RESPONCE OF SOME FLAX GENOTYPES TO PULLING DATE UNDER NEWLY RECLAIMED SANDY SOIL AND SPRINKLER IRRIGATION CONDITIONS

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Abstract

Two field experiments were carried out at Ismailia Agric. Res. Station, Ismailia Governorate, during 2002/2003 and 2003/2004 seasons to investigate the influence of some flax genotypes and pulling date on flax yield, yield components and fiber quality.

The obtained data recorded that the promising strain 2465/1/3 (which released by fiber crops Res. Section in Giza Agric. Res. Station), surpassed the local cultivar Sakha 1. and the other investigated strains, in all flax yield and its fiber quality traits, this result, may be due to that 2465/1/3 strain has high adaptation in the newly reclaimed sandy soil, but Sakha 1 Cv. has poor adaptation in the same region.

Data illustrated that medium pulling date (150 days after sowing), significantly gave the highest mean values of all tested parameters for flax yield and its quality.

INTRODUCTION

It is established that flax (*Linum usitatissiumum* L.) is an old fiber and/or seed plant in Egypt as well as in other countries. It has long history however it was grown as a double purpose crop since more than 7000 years ago. Flax has deep roots in our history however mommies which have been found in old Pharaoh's tombs were wrapped in linen shrouds about 5000 years B.C. in addition, Herodotus, in his writings, reported that old Egyptian Pharaoh's had grown, pulled, processed flax and made very fine linen fabrics with high quality for kings and princesses only.

Recently, flax can be used in many different purpose i. e., Linen and textile fabrics, medicinal application, particle boards, building industry, polymer composite, varnish, paints, pulp and paper industry, in addition to human and animal feeding (Kozlowski, 2001). Flax growing tended to decrease in Egypt, therefore more attention has been given lately to increase its acreage through planting high yielding genotypes in newly reclaimed lands to avoid the competition between flax growing and other strategic feeding crops in the old land, (El-Hariri, *et. al.,* 2001).

Many investigators obtained higher levels of varietal differences in yield and quality of flax in different growing regions of flax around the world. (Verma and Pathak 1993, El-Hariri *et al.,* 2001), El-Hariri *et. al.,* 2002 , a and b and El-Sweify, *et al.,* 2003).

Choosing the right time for flax Pulling is very important and needs more skill and high experience, Pulling date affects yield and quality of flax products (fibers and oil), as reported by El-Hariri *et al.,* (1996), Mohamed *et al.,* (1998), and El-Sweify *et al.,* (2003).

This work was carried out to investigate the response of yield and quality of fiber as well as seed oil of flax to different genotypes and pulling dates under sprinkler irrigation system on newly reclaimed sandy soil.

MATERIALS AND METHODS

Two field experiments were carried out at Ismailia Experimental Station Res. Ismailia Governorate, during 2002/2003 and 2003/2004 seasons to investigate the influence of five flax genotypes (one commercial cultivar Sakha 1 and four promising strains 402/3/18/9, 402/12/11/6, 2465/1/3 and St. 5 released by Fiber Crops Res. Sec., Field Crops Inst., ARC (Table 1), and there pulling dates (i.e. 140/150 and 160) on yield and its components and quality

Table 1. The origin of the studied flax genotypes:

Genotypes	Origin
Sakha 1 (G1)	Local cultivar released from cross i.1485x130m Bombay.
St.402/3/18/9 (G2)	A new strain released from cross i.235 (America)xGiza 5.Cv.
St.402/12/11/6 (G3)	A new strain released from cross i.235(America)xGiza 5. Cv.
St.2465/1/3 (G4)	Selected from Humpata (Hungarian imported).
St.5	A new strain released from Cross i.2351xSt.268/1

Treatments were arranged in split plot design with four replications where pulling dates were the mainplots, and genotypes as subplots, The subplot was 6 m^2 area. Flax seeds were sown at the recommended rate (70 Kg/Fed.) in rows 3m long and 20 Cm apart. Recommended N, fertilizer was applied at the rate of 75 Kg N/Fed in the form of ammonium nitrate (33.5%N) (Splitted at four doses at 20, 40, 60 and 80 days after sowing), $p_2 o_5$ and $K_2 o$ were added during soil preparation at the rate of 150 Kg super phosphate and 50 Kg potassium sulphate per feddan respectively. Sprinkler irrigation system was carried out towice every week, which is more adapted to rationalize irrigation water in field crops, in this type of reclaimed soil.

