J. Plant Production, Mansoura Univ., Vol. 6 (6): 1077-1088, 2015

EFFECT OF HARVESTING DATES AND RETTING METHODS ON THE YIELD AND QUALITY OF THREE FLAX GENOTYPES *(Linum usitatissimum l.)*

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ABSTRACT

Two field experiments were conducted at the Experimental Farm, Sakha Agric. Res. Station , Sakha, kafrelsheikh, Egypt during the two successive winter seasons of 2012/2013 and 2013/2014 to study the effect of four harvesting dates i.e 120,130,140 and 150 days after sowing and retting methods (Retting in water change every 24 hours and Still water retting) on yield and its quality yield components of three flax Genotypes (Sakha 3, Ilona and S. 541 /D/10) The experimental design was split plot with four replicates where in field experiment, the three genotypes were distributed in the main plots and harvesting dates were allocated in the sub plots, while after harvesting the twelve combinations between the genotypes and harvesting were distributed in the main plot while the two retting treatments were allocated in the sub plots.

The results revealed high significant differences among the flax genotypes in straw yield and its components. Sakha 3 cultivar registered the greatest values of technical length, straw yield/plant and straw yield/fed., sakha 3 and Ilona cultivars gave the highest values in fiber strength, fiber fineness, fiber percent, fiber yield /plant and fiber yield /fed. while S. 541 /D/10 genotype was the highest in stem diameter, fruiting zone length, number of capsules/plant, number of seeds /plant, 1000-seed weight, seed yield / fed. and seed oil content.

The results revealed that the harvesting flax plants at 140 DAS gave significantly increases in technical length and fruiting zone length in both seasons. While, the same effect was in seed yield /plant& straw yield /fed. in the second season and in both seed yield /fed. and straw yield/ plant in first season, on the other hand the traits of fiber length, fiber strength, fiber fineness, fiber percent, fiber yield /plant and fiber yield /fed. recorded the highest significantly values at harvesting date 140 DAS in both seasons and did not significantly differed with harvesting date 150 DAS in fiber length in both seasons and in fiber yield /fed. in the second seasons. However, delayed harvesting date to 150 DAS showed the highest values in number of capsules/plant, number of seed /plant, 1000-seed weight (g), seed yield /plant, seed yield /fed. straw yeild/fed. seed oil content in both seasons and straw yield/plant in the second season. While, The harvest date at 130 DAS recorded the highest values in stem diameter in both seasons compared with other harvesting dates.

The interaction between the genotypes and harvesting dates had a significant effect in technical length, fiber strength, fiber fineness, fiber percent, fiber yield /plant, fiber yield /fed. fruiting zone length, stem diameter, number of capsules/plant, number of seed /plant, 1000-seed weight, seed yield /plant , seed yield /fed., straw yield/plant straw yield/fed. and seed oil content in both seasons.

The twelve combinations between genotypes of flax and harvesting dates recorded significant differences in fiber fineness, fiber length, fiber strength, fiber percent, fiber yield /plant and fiber yield /fed. in both seasons . The combinations between both sakha 3 and Ilona genotype and the harvesting date at 140 DAS recorded the highest values in all previous characters both seasons, Without

significantly differences with the combination between harvesting date 140 DAS and S. 541 /D/10 genotype in the fiber yield/fed. character.

The retting method recorded significant differences in fiber length, fiber strength, fiber yield /plant and fiber yield /fed. in the second season only. While the characters of fiber fineness and fiber percent recorded the significant differences in both seasons. The retting method with water change every 24 hours recorded the greatest significantly values in fiber length, fiber strength, fiber fineness, fiber percent, fiber yield/plant and fiber yield/fed.

The interaction among the twelve combinations between flax genotypes with harvesting dates and two retting method had a significant effect in fiber fineness in the first season, fiber yield/ fed. in the second season and fiber percent & fiber yeild/plant in both seasons .

From the results and under the conditions of this study, it could be concluded that for producing the high seed and fiber yield, it can be recommended by S. 541 /D/10 and sakha 3 genotypes and harvest at 140 DAS with retting by water change every 24 hours for high quality of fibers.

Keywords: Flax genotypes, harvesting dates, retting methods and Yield & its quality

INTRODUCTION

Flax (*Linum usitatissimum L.)* is an old economic crop grown as a dual purpose crop for seeds and fibers which is used for the manufacture of linen. Flax is ranked second plant after cotton as a fiber crop regarding the cultivated area. Flax is one of the ancient important crop grown for fiber and oil locally used in textile industry. Flax is considered one of the most important dual purpose crops for oil and fiber production in Egypt and the world, In Egypt, flax plays an important role bank note papers.

