ، ٢٠٠٢/٢٠٠١ وذلك لدراسة مقارنه للمحصول ومكوناته وخواص الألياف في الأراضي الرملية حديثة الاستصلاح لبعض أصناف الكتان تحت معدلات التسميد النتروجيني المختلفة .

وكان التصميم المستخدم هو تصميم القطعة المنشقة مرة واحدة ذات الأربع مكررات واستخدام ٧ تراكيب وراثية من الكتان (سخا١ ، سخا٢ ، س ٧/١٨/٢/٣٢٩ ، س ١٠/٥/٣/٤٠٢ ، س٣/٢٠/٢١/٤٠٢ ، أريانا ، ٨/١٤/٣٧/٢٨٨) حيث وضعت في القطع الرئيسية و ٣ مستويات من التسميد الأزوتي (٥٠ ، ٦٥ ، ٨٠ كجم للفدان في القطع المنشقة) .

ويمكن تلخيص أهم النتائج فيما يلي :

١- أعطت السلالة ١٠/٥/٣/٤٠٢ أعلى طولا كلى وطول فعال . بينما أعطي الصنف سخا ١ أعلى محصول قش للنبات وكذلك للفدان بينما أعطى سخا ٢ أعلى قيم من عدد الكبسولات /نبات ومحصول البذرة /نبات ومعامل البذرة والنسبة المئوية للزيت . بينما الصنف المستورد أريانا أعلى محصول للألياف والنسبة المئوية للألياف و أعلى نعومة . بينما أعطى أقل معامل بذرة وأقل نسبة مئوية للزيت وأقل محصول زيت للفدان .

٢- أعطى سخا١ أعلى محصول من القش للفدان مع معدل ٨٠ كجم نتروجين / فدان . بينما أعطى سخا٢ عند هذا المعدل أعلى محصول بذرة / فدان وكذلك أعلى محصول زيت / فدان . بينما نتج أعلى محصول ألياف للفدان٤٩٦,٨ كجم من إضافة ٨٠ كجم ن/للفدان للصنف أريانا ولكن كان أفضل صفات للنعومة لهذا المستورد عند ٥٠ كجم نتروجين / فدان .

٣- أظهرت دراسات الارتباط بين أزواج الصفات أن هناك ارتباط موجب ومعنوي بين محصول القش مع كل من محصول البذور والنسبة المئوية للزيت وأيضا كان هناك ارتباط موجب مع محصول البذرة وكل من عدد الكبسولات للنبات ووزن ١٠٠٠ بذرة والنسبة المئوية للزيت . لذلك يمكن زيادة محصول البذور عن طريق الانتخاب لهذه الصفات .

أما بالنسبة لطول الألياف فأظهر ارتباط موجب ومعنوي مع الطول الفعال . كما اظهر معامل بذرة ارتباط موجب مع النسبة المئوية للزيت . على العكس من ذلك كان هناك ارتباط سالب ومعنوي بين نعومة الألياف وكل من محصول القش والنسبة المئوية للزيت .