The soil type was sandy, physical and chemical properties of it were incbided in Table (2)

Table 2. The mechanical and chemical properties of soil used before conducting the experiment

Characters		Values
Coarse Sand (%)	Mechanical analysis	61.65
Fine Sand (%)		30.01
Silt (%)		2.91
Clay (%)		5.43
Soil texture		Sandy
$Caco_3$ (%)		1.64
Organic matter	Chemical analysis	1.15
pH		7.89
EC (dsm^{-1} at 25c°)		0.22
Field capacity		7.66
Available N(PPM)		32.53
Available P(pm)		5.98
Available K (ppm)		51.29
Cations (meg /L)		-
Ca^{++}		0.85
Mg^{++}		0.95
Na^{+}		0.65
K^{+}		0.13
Anians (meg /L) :		-
Co_3^{-}		0.00
$So4^{-}$		0.57
Cl^{-}		1.10

The preceding crop were peanut and corn in 2002/2003 and 2003/2004 seasons respectively. Flax plants were hand pulled at the three pulling dates, then left one week for complete air-drying.Ten random guarded samples were taken and following data were recorded:

I – Yield Components:

Total plant height in Cm, technical stem length in Cm, fruiting zone length in Cm, Main stem diameter (mm.), straw yield/plant in grams, No. of fruiting branches, No. of capsules/plant, No. of seeds/Capsule, 1000. seed weight in grams, seed yield/plant in grams and oil percentage according to the extraction method described by the A.O.A.C. methods (1990), using soxhlet apparatus and petroleum ether with a boiling range of 60-80 C° as a solvent for six hours.

II – Flax Yield:

Straw (ton), seed (Kg), and fiber (ton) yields/fed. were calculated on the whole plot area basis, while oil yield (Kg)/fed. was calculated by multiply oil percentage X seed yield/fed.

III – Fiber Quality:

Representative samples of the whole plot area were taken and retted in P.V.C. Tubes at Ismalia Exp. sta., after compete retting, retted straw was airdried then separating fibers was practiced manvaally were the filer quality parameters were estimated.

Total fiber bvgth, fiber percentage, fiber yield/ plant in grams and fiber fineness which estimated according to Radwan and Momtaz (1966).

The data obtained were subjected to the proper statistical analysis as split plot design according to Snedecor and Cochran (1982)., therefore combined analysis was carried out according to Le Clerg, *et al.,* (1966), mean values were compared using L.S.D. at 5% and 1% Levels of significance.

RESULTS AND DISCUSSION

I – Yield Components:

A- Effect of genotypes:

Table (2) indicates yield components if different investigated genotypes. Data shows that these genotypes have high significant difference in all yield components except two characters which are straw yield and no. of seeds/capsule. The selection family 2465/1/3 gaves the highest values for all studied characters which related to both of straw and seed yields, recording 78.93 Cm, 63.19 Cm, 15.74 Cm, 2.00 mm, 1.627 gm, 5.85, 8.49, 7.11, 9.96 gm, 41.58% and 0.503 gm. For: total length, technical length, fruiting zone length, main stem diameter, straw yield, no. of fruiting branches as well as no. of capsules per plant, no. of seeds/capsules, 1000-seed weight, oil percentage and seed yield, respectively. El-Hariri *et al.* (2002 a and b) reported that genotype st. 2465/1/3 exceeded significantly than other tested genotypes in straw yield and no. of capsules per plant. This may be due to the growth habit however it is a promising strain of double purpose flax, so it produce high yield of loth straw and seeds on the same plant. On the other hand the local cultivar Sakha I recorded the lowest values in all studied characters except, fruiting zone length, which recorded the lowest value (13.14 Cm) by the new strain 402/12/11/6. that obtained result of poor adaptation of Sakha 1 Cv . in the newly reclaimed sandy soil, may be due to its high adaptation in the old land which considered the original region production of it.