In Egypt, flax plays an important role in the national economy owing to export beside local industry Sharief, 1999 reported that Liflora cultivar achieved through growing high yielding surpassed other four genotypes in plant height, technical length proper fertilizer application. The lineseed contains about 36 to 48% oil content. It is an important source of essential fatty acids for human diets, and has several health benefits (Millis, 2002). It is necessary to increase flax productivity per unit area which could be achieved by using high yielding genotypes (Verma and Pathak ,1993 and Abu El-Dahab, 2002). Evaluation of high yielding genotypes in itself is not enough to increase production, Bakry et al (2012) revealed that high significant differences among the flax genotypes in yield and its components. Giza 8 cultivar surpassed Olin and Amon genotypes in the characters of plant height (cm), technical length(cm), 1000-seed weight (g), straw yield (t/ha), fiber % and fiber yield (t/ha), while Olin genotypes produced the highest values of seed yield/ plant (g). On the other hand, Amon cultivar surpassed the other two genotypes in fruiting zone length (cm), number of branches/plant, number of capsules/plant, straw yield/plant (g), seed yield (t/ha), oil % and oil yield (t/ha). In the recent years many efforts were devoted to increase the productivity of flax through improving the best cultural practices such as harvesting date for improving the productivity and quality of flax. El-kady et al., (2010) reported that the harvest date of 155 days after sowing showed significant increases in stem diameter, straw yield/plant as well as per fed.

fiber yield and its quality compared to the other three dates (135, 145 and 165 days after sowing). However, delayed harvesting date to 165 days after sowing recorded significant increase in technical length, upper branching zone length, seed yield and its related characters, seed index, oil content and oil yield/fed..

Retting is the major limitation to an efficient production of textile fibers. Traditional retting has been carried out by autochthonous bacterial community. Aerobic and anaerobic pectinolytic strains were used. Anaerobic pectinolytic strains had a wide range of acid polygalacturonase (PG) activity, whereas aerobic isolates did not produce any acid PG activity, but only an alkalophylic one, suggesting they could play a minor role in the retting process, C. felsineum and C. acetobutylicum were confirmed as the main anaerobic agents. Nevertheless, a high proportion of anaerobic and aerobic pectinolytic strains were assigned to C. saccharobutylicum and B. pumilus, respectively, both species never being described as involved in water retting. Anaerobic and aerobic strains with high PG activity were selected and characterized. PG activity is well correlated with the strain retting efficiency and improvement of the process was obtained by inoculating the retting water with spores of selected aerobic and anaerobic bacteria. An advisable feature of retting strains is the absence of cellulosolytic activity. An aerobic strain with no cellulosolytic activity was identified Tamburini et al (2004). El-Borhamy (2003) found that retting with water change every 48 hours gave the tallest fiber while, retting in streaming water gave the highest values of fiber fineness, fiber strength, fiber yield per fed. and fiber percentage.

El-Borhamy (2011) reported that retting with still water recorded the great values of fiber yield and its technical characters.

Therefore, the aim of this study was to investigate the effect of harvesting dates and retting method on the productivity and quality of three flax genotypes.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm of Sakha Agricultural Research Station, Kafr EL-Sheikh Governorate, North Delta, Egypt during 2012/2013 and 2013/2014 seasons to study the effect of different harvesting dates and retting methods on the yield and quality of some flax genotypes. The genotypes were:

Sakha 3: a fiber purpose type, selected from cross Belinka 2 Ex I.2096 (local variety), Ilona: a fiber purpose type, imported variety from Belgain and S.541/D/10: an oil purpose type selected from cross S-2419/1x148/6/1 (promising). The experimental design was split plot with four replicates in field experiments where the three genotypes were distributed in the main plots and harvesting dates (120, 130, 140 and 150 days after sowing) were allocated in the sub plots, while after harvesting the twelve combinations between the genotypes and harvesting (3 genotype X 4 harvesting dates = 12) were distributed in the main plot while the two retting treatments (Retting in water change every 24 hours and Still water retting) were allocated in the

sub plots. The sub plot area was 12 m^2 (3m x 4 m) in both seasons. Soil samples were randomly taken from the experimental sites at depth from 0 to 30 cm from soil surface and were prepared for both mechanical and chemical analysis. The soil of the experimental fields was clay in texture with pH of 8.1, organic matter, 1.71 % and containing 17.90, 13.67 and 281 ppm available N, P and K, respectively (average of the two seasons).

