Comparative Study for Flax Varieties under Different Retting Treatments

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ABSTRACT

This investigation was carried out at Etay El-Baroud Agric. Res. Station, Egypt, during the two successive seasons (2004/05 and 2005/06) to study the effect of water retting treatments i.e., without change water, change water every 72 hours and change water daily on the fiber quality and quantity of three flax varieties i.e., Sakha 1, Sakha 3, and Sakha 4.

The summaries of results were obtained as follow:

1- Sakha 1 flax variety surpassed in length of capsules zone, stem diameter, straw and seed yields / plant as well as per faddan including its components. Meanwhile, the newly flax variety, Sakha 3, surpasses either Sakha 1 or Sakha 4 in technical length, straw yield/ Faddan, total fiber percentage, fiber length, strength, fiber fineness and fiber yield/faddan Moreover, Sakha 4 followed Sakha 3 variety in the majority fiber characters in the two successive seasons.

2- The retting treatment without change water recorded maximum estimates of total fiber percentage, fiber yield per faddan and fiber fineness in both seasons, while the change water daily treatment produced the tallest and strongest fibers.

3- The interaction among varieties and retting treatments had significant effect on the studied fiber characters.

INTRODUCTION

Flax (*Linum usitatissimum* L.) represented the only economic member of the family *Linaceae*, which this species had grown in many countries in the world to obtain fiber and seeds, especially in the ancient Egypt since thousands years ago till recent time. Flax is considered the most important bast fiber crop in A. R. E. The cultivation area of flax in last few years become limited due to the great competition with the other winter crops.

Many investigators detected varietal differences among flax due to genetically structure such as El-Borhamy (2003), Zedan (2004) and Abd El-Fatah and El Deeb (2006).

Retting is the most important operation in production of flax, as if retting is not carried out properly the fiber may be ruined, or the fiber quality become lowered. Retting can not improve the fiber quality which is in the straw, but proper retting can ensure that the original properties of the fiber are maintained and not lost. Several researchers studied the influence of retting treatments on fiber yield and quality such as Pallesen (1996), Radish *et al* (1999), Sharma and Faughey (1999), Fila *et al* (2001), El-

Borhamy (2003) and Abd El- Fatah and El Deeb (2006). The aim of this study is to compare the new two flax varieties; Sakha3 and Sakha 4 with the commercial variety Sakha 1 in yield, yield components and fiber quality under three retting treatments.

MATERIALS AND METHODS

The present investigation was conducted at Etay El-Baroud Agric. Res. Station, Egypt, during two successive seasons of 2004/2005 and 2005/2006 to study the effect of three retting treatments on fiber yield and quality in three flax varieties. The three studied varieties were denoted in Table (1).

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

Variety	Pedigree
Sakha 1	Resulted from crossing between (Bombay X 1.1485)
Sakha 3	Resulted from crossing between (Belinka (2E) X 1.2096)
Sakha 4	Resulted from crossing between (Belinka (R3) X 1.2569)

These new varieties were bred at Fiber Crops Res. Dept. The plant density was 2250 seeds per square meter.

Split plot design with four replications was used. The main plot was involved the three flax varieties, whereas the sub-plot were occupied by three retting treatments; i.e., without change water daily and every 72 hours. Sub-plot area was 6 m^2 (1.5 x 4 m). Recommended cultural practices for growing flax were carried out. Harvesting was carried out manually during the first weak of May in both seasons.

At maturity, ten guarded plants were randomly pulled from each sub plot to determine the yield components. Flax straw yield, seed yield, and fiber yield per faddan were calculated from the sub-plot area. Data collected in included :

I- Straw Yield and its Components:

1- Technical stem length (cm).
2- Length of capsules zone (cm).
3- Main stem diameter (mm).
4- Straw yield / plant (g).
5- Straw yield / faddan (ton).

II- Seed Yield and its Components:

1- Number of capsules / plant.
2- Number of seeds / plant
3- Seed yield per plant (g).

4- Seed yield per faddan (kg).
5- Seed index (g/1000 seeds).
6- Oil percentage (%).