It could be concluded that the previous varietal differences in flax yield components might be due to differences in genotypes genetic potential which in turn reflected on yield components. In addition differences between genotypes concerning partition of dry matter accumulation as well as glucose required to plant synthesis, carbon equivalents yield energy/plant and coefficient of energy for crop harvest indices . In this connection, it should be mentioned that many workers obtained similar conclusion Khotyleva *et al.,* (1994), E-Hariri *et al.,* (2002 a and b), and El-Sweify *et al.,* (2003).

B – Effect of Pulling Date:

Date in Table (2) show that flax yield components high significantly responded to pulling date. The results indicated that there were gradually increased in the value of all traits towards the lated pulling date except straw and seed yields/plant which reached the maximum values at the medium date and then decreased at the late pulling date. The differencesd between values of yield components which obtained from plants pulled at early date, when compared with either medium or late dates, reached the high significant level. These results suggest that flax plants continued growing as well as building of different organs until the pulling symptoms are reached, it might be due to an increase in metabolites synthesized by flax plants owing to prolonged growth period and that was more pronounced especially during the latest pulling date, which in turn increased dry matter accumulation in plant organs till it reached full maturity stage (160 days after sowing). These results are in agreement with those obtained by .El-Hariri *et al.,* (1996), Mohamed *et al.,* (1998), and El-Sweify *et al.,* (2003).

II – Flax yield:

A- Effect of Genotypes:

The results reported in Table (3) showed clearly the response of different flax yield parameter owing to different flax genotypes under investigation. These results indicated that, there was remarkable and high significant influence on biological (ton), straw (ton), seed (Kg), fiber (ton) and oil (Kg) per fed. Owing to growing different genotypes. The promising strain 2465/1/3 exceeded the other tested genotypes in biological, straw, seed, fiber and oil yields/fed. Recording 4.289 ton, 3.988 ton, 289.85 Kg, 0.666 ton and 121.21 Kg/fed respectively, while the local cultivar Sakha 1 gave the lowest values for studied flax yield parameters by 3.999 ton, 2.972 ton, 227.67 Kg, 0.392 ton, and 81.17 Kg for biological, straw, seed fiber and oil yields/fed. Traits respectively. The increase in the above mentioned characters for the promising st. 2465/1/3 over Sakha 1 cv. amounted to 0.290 ton, 1.01 ton, 62.18 Kg., 0.27 ton and 40.04 Kg for biological, straw, seed, fiber and oil yields/fed., respectively. These

results have the same trend which obtained by flax yield components and suggested the superiority of st. 2465/1/3 over Sakha 1 Cv. And the other tested flax genotypes. These results may be due to the high adaptation of st. 2465/1/3 and poor adaptation of the local cultivar Sakha 1 when they are growing under newly reclaimed sandy soil conditions.

B – Effect of pulling date:

Pulling date revealed considerable and high significant influence on flax yield parameters under study. Data in Table (4) illustrated that all yield characters i.e. biological, straw, seed, fiber and oil yields per fed. Reached their maximum values at the medium pulling date. It could be mentioned that higher values of tested characters at medium pulling date might be due to continous growing in fiber cells as well as precipitation of cellulose in secondary walls of individual fiber unit and this in turn increase the straw and fiber yields. The five flax yield parameters under study i.e. straw, seed, fiber, oil yields/fed. Recorded the maximum values at the medium pulling date (150 days after sowing), by, 3.941 ton, 313.55 Kg, 0.658 ton and 125.96 Kg respectively, then these values decreased at the latest pulling date by , 0.21 ton, 0.658 ton, 27.73 Kg and 14.47 Kg. from data in Tables (3 and 4) showed that there were significant decrease in straw yield per plant as well as per fed. when flax plants were pulled at the 3rd date, this reduction, might be due to a decline in moisture content of flax plants, in addition, delayed pulling exposed flax plants to over maturity stage, which often accompanied by a decline in dry matter content owing to translocation of organic compounds to be sorted in seeds, which the decrease in seed yield per plant as well as per fed. May be due to losing part of seed yield from flax plants which exposed to over maturity during the pulling processes. These results are in agreement with those obtained by El-Hariri *et al.,* (1996), and El-Sweify *et al.,* (2003).