Seed of the flax genotypes was sown in 7th and 10 th of November in the first and second season, respectively. The preceding crops were corn (*zea mays*) and sunflower in the first and second seasons, respectively. Seed was uniformly broadcasted at the recommended rate of each genotype. Before the sowing, the experimental soil was fertilized with 100 kg/fed. of calcium super phosphate (15.5 % P2O5) during the practices of soil preparation.The nitrogen fertilizers was applied at the rate of 45 kg/fed. at tow doses in the form of urea (46.6 % N), the first dose (50%) was applied at the first irrigation and the second dose (50%) at the second irrigation, the rest of cultural practices were applied as recommended. Ten guarded individual plants were randomly taken from each sub plot to estimate technical stem length (cm), stem diameter, fruiting zone length, numbers of capsules /plant, numbers of seeds /plant, 1000 seed weight, seed and straw yields/plant (g). At different harvesting dates, flax plants were pulled out manually, then seed and straw yields (t/fed.) were estimated from the central area of one square meter of each sub plot. Seed oil % was determined according to A.O.A.C. (1990) Oil yield (t/fed.) was calculated by seed yield (t/fed.) x seed oil (%).

In both seasons retting process was carried out in august, it carried out in tubes retting in still water methods take seven days to reach the end point of retting while in water change every 24 hours it takes ten days to reach the end point of retting. The end point of retting operation was obtained when fiber were easily separation from the internal core of flax plants.

Fiber length (cm), fiber yield/ plant (g), fiber fineness (N.m), fiber strength (R.K.M) fiber percentage and fiber yield per fed. (Kg). were determined. Fiber percentage was calculated by (weight of total fiber (g) /weight of straw after retting (g)) x 100. Fiber yield (t/fed.) was calculated by straw yield (t/ fed.) x fiber (%), fiber fineness (N.m) and fiber strength were determined according to Radwan and Momtaz Method (1966).

The analysis of variance was carried out according to Gomez and Gomez (1984) for all collected data. Treatment means were compared by Duncan's Multiple Range Test according to Duncan (1955). All statistical analysis was performed using analysis of variance technique by means of "MSTATC" computer software package

RESULTS AND DISCUSSION

Straw yield and its related characters:

Technical length and stem diameter of three flax genotypes(Sakha 3, Ilona and S.541 /D/10) as affected by (120, 130, 140 and 150 DAS) in 2012/2013 and 2013/2014 are presented in Table (1).

The data show that flax genotypes recorded significant differences in all mentioned characters in both seasons except in the second season the

genotypes did not significantly differed at the character of technical length. The data revealed that Sakha 3 and Ilona recorded the greatest values of Technical length in first season, while the S. 541 /D/10 genotypes recorded the lowest values in this character. The heights significant values of stem diameter were obtained from S. 541 /D/10 genotypes while; sakha3 cultivar gave the lowest values in these traits. These results were corresponded with those findings by Millis, 2002, El-kady et al., (2010), El-Borhamy (2011) and Bakry et al., (2012). Sakha 3 cultivar gave the highest values in straw yield /plant in the first season, while the lowest values obtained by Ilona cultivar. With respect to straw yield/ fed. Sakha 3 gave the highest values in both seasons and the lowest recorded by Ilona cultivar.

Table (1): Effect four harvesting dates on three genotypes of flax and their interaction on technical length (cm), stem diameter (mm), straw yield / plant and straw yield /fed during 2012/2013 and 2013/2014 seasons.

Factor	Technical length (cm)		Stem diameter (mm)		Straw yield /plant(g)		Straw yield /fed. (ton)	
A. Flax genotypes	2012/ 2013	2013/ 2014	2012/ 2013	2013/ 2014	2012/ 2013	2013/ 2014	2012/ 2013	2013/ 2014
Sakha 3	92.92 a	92.63	2.06 b	2.17 b	2.03 a	2.07 a	4.14 a	4.13 a
Ilona	91.14 ab	94.02	1.91 c	1.98 c	1.70 c	1.75 b	2.91 c	2.84 c
S.541 /D/10	88.44 b	93.46	3.19 a	3.29 a	1.96 b	2.02 a	3.73 b a	3.73 b
F-test	*	Ns	**	**	**	*	**	**
A. Harvestdate (DAS)								
120	85.58 c	89.54 c	2.35 c	2.45 c	1.52 d	1.52 c	3.07 d	3.07 c
130	89.38 b	93.57 b	2.66 a	2.79 a	1.88 c	1.98 b	3.35 c	3.27 b
140	93.98 a	96.72 a	2.00 d	2.09 d	2.16 a	1.98 b	3.92 b	3.93 a
150	94.39 a	93.64 b	2.52 b	2.59 b	2.04 b	2.29 a	4.03 a	4.00 a
F-test	**	**	**	**	**	**	**	**
Interaction (A x B)	**	**	**	**	*	**	**	**