III-Fiber Yield and its Technological Characters:

1- Total fiber percentage (%).
2- Fiber length (cm).
3- Fiber strength Determined as breaking length in kilometer (R.K.M.) according to Radwan and Momtaz formula (1966)
(R.K.M.) = Nm x M.B.P.
where:
Nm = Metrical number.
M.B.P. = Mean of breaking point for individual flax fiber.
4- Fiber fineness in metrical number (N.m); In metrical number (N.m) was determined according to Radwan and Momtaz method (1966) using the following formula:

$$N.m = \frac{N.L}{G}$$

Where:
N = number of fibers (20 fibers each 10 cm).
L = length of fibers in mm.
G = weight of fibers (mg).
5- Fiber yield / fad (kg).

Statistical Analysis:

Combined analysis was carried out for the studied traits over the two growing seasons according to Le Clerg *et al* (1966).

Duncan's multiple range test (Duncan, 1955) was used for comparison among means.

RESULTS AND DISCUSSION

1. Components of Straw and Seed Yields:

Combined mean values for components of straw and seed yields of the three flax varieties are presented in Table (3).

Analysis of variance showed significant differences between varieties for all studied characters. Data showed that Sakha1 variety ranked first regarding length of capsules zone (18.80 cm), stem diameter (2.11 mm) and straw yield per plant (1.94 g), meanwhile, commercial variety Sakha 1 has been considered the best variety with regarding in all studied seed yield and its attributes as number of capsules per plant (9.30), number of seed per plant (62.36), seed yield per plant (0.505 g), seed yield per

Table 2: Mean values of straw, seed yields and their components for the three varieties in both season.

Variety / Characters	Sakha 1 season		Sakha 3 season		Sakha 4 Season	
Straw yield:	2004/05	2005/06	2004/05	2005/06	2004/05	2005/06
Technical length (cm)	92.87	90.20	95.73	94.00	89.30	89.10
Length of capsules zone (cm)	19.30	18.30	12.32	12.10	11.78	11.72
Stem diameter (mm)	2.12	2.10	1.83	1.88	1.82	1.81
Straw yield/plant (g)	1.93	1.95	1.18	1.20	1.06	1.03
Straw yield /fad. (ton)	3.830	3.860	4.010	4.095	3.990	3.998
Seed yield :						
Number of capsules / plant	9.13	9.48	7.10	7.7 1	7.50	7.55
Number of seeds/plant	63.22.	61.50	44.11	42.04	50.59	48.00
Seed yield / plant (g)	0.450	0.555	0.278	0.288	0.283	0.298
Seed yield / fad. (kg)	510.90	530.00	383.80	410.30	369.20	365.77
Seed index (g/1000 seeds)	9.30	9.41	4.890	4.780	4.720	4.750
Seed oil percentage	41.20	41.22	33.90	33.80	33.60	33.20

Means followed by the same letter are not significantly differed at 5% level of probability according to Duncan's multiple range test.

faddan (520.45 kg), seed index (9.36 g) and oil percentage (41.20%) . The largest technical length and highest straw yield per faddan were recorded by Sakha 3 variety (94.87 cm and 4.050 ton) respectively, but it occupied the 2nd rank for length of capsules zone, stem diameter, straw yield perplant, seed yield per faddan, seed index and oil percentage. On the other hand, Sakha 4 variety gave the shortest technical length (89.20 cm), straw yield per plant (1.05 g), seed yield per faddan (362.48 kg), seed index (4.74 g) and oil percentage (33.40%). These results are in harmony with those obtained by Aly *et al* (2002), El-Borhamy (2003), Kineber (2003), Mostafa and Ashmawy (2003), El-Kady and Kineber (2004) and Abd El-Fatah and El Deeb (2006).

Table 3: Combined analysis mean values of straw, seed yields and their components for the three varieties over the two seasons.

Characters \ Variety	Sakha 1	Sakha 3	Sakha 4
Straw yield:			
Technical length (cm)	91.54b	94.87a	89.20c
Length of capsules zone (cm)	18.80a	12.21b	11.75b
Stem diameter (mm)	2.11a	1.85b	1.82b
Straw yield/plant (g)	1.94a	1.19b	1.05c
Straw yield /fad. (ton)	3.850c	4.050a	3.994b
Seed yield :			
Number of capsules / plant	9.30a	7.45c	7.53b
Number of seeds/plant	62.36a	43.10c	49.30b
Seed yield / plant (g)	0.505a	0.283c	0.291b
Seed yield / fad. (kg)	520.45a	397.05b	362.48c
Seed index (g/1000 seeds)	9.36a	4.83b	4.74c
Seed oil percentage	41.20a	33.85b	33.40c

Means followed by the same letter are not significantly differed at 5% level of probability according to Duncan's multiple range test.