III - Fiber quality:

A- Effect of genotypes:

Data presented in Table (4) showed clearly that fiber quality parameters of flax high significantly differed owing to genotypes. Local Egyptian Cv. Sakha 1 and new strain 402/3/18/9 gave lower values in all tested characters i.e. fiber length, fiber percentage, fiber fineness and fiber yield recording, (67.26 Cm, 19.90%, 144.66 N.m. and 0.169 g/plant) and (68.23 Cm, 13.44%, 173.03 N.m. and 0.180 g/plant) for the two above mentioned genotypes, respectively. On the other hand, the promising strains 2465/1/3 and St.5 gave maximum values for the same respective quality parameters. St. 2465/1/3 exceeded Sakha 1 with 5.04%, 23.25%, 28.26% and 33.70% for fiber length, fiber percentage, fiber fineness and fiber yield/plant. St. 402/12/11/6 recorded between values for the same above mentioned fiber quality

traits. It could be concluded that fiber quality parameters, depended mainly on genotype and this is mainly due to the genetically constituents, as well its interacted with environmental conditions. In this connections it should be mentioned that many workers obtained similar concisions Khotyleva *et al.,* 1994, El-Hariri *et al.,* 1996, El-Sweify and Mostafa, 1996, El-Hariri *et al.,* 2002 a and El-Sweify *et al.,* 2003.

B – Effect of pulling date:

The results in Table (4) illustrated that fiber length, fiber percentage, fiber fineness and fiber yield/plant high significantly responded to pulling date. There was an increase in fiber quality parameters with advancement towards maturity up to medium pulling date, except with fiber length which was gradually increased from 64.33 Cm. to 73.31 Cm at early and late pulling dates, respectively. The other tested fiber quality traits tended to decrease at the late pulling date. The highest mean values were obtained from plants pulled at the medium date (150 days after sowing) were 16.85%, 197.09 N.m. and 0.279 g/plant for fiber percentage, fiber fineness and fiber yield/plant, respectively.

The decline in fiber quality which recorded by plants pulled at the third date (160 days after sowing), may be due to lignifications which takes place when flax plants were left too long before pulling, therefore early and late pulling dates gave inferior flax yield with lower quality grades. In this respect, confirmed results were reported by El-Hariri *et al.,* 1996, Mohamed *et al.,* 1998 and El-Sweify *et al.,* (2003).

Interaction effect:

Data illustrated that the interacion effect between the two studied factors i. e. genotypes and the three pulling dates, were insingnificant for all tested characters except the four following parameters , as, shown in Table (6), fruiting zone bngth , seed yield per plant and seed yield as well as oil yield kg/ fed . Fruiting zone lngth in cm. and oil yield per fed. in kg were highsignificantly affected by the interaction between genotype and pulling date recording highest mean values by 18.8 cm and 148.27 kg / fed from plants of st5 (G 5) and st 2465/1/3 (G 4), respectivelly when these plants were pulled at 160 days (d_3)after sowing , wherevere the seed yield per plant (in gm .) as well as per fed (in kg.) were only significantly affected by the interaction and their highest mean values (0.586 gm and 344.4 kg.) were recorded by plants of st. 2465/1/3 (G4) when pulled at the late date (d3) .

GENERAL CONCLUSION

From the previous obtained data, it could be concluded that the promising strain 2465/1/3, which released by Fiber Crops Research Section in Giza, exceeded local cultivar Sakha I and the other investigated genotypes in flax yield, and components and fiber quality parameters when its plants pulled at medium date (150 days after sowing), therefore, it may be recommended to encourage expansion of this promising strain in newly reclaimed lands under the sprinkler irrigation system and this in turn encourage expansion of flax growing horizontally where there is no competition between flax and other winter feeding crops.