***, ** and Ns indicate p <0.05, <0.01 and not significant, respectively. Means of each treatment followed by the same letter are not significantly different at 5% level, according to Duncan's multiple range test.**

The different harvest dates showed a significant effect in all mentioned characters in both seasons. The harvest at 140 DAS recorded the greatest values in Technical length in both seasons and without significant differences with the harvest at 150 DAS in Technical length character in first season only and the harvest at 130 DAS recorded the highest values in stem diameter characters in both seasons. While, the lowest values in Technical length and stem diameter were obtained from the harvest at 120 DAS in both seasons. Such effect of harvest date might have been resulted from the effect of environmental conditions. These results were corresponded with those findings by El- Elkady et al., (2010), El- borhamy (2003) and El- borhamy (2011).

The interaction between the genotypes and harvesting dates had highly significant effect on Technical length and Stem diameter in both seasons.

Seed Yield and its related characters:

It noticed from the data in Tables (2&3) that seed yield and its related characters had a significant effect by three genotypes(Sakha 3, Ilona, S.541 /D/10) and the harvest dates (120, 130, 140 and 150 days from sowing) as well as its interaction in 2012/2013 and 2013/2014 seasons.

Data presented in Table (2&3) revealed that a significant effect was recorded on the Fruiting zone length, number of capsules/plant, number of seeds /plant, 1000 seed weight and seed yield /plant, seed yield /fed., Straw yield / plant, Straw yield /fed and seed oil percentage by different genotypes (Sakha 3, Ilona, 541 /D/10) and the harvest dates in the two growing seasons. The greatest value of number of capsules/plant, number of seed /plant, 1000 seed weight, seed yield /plant, seed yield /fed. and seed oil percentage were obtained from S. 541 /D/10 genotypes followed by Sakha 3 and Ilona in a descending order in both seasons. While, the lowest values were obtained by Sakha 3. The highest seed yield / plant and seed yield /fed were obtained from S.541/D/10 cultivar followed by Sakha 3 in both seasons. While, the lowest values were obtained by Ilona. The superiority of seed yield and its related characters with different genotypes may be due to the genetic differences between Sakha 3, Ilona, and S.541/D/10. Similar results were obtained by Millis, 2002, El-kady et al., (2010), El-Borhamy (2011) and Bakry et al., (2012)

Table (2): Effect four harvest date on three genotypes of flax and their interaction on Fruiting zone length (cm), number of capsule/plant, number of seed /plant, and 1000 seed weight during 2012/2013 and 2013/2014 seasons.

Factor	Fruiting zone length (cm)		Number of capsule/plant		N. of seeds/plant		1000 seed weight (g)	
A. flax genotypes	2012/ 2013	2013/ 2014	2012/ 2013	2013/ 2014	2012/ 2013	2013/ 2014	2012/ 2013	2013/ 2014
Sakha 3	9.93 b	11.9 b	7.51 b	8.70 b	56.86 b	60.9 b	3.39 b	3.5 b
Ilona	8.29 c	10.3 c	7.05 c	8.24 c	52.21 c	56.2 c	2.78 c	3.04 c
S.541 /D/10	17.86 a	20.1 a	21.07 a	21.96 a	157.66 a	161.6 a	8.77 a	8.96 a
F-test	**	**	**	**	**	**	**	**
B. Harvest date (DAS)								
120	8.57 d	10.69 d	9.57 d	10.8 d	62.98 d	67.0 d	4.13 c	4.34 d
130	10.38 c	12.50 c	11.80 c	13.0 c	85.07 c	89.1 c	4.43 c	4.58 c
140	14.83 a	16.82 a	12.38 b	13.6 b	98.98 b	103.1 b	5.42 b	5.7 b
150	14.32 b	16.30 b	13.78 a	14.5 a	108.63 a	112.6 a	5.94 a	6.12 a
F-test	**	**	**	**	**	**	**	**
Interaction (Ax B)	**	**	**	**	**	**	**	**

****, * and NS indicate p <0.05, <0.01 and not significant, respectively. Means of each factor designated by the same letter are not significantly different at 5% level, according to Duncan's multiple range tests.**

Concerning the effect of different harvest dates on number of capsule, number of, number of seed /plant, 1000 seed weight, seed yield /plant, seed yield /fed. and seed oil percentage. The data in table (2&3) revealed that the

greatest values of all traits were obtained from the harvest at 150 DAS except seed yield /plant character in the first season recorded the highest values of seed yield /plant at 140 DAS as harvest date, add that the harvest date at 140 DAS did not significantly differed with 150 DAS in seed yield /fed. In the first seasons However, the harvest at 120 DAS registered the lowest values of those traits in both seasons. These results may be due to the effect of difference of environmental conditions as soon as heat and relative humidity in the period of harvest, those factors may be affected the maturity of fiber characters. These results were harmony with those obtained by El- El-kady et al., (2010), El- Borhamy (2003) and El- borhamy (2011).