2. Fiber Yield and its Technological Characters:

Combined mean values for fiber yield and its technological characters of three flax varieties as affected by retting treatments are presented in Table (5)

A. Effect of Varieties:-

Data in Table (5)showed highly significant differences between flax varieties in total fiber percent, strength, fineness and yield/fad, where

Table 4. Mean values of fiber yield and its components for the three varieties and retting in two seasons.

Characters / Treatment		Total fiber (%)	Fiber length (cm)	Fiber strength (R.K.M.)	Fiber finenss (N.m)	Fiber yield per faddan (kg)
Variety	**Season**					
Sakha 1	2004/05	16.35	82.12	59.80	290.11	680.010
	2005/06	16.55	82.20	59.60	298.11	690.010
Sakha 3	2004/05	22.19	82.20	64.30	330.15	780.500
	2005/06	22.59	82.08	64.46	332.21	794.572
Sakha 4	2004/05	21.50	81.70	63.00	320.15	770.476
	2005/06	21.86	81.92	63.16	324.19	786.470
Retting:						
Without change water	2004/05	20.70	81.60	57.70	356.10	760.460
	2005/06	21.04	81.90	57.72	356.24	764.460
Water change every 72 hours	2004/05	19.35	81.80	62.90	325.20	750.270
	2005/06	19.65	81.88	62.71	327.28	750.670
Change water daily	2004/05	20.22	82.70	66.75	260.60	730.120
	2005/06	20.27	82.78	66.81	264.74	746.120

Sakha 3 variety produced the highest values (22.39%), (64.38 R.K.M.), (331.18 N.m)and(787.56 N.m), respectively. Sakha 4 variety followed the preceding variety where it produced (21.68%) for total fiber percent, (63.08 R.K.M.) for fiber strength, (322.17 Nm) for fiber fineness and (778.473 kg) for fiber yield per faddan. On the other hand, Sakha 1 variety had the lowest estimates in all four fiber characters, however there were no significant differences between the studied varieties in fiber length. These differences among varieties could be attributed to genetical structure. Similar results were obtained by El-Borhamy (2003), Kineber (2003), El-Kady and Kineber (2004) and Abd El-Fatah and El Deeb (2006).

Table 5: Combined analysis mean values of fiber yield and its quality for the three flax varieties as affected by retting treatments over the two seasons.

Characters / Treatment	Total fiber (%)	Fiber length (cm)	Fiber strength (R.K.M.)	Fiber finenss (N.m)	Fiber yield per faddan (kg)
Variety:					
Sakha 1	16.45b	82.06a	59.85c	294.11c	685.01c
Sakha 3	22.39a	82.14a	64.38a	331.18a	787.561a
Sakha 4	21.68a	81.81a	63.08b	322.17b	778.473b
Retting:					
Without change water	20.87a	81.75a	57.71c	356.17a	762.46a
Water change every 72 hours	19.50b	81.84a	62.81b	326.24b	750.47b
Change water daily	20.25b	82.74a	66.79a	262.67c	738.12c

Means followed by the same letter are not significantly differed at 5% level of probability according to Duncan's multiple range test.

B- Effect of Retting Treatments:

The obtained data presented in Table (5) revealed that retting treatments exhibited significant effects on fiber yield and its quality except fiber length. The highest values of total fiber percent, fiber fineness and yield per faddan were obtained by retting without change water, while change water daily during retting gave the strength fiber (66.79 R.K.M.). Water change every 72 hours produced the intermediate values for total fiber percent (19.50 %), fiber strength (62.81 R.K.M.), fiber fineness

Table 6. Combined analysis mean values interaction between flax varieties and retting treatments for fiber yield and its technical characters over the two seasons.