Table 3. Effect of genotypes and pulling date on yield components of flax grown in newly reclaimed sandy soil. (Averages of 2002/2003 and 2003/2004 seasons).

	Total length (Cm)	Technical Length (Cm)	Fruiting Zone Length (Cm)	Main stem diameter (mm)	Straw yield per plant (gm)	No.of fruiting branches	No. of capsules per plant	No. of Seeds per capsule	1000-Seed weight (gm)	Oil percentage	Seed yield per plant
A- Genotypes (G)											
Sakha 1 (G_1)	72.05	58.51	14.25	1.86	1.293	4.33	5.37	6.48	8.55	35.58	0.315
St.402/3/18/9 (G_2)	74.24	60.18	15.01	1.90	1.341	4.39	6.27	6.83	9.01	37.18	0.346
St.402/12/11/6 (G_3)	75.81	62.67	13.14	1.96	1.412	5.21	6.31	6.89	9.24	40.10	0.356
St.2465/1/3 (G_4)	78.93	63.1	15.74	2.00	1.627	5.85	8.49	7.11	9.96	41.58	0.503
St. 5 (G_5)		9									
	78.54	63.08	15.69	2.09	1.602	5.33	7.07	7.08	9.69	39.17	0.371
F. test	**	**	**	**	N.S.	**	**	N.S.	**	**	**
L.S.D. 0.05	2.11	2.02	0.94	0.09	-	0.43	0.63	-	0.25	0.51	0.040
L.S.D. 0.01	2.91	2.78	1.30	0.12	-	0.59	0.87	-	0.34	0.70	0.056
B-Pulling dates(P)											
140 Days (early)	70.31	57.63	12.96	1.80	1.161	4.44	5.42	6.18	8.22	37.28	0.261
150 Days (Medium)	77.13	62.02	15.24	1.99	1.701	5.15	6.82	6.86	9.46	38.85	0.457
160 Days (Late)	80.31	64.92	16.10	2.07	1.503	5.49	7.86	7.60	10.19	40.03	0.417
F. test	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 0.05	1.49	1.53	1.83	0.07	0.073	0.36	0.48	0.35	0.18	0.37	0.014
L.S.D. 0.01	1.99	2.04	1.85	0.16	0.097	0.48	0.64	0.47	0.23	0.50	0.019
C-Interaction (GXP) F. test	N.S.	N.S.	**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	*

Table 4. Effect of genotypes and pulling date on flax yield grown in newly reclaimed sandy soil. (Average of 2002/2003 and 2003/2004 seasons)

	Straw yield, Ton/fed.	Seed yield, Kg/fed.	Fiber yield, Ton/fed.	Oil yield; Kg/fed.
A- Genotypes (G)				
Sakha 1 (G_1)	2.972	227.67	0.392	81.17
St. 402/3/18/9 (G_2)	3.464	260.90	0.478	97.26
St. 402/12/11/6 (G_3)	3.493	275.26	0.573	110.81
St. 2465/1/3 (G_4)	3.988	289.85	0.666	121.21
St. 5 (G_5)	3.896	278.02	0.629	109.41
F. test	**	**	**	**
L.S.D. 0.05	0.234	12.55	0.063	4.69
L.S.D. 0.01	0.323	17.30	0.087	6.47
B- Pulling dates (P)				
140 days (early)	3.018	199.65	0.396	74.47
150 days (medium)	3.941	313.55	0.658	125.96
160 days (late)	3.729	285.82	0.589	111.49
F. test	**	**	**	**
L.S.D. 0.05	0.182	9.65	0.058	3.82
L.S.D. 0.01	0.244	12.91	0.078	5.11
C- Interaction (GXP)				
F. test	N.S.	*	N.S.	**

Table 5. Effect of genotypes and pulling dates on some characters of flax fiber quality. (Average of 2002/2003 and 2003/2004 seasons)