Table (3): Effect four harvest date on three genotypes of flax and their interaction on seed yield /plant, seed yield / fed. and seed oil percentage during 2012/2013 and 2013/2014 seasons.

Factor	Seed yield /plant(g)		Seed yield /fed.(kg)		Oil %	
A. flax genotypes	**2012/ 2013**	**2013/ 2014**	**2012/ 2013**	**2013/ 2014**	**2012/ 2013**	**2013/ 2014**
Sakha 3	0.29 b	0.32 b	284.64 b	288.9 b	30.59 c	30.9 b
Ilona	0.21 c	0.25 c	253.91 c	254.1 c	26.49 b	26.8 c
S.541 /D/10	0.33 a	0.37 a	683.05 a	685.6 a	34.68 a	36.3 a
F-test	**	**	**	**	**	**
B. Harvest date (DAS)						
120	0.18 d	0.22 c	271.79 c	266.6 d	27.3 d	27.3 d
130	0.21 c	0.25 b	366.61 b	368.2 c	28.75 c	29.1 b
140	0.35 b	0.39 a	488.60 a	495.5 b	32.51 b	33.9 c
150	0.36 a	0.40 a	501.80 a	507.9 a	34.06 a	35.1 a
F-test	**	**	**	**	**	**
Interaction (Ax B)	**	**	**	*	**	**

****, * and NS indicate p <0.05, <0.01 and not significant, respectively. Means of each factor designated by the same letter are not significantly different at 5% level, according to Duncan's multiple range tests.**

With regard to the interaction between flax genotypes and harvesting dates on seed and straw yield in both seasons, the data in table (4) show that interaction between flax genotypes and harvesting dates had highly significant effect on seed and straw yields characters. The combination between S.541/D/10 genotype with the harvest at 150 DAS produced the highest significant values of seed and straw yields in both seasons without significant differences with the combination between S.541/D/10 genotype and harvest at 140 DAS at seed yield in the first season On the other hand, the lowest values of seed and straw yields characters produced from harvested plants Ilona genotype at 120 DAS in both seasons.

Table (4): seed and straw yields /fed as affected by the interaction between four harvesting dates and three genotypes of flax during 2012/2013 and 2013/2014 seasons.

Variables	Seed yield			Straw yield		
2012/2013						
Genotypes / Harvesting date	**Sakha 3**	**Ilona**	**S.541/D/10**	**Sakha 3**	**Ilona**	**S.541/D/10**
120	159.64 g	145.71 g	510.02 c	3.16 e	2.67 g	3.36 d
130	223.93 f	212.32 f	663.59 b	3.17 e	2.86 fg	4.04 b
140	375.56 d	329.12 e	761.13 a	4.30 b	3.09 e	4.36 b
150	379.43 d	328.51 e	797.47 a	4.28 b	3.01 ef	4.79 a
2013/2014						
Genotypes / Harvesting date	**Sakha 3**	**Ilona**	**S.541/D/10**	**Sakha 3**	**Ilona**	**S.541/D/10**
120	160. 70 h	131.61 i	507.52 d	3.15 e	2.70 g	3.35 d
130	218.57 g	217.32 g	668.59 c	3.15 e	2.63 g	4.03 c
140	389.01 e	334.12 f	763.39 b	4.33 b	3.08 ef	4.38 b
150	387.48 e	333.51 f	802.72 a	4.28 b	2.95 f	4.78 a

B- Fiber yield and its quality:

The results in Tables (5&6) show that the twelve combinations between flax genotypes & harvesting dates and two retting methods (Retting in water change every 24 hours and Still water retting) and their interactions had a significant effect on fiber fineness, fiber length, fiber strength, fiber percent, fiber yield /plant and fiber yield /fed. during 2012/2013 and 2013/2014 seasons.