Varieties	Retting treatment	Total fiber %	Fiber length (cm)	Fiber strength (R.K.M)	Fiber fineness (N.m)	Fiber yield / fad. (kg)
Sakha 1	Without change water	17.29d	81.78c	55.26e	330.61d	694.025a
	Water change every 72 hours	15.93e	81.77c	60.63d	309.06e	689.21b
	Change water daily	16.14de	82.62c	63.67c	242.65g	671.805d
Sakha 3	Without change water	22.93a	82.22a	59.39d	374.06a	799.17a
	Water change every 72 hours	21.80b	81.93b	63.93c	329.93d	786.845bc
	Change water daily	22.46b	82.27a	69.83a	291.41f	776.68c
Sakha 4	Without change water	22.39a	81.27cd	58.50f	372.83b	794.185b
	Water change every 72 hours	20.78c	80.83d	63.88c	339.73c	775.365c
	Change water daily	21.87b	83.33b	66.87b	253.96h	765.870e

Means followed by the same letter(s) are not significantly differed at 5% level of probability according to Duncan's multiple range test.

(326.24 N m) and yield per faddan (738.12 kg)). These results agreed with those obtained by Easson and Molloy (1996) and Meijer *et al* (1995). On the other hand, Radish *et al* (1999) who compared between tank retting and retting by spraying under with a polyethylene sheet and found that controlling tank retting gave higher fiber yield and fineness than other retting method.

C- Interaction Effect:

Data in Table (6) showed that flax variety x retting treatment interactions had significant effects on all studied fiber yield and its technological characters as a combined over the two growing seasons.

The highest fiber percentages (22.93, 22.46 and 22.39 %) produced from Sakha 3 variety using both without water change and daily water change and Sakha 4 without water change, respectively. Also, Sakha 3 variety under without water change or with daily water change produced the tallest fibers (82.22 and 82.27 cm), while the strongest flax fibers (69.83 R.K.M.) resulted from Sakha 3 with daily water change. On the other hand, Sakha 3 Variety produced the highest fiber yield (799.17 kg/fad) and finest fibers (374.06 N.m) under without water change.

On the contrary, Sakha 1 produced the lowest fiber percent (15.93 %) with water change every 72 hours, weakest fibers (55.26 R.K.M.) without water change, lowest fiber yield (671.805 kg/fad) and coarsest fibers (242.65 N.m) with daily water change.

GENERAL CONCLUSION

the mentioned results showed that Sakha 3 flax variety gave the highest fiber yield per faddan with the retting treatment (without change water), however Sakha 1 flax variety surpassed all varieties in seed yield and its related charaters.

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الملخص العربي

دراسة مقارنة لبعض أصناف الكتان تحت معاملات التعطين المختلفة

الديب إبراهيم عبد الله الديب

مركز البحوث الزراعية – معهد المحاصيل الحقلية

قسم بحوث محاصيل الألياف

أجريت هذه الدراسة في المزرعة البحثية بمحطة البحوث الزراعية بإيتاي البارود بمركز البحوث الزراعية – مصر . خلال موسمي ٢٠٠٤/٢٠٠٥ و ٢٠٠٥/٢٠٠٦ لدراسة تأثير ثلاث معاملات تعطين بالماء و هي بدون تغيير ماء (مياه راكدة) و تغيير الماء كل ٧٢ ساعة و مياه متغيره يوميا على محصول الألياف و خواصها التكنولوجية لثلاثة أصناف من الكتان هي سخا ١ ، سخا ٣ ، سخا ٤ .

أهم النتائج التي تم التوصل إليها كما يلي :-

١ – تفوق الصنف سخا ١ في صفات طول المنطقة الثمرية و سمك النبات و محصول القش للنبات و محصول البذرة و الصفات المرتبطة بها ، بينما تفوق الصنف الجديد سخا ٣ على كلا من الصنفين سخا ١ ، سخا ٤ في صفات الطول الفعال و محصول القش للفدان و نسبة الألياف و طول و متانة و نعومة الألياف و محصول الألياف للفدان وقد جاء الصنف سخا٤ في المرتبة الثانية بعد سخا ٣ في صفات الألياف.

٢ – أدى عدم تغيير مياه التعطين إلى زيادة في النسبة المئوية للألياف الكلية و كذلك محصول الألياف للفدان و نعومتها. أما طريقة تغيير المياه المستمرة (كل ٢٤ ساعة) فقد أعطت أطول و أمتن الألياف .

٣ – كان التفاعل بين الأصناف و طريقة التعطين معنويا على كل الصفات التكنولوجية للألياف .