	Fiber length Cm.	Fiber percentage	Fiber fineness	Fiber yield plant
A. Genotypes (G)				
A. Genotypes (G)				
Sakha 1 (G_1)	67.26	12.90	144.66	0.169
St. 402/3/18/9 (G2)	68.23	13.44	173.03	0.180
St. 402/12/11/6 (G3)	69.19	16.10	185.49	0.232
St. 2465/1/3 (G4)	70.83	16.81	201.66	0.267
St. 5 (G5)	72.42	16.23	189.20	0.256
F. test	**	**	**	**
L.S.D. 0.05	2.17	1.84	19.67	0.020
L.S.D. 0.01	2.99	2.53	27.11	0.027
B- Pulling dates (P)				
140 days (early)	64.33	12.72	154.62	0.151
150 days (medium)	71.12	16.85	197.09	0.279
160 days (late)	73.31	15.73	184.73	0.232
F. test	**	**	**	**
L.S.D. 0.05	1.35	1.66	12.97	0.016
L.S.D. 0.01	1.81	2.22	17.35	0.021
C. Interaction (GXP)				
F. test	N.S.	N.S.	N.S.	N.S.

Table 6. The interaction effects betuween the two studied treatments of genotypes (G) and pulling dates (d).

Characters	Fruiting zone lenth (cm.)			Seed yield/ plant (g)			Seed yield/ fed (kg)			Oil yield/ fed (kg)		
Pulling dates / Genotypes	Early d1	Medium d2	Late d3	Early d1	Medium d2	Late d3	Early d1	Medium d2	Late d3	Early d1	Medium d2	Late d3
Sakha (G1)	13.44	15.51	13.79	0.195	0.336	0.418	178.7	233.78	270.53	61.15	83.21	99.18
St. 402/3/18/9 (G2)	11.43	16.05	17.55	0.224	0.392	0.422	196.12	275.44	311.15	70.32	102.47	119.01
St. 402/12/11/6 (G3)	14.65	12.46	12.33	0.239	0..392	0.439	200.2	301.54	324.60	77.08	120.37	134.98
St. 2465/1/3 (G 4)	12.60	16.66	18.02	0.372	0.553	0.586	217.87	307.31	344.4	85.84	129.54	148.27
St.5 (G5)	12.69	15.60	18.80	0.278	0.413	0.424	205.4	311.60	317.61	77.98	121.89	128.37
F.test		* *			*			*			* *	
L.S. D at 0.05		3.09			0.032			21.55			8.154	
L.S. D at 0.01		4.14			-----			-----			11.42	

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استجابة محصول الكتان لبعض التراكيب الوراثية وميعاد الحصاد فى الأراضى الرملية المستصلحة حديثاً تحت ظروف الرى بالرش

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أجريت تجربتان حقليتان فى محطة البحوث الزراعية بالإسماعيلية – محافظة الإسماعيلية خلال الموسمين الزراعيتين ٢٠٠٢/٢٠٠٣، ٢٠٠٣/٢٠٠٤ وذلك لدراسة تأثير بعض التراكيب الوراثية ومواعيد الحصاد على إنتاجية الكتان وصفات جودة الألياف تحت ظروف الرى بالرش فى الأراضى الرملية المس تصلحة حديثاً.

وكانت أهم النتائج المتحصل عليها هى:

- تفوقت السلالة المبشرة ٣/١/٢٤٦٥ على الصنف المحلى المنزرع سخا ١وأيضاً على باقي السلالات الجديدة تحت الدراسة – وذلك فى كل من مكونات المحصول – المحصول للنبات والفدان ولصفات جودة الألياف.
- أثبتت النتائج أن تأثير ميعاد الحصاد كانت معنوية جداً على معظم قيم الصفات المدروسة وأن أنسب موعد لتقليع نباتات الكتان المنزرع فى الأراضي الرملية وتحت ظروف الرى بالرش هو الموعد الثاني تحت الدراسة وهو بعد ١٥٠ يوم من الزراعة.
- بناء على نتائج البحث يمكن التوسع فى زراعة السلالة المبشرة ٣/١/٢٤٦٥ بحيث يتم التقليع بعد ١٥٠ يوم من الزراعة.