The data in Tables (5&6) revealed that the combinations between the harvest at 140 DAS with both Ilona and sakha 3flax gentype recorded that the highest significant values in fiber fineness, fiber yield/plant, fiber strength, fiber percent, fiber yield/plant and fiber yield /fed. in both seasons, while the three combinations between the harvest at 140 DAS with the three genotypes did not significantly differed in fiber length character but in fiber yield/fed. character the same three combinations recorded the greatest significant values It could be concluded that fiber yield and quality parameters, depended mainly on genotype and this is mainly due to the genetically constituents with environmental conditions as soon as heat and relative humidity in the period of harvest, those factors may be affected the maturity of fiber characters and as well as its interaction. The combination between the S.541 /D/10 genotype and harvesting date at 120 DAS registered the lowest values in all quality characters, These results are in harmony with those obtained by Millis, 2002, El-kady et al., (2010), El-Borhamy (2011) and Bakry et al (2012), El - kady et al., (2010), El- Borhamy (2003) and El- borhamy (2011).

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Regarding to the effect of retting methods on flax the data in table (5&6) showed that the two retting methods had significantly differences in fiber fineness and fiber percent in both seasons while in fiber length, fiber strength, fiber yield/plant and fiber yield/ fed. in the second season only while, the fiber length, fiber strength , fiber yield/plant and fiber yield/fed. characters registered significantly differences in the second seasons only, The retting method by water change every 24 hours recorded the greatest significantly values in fineness, fiber length, fiber strength, fiber percent, fiber yield/plant and fiber yield/fed. Compared with Still water method which recorded the lowest values. These results may be due to the effect of microorganisms on fiber quality; these results were harmony with those obtained by El-kady et al., (2010), El- Borhamy (2003) and El- Borhamy (2011).

With regard to the interaction between two retting methods and the combinations between four harvest dates (HD) & three genotypes of flax on fiber fineness, fiber percent, fiber yield/plant and fiber yield/fed. the data in table (5&6) show that there were significantly differences in fiber fineness in the first season, fiber yield/fed. in the second season while in fiber percent and fiber yield/plant in both season.

Table (6): Effect of two retting methods and the combinations between four harvest dates (HD) & three genotypes of flax and their interactions on fiber yield /plant and fiber yield /fed. during 2012/2013 and 2013/2014 seasons.

Factor	Fiber yield /plant (g)		Fiber yield /fed. (kg)	
A. genotype and harvesting dates combinations	**2012/2013**	**2013/2014**	**2012/2013**	**2013/2014**
Sakha 3 + 120 HD	0.79 c	0.76 ef	282.4 fg	280.7 de
Sakha 3+ 130 HD	1.01 b	0.97 d	304.2 ef	306.4 cd
Sakha 3+ 140 HD	1.1 a	1.1 a	452.3 a	437.7 a
Sakha 3+ 150 HD	1.04 b	1.05 bc	411.7 b	414.0 a
Ilona + 120 HD	0.76 cd	0.75 fg	236.4 h	237.5 f
Ilona + 130 HD	0.80 c	0.80 ef	263.0 gh	272.6 e
Ilona + 140 HD	1.11 a	1.09 ab	410.6 b	380.5 b
Ilona + 150 HD	1.04 b	1.03 c	282.0 fg	283.5 de
S.541 /D/10 + 120 HD	0.72 d	0.72 g	261.4 gh	261.1 ef
S.541 /D/10 + 130 HD	0.77 cd	0.767 ef	335.7 d	335.3 c
S.541 /D/10 + 140 HD	0.81 c	0.801 e	377.7 c	413.3 a
S.541 /D/10 + 150 HD	0.78 cd	0.76 efg	330.6 de	311.8 cd
F test	**	**	**	**
B. retting methods				
Still water	.891	.87 b	326.7	324.1 b
water change every 24 h	.892	.89 a	331.4	331.6 a
F test	NS	*	NS	**
Inter action				
F test	*	**	NS	**

****, * and NS indicate p <0.05, <0.01 and not significant, respectively. Means of each factor designated by the same letter are not significantly different at 5% level, according to Duncan's multiple range tests.**

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تأثير مواعيد الحصاد وطريقة التعطين على المحصول والجودة لثلاثة طرز وراثية من الكتان

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أجريت تجربتان حقليتان بالمزرعة البحثية بمحطة البحوث الزراعية بسخا -كفر الشيخ -مصر فى خلال الموسمين الشتويين ٢٠١٢/٢٠١٣ و ٢٠١٣/٢٠١٤ لدراسة تأثير أربعة مواعيد حصاد عند ١٢٠، ١٣٠، ١٤٠، ١٥٠ يوم من الزراعة وطريقة التعطين (التعطين فى ماء مع التغيير كل ٢٤ ساعة والتعطين فى ماء راكد) و التفاعل بينهما على المحصول وجودته لثلاثة تراكيب وراثية من الكتان هى (سخا ٣، ايلونا ، S.541/D/10) وقد وزعت المعاملات الحقلية فى تصميم القطع المنشقة فى أربع مكررات حيث اشتملت القطع الرئيسية على التراكيب الوراثية بينما تضمنت القطع الشقيه مواعيد الحصاد. وقد وزعت معاملات التعطين بعد الحصاد ايضا فى تصميم القطع المنشقة فى أربع مكررات حيث اشتملت القطع الرئيسية على التوالبق بين التراكيب الوراثية الثلاثة وبين مواعيد الحصاد بينما وزعت معاملتى التعطين فى القطع الشقيه و كانت النتائج المتحصل عليها كما يلى :-

- أظهرت النتائج اختلافات عالية المعنوية بين التراكيب الوراثية للكتان فى محصول القش ومكوناته.وقد سجل الصنف سخا ٣ القيم الأعلى فى صفة الطول الفعال ، محصول القش/ نبات ، محصول القش/ فدان. بينما سجل كلا من صنفى سخا ٣ وايلونا أعلى القيم لصفات متانة الألياف ، نعومة الألياف ، نسبة الألياف ، محصول الألياف/ نبات ، محصول الألياف /فدان. بينما أعطت السلالة S.541/D/10 القيم الأعلى فى صفات قطر الساق ، طول المنطقة الثمرية ،عدد الكبسولات /نبات ، عدد البذور/نبات، وزن الألف بذرة ، محصول البذور /فدان ومحتوى البذور من الزيت.
- أظهرت النتائج أن حصاد الكتان عند ١٤٠ يوم بعد الزراعة سجلت زيادة معنوية فى الطول الفعال وطول المنطقة الثمرية فى كلا الموسمين. وقد ظهر نفس التأثير فى الموسم الثانى فى صفات محصول البذرة /نبات ومحصول القش/فدان ولمحصول البذرة /فدان ومحصول القش/نبات فى الموسم الأول ومن الناحية الأخرى فقد سجلت صفات (طول الألياف ومتانة الألياف ونعومة الألياف ونسبة الألياف ومحصول الألياف/نبات ومحصول الألياف /فدان) أعلى القيم معنوية دون اختلاف معنوى مع الحصاد عند ١٥٠ يوم بعد الزراعة فى صفة طول الألياف فى كلا الموسمين وفى صفة محصول الألياف/فدان فى الموسم الثانى، وقد أعطى الحصاد بعد ١٥٠ يوم من الزراعة أعلى القيم فى صفات عدد الكبسولات/ نبات ، عدد البذور/نبات، وزن الألف بذرة ، محصول البذور/نبات، محصول البذور/فدان، ومحتوى البذرة من الزيت فى كلا موسمى الزراعة ومحصول القش/نبات فى الموسم الثانى. وقد سجلت القيم الأعلى فى صفة قطر الساق فى كلا الموسمين عند الحصاد عند ١٣٠ يوم من الزراعة بالمقارنة بمواعيد الحصاد الأخرى.
- اظهر التفاعل بين التراكيب الوراثية ومواعيد الحصاد تأثير معنوي فى كلا الموسمين وذلك فى صفات الطول الفعال ومتانة الألياف ، ونعومة الألياف، ونسبة الألياف، ومحصول الألياف /نبات ، محصول الألياف/فدان ، وطول المنطقة الثمريه، وقطر الساق ، وعدد الكبسولات /نبات، وعدد البذور/نبات ووزن الألف بذرة ، محصول البذور/نبات ، محصول البذور/فدان ، ومحصول القش/نبات ، محصول القش/فدان ، ومحتوى البذور من الزيت.
- سجلت تواليف التراكيب الوراثية مع مواعيد الحصاد تاثيرا معنوى فى كلا الموسمين فى صفات نعومة الألياف وطول الالياف ومتانة الالياف ونسبة الألياف ومحصول الألياف/نبات ومحصول الألياف /فدان، وقد سجلت التوليفة بين الحصاد عند ١٤٠ يوم من الزراعة مع صنف سخا ٣ وايلونا اعلى القيم المعنوية فى الصفات السابقة ولم تختلف معنويا مع حصاد السلالة S.541/D/10 عند ١٤٠ يوم من الزراعة فى صفة طول الالياف فى الموسمين وصفة محصول الالياف للفدان فى الموسم الثانى .
- سجلت طريقتى التعطين اختلافات معنوية فى كلا الموسمين فى صفات نعومة الألياف ونسبة الألياف بينما فى الموسم الثانى فقط فقد سجلت الاختلافات المعنوية فى صفات طول الألياف ومتانة الألياف ومحصول الألياف/نبات ومحصول الألياف /فدان، وقد سجل التعطين بتغيير المياه كل ٢٤ ساعة أعلى القيم معنوية فى طول الألياف ، متانة الألياف ، نعومة الألياف ، نسبة الألياف ، محصول الألياف/نبات ، محصول الألياف /فدان .
- سجل التفاعل ما بين تواليف التراكيب الوراثية مع مواعيد الحصاد وبين طريقة التعطين تأثير معنوي فى صفة نعومة الألياف فى الموسم الأول ومحصول الألياف/فدان فى الموسم الثانى ونسبة الالياف ومحصول الألياف/نبات فى كلا الموسمين.

من النتائج السابقة يمكن التوصية بزراعة التراكيب الوراثية للكتان الصنف سخا ٣ والسلالة S.541/D/10 للحصول على أعلى إنتاجية من الألياف والبذور على التوالى وحصاد الكتان عند عمر ١٤٠ يوم بعد الزراعة والتعطين مع تغيير المياه كل ٢٤ ساعة للحصول على أعلى صفات جودة الألياف وذلك تحت ظروف هذه الدراسة.

Table (5): Effect of two retting methods and the combinations between four harvest dates (HD) & three genotypes of flax and their interactions on fiber fineness, fiber length, fiber strength, and fiber percent during 2012/2013 and 2013/2014 seasons.

Factor	Fiber fineness (N.m)		Fiber length (cm)		Fiber strength (R.K.M)		Fiber percent (%)	
A. genotype and harvesting dates combinations	**2012/13**	**2013/14**	**2012/13**	**2013/14**	**2012/13**	**2013/14**	**2012/13**	**2013/14**
Sakha 3 + 120 HD	270.0 d	268,2 de	86.4 abc	87.1 bcd bcd	30.3 e	31.4 f	17.8 e	17.88 e
Sakha 3+ 130 HD	299.4 c	309.4 bc	87.5 ab	89.8 abc	35.9 b	36.1 c	19.2 c	19.25 cd
Sakha 3+ 140 HD	339.2 a	337.0 a	89.6 ab	91.5 ab	37.4 a	37.9 a	21.1 a	21.23 a
Sakha 3+ 150 HD	322.1 b	320.2 b	89.0 ab	90.8 abc	34.4 c	35.5 cd	19.3 c	19.31 cd
Ilona + 120 HD	269.8 d	269.5 de	88.3 ab	89.0 abc	30.5 e	30.4 g	17.6 ef	17.88 e
Ilona + 130 HD	299.3 c	299.6 c	89.3 ab	90.1 abc	35.7 b	35.6 cd	18.7 d	18.91 d
Ilona + 140 HD	339.4 a	338.1 a	90.7 ab	91.4 ab	36.9 a	37.2 b	20.6 b	20.14 b
Ilona + 150 HD	324.4 b	324.5 ab	89.6 ab	90.7 abc	34.7 c	35.0 d	19.6 c	19.59 c
S.541 /D/10 + 120 HD	256.5 e	257.2 e	82.8 c	83.6 d	29.0 f	29.2 h	15.6 h	15.54 h
S.541 /D/10 + 130 HD	263.4de	264.5 de	85.7 bc	86.7 cd	30.9 e	30.8 g	16.6 g	16.6 g
S.541 /D/10 + 140 HD	274 d	274.9 d	91.1 a	92.3 a	32.8 d	33.01 e	17.4 f	17.45 ef
S.541 /D/10 + 150 HD	264.8de	266.2 de	90.3 ab	91.4 ab	34.8 c	35.11 d	17.2 f	17.12 fg
F test	**	**	*	*	**	**	**	**
B. retting methods								
Still water	292.2 b	291.3 b	88.2	89.1 b	33.5	33.8 b	18.2 b	18.25 b
water change every 24 h	294.9 a	297.0 a	88.5	89.9 a	33.6	34.03 a	18.6 a	18.52 a
F test	**	**	NS	**	NS	*	**	**
Inter action								
F test	*	NS	NS	NS	NS	NS	**	**

****, * and NS indicate p <0.05, <0.01 and not significant, respectively. Means of each factor designated by the same letter are not significantly different at 5% level, according to Duncan's multiple range tests.**