

## **EFFECT OF SOWING AND HARVESTING DATES ON YIELD AND ITS QUALITY FOR SOME FLAX VARIETIES**

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### **ABSTRACT**

A two field experiment was conducted 2004/2005 and 2005/2006 seasons at Etay El-Baroud Agric. Res. Station to study the effect of sowing and harvesting date on yield and yield components of some flax varieties. In each season, five flax varieties, viz; Giza8, Sakha1, Sakha2, Sakha3, and Sakha4, three sowing dates viz; 30/10, 15/11, and 1/12, and three harvesting dates viz; 135, 150, and 165 days after sowing were evaluated in split-split plot design with four replicates.

The main results obtained from this study showed that varieties differed significantly in straw and seed characters under study. Sakha3 was superior to other varieties in technical length, straw yield per faddan, fiber length and fiber percentage. While Giza8 superior to other varieties in main stem diameter. On the other hand Sakha2 was superior in straw yield per plant, seed yield per plant as well as faddan, number of capsules per plant, number of seed per plant, 1000-seed weight (seed index) and oil percentage.

Sowing date had a significant effect on all characters, except main stem diameter, 1000-seed weight and oil percentage. Sowing flax on 15<sup>th</sup> Nov. recorded the highest means of straw and seed yields as well as its components. Harvesting date significantly affected all studied characters, except main stem diameter. The proper time for harvesting flax markedly depended on sowing on 15<sup>th</sup> Nov. and harvesting at 150 days which was the suitable date to produce the highest straw yield, while sowing on 15<sup>th</sup> Nov and harvesting at 165 days after sowing was the suitable time to produce the highest seed yield.

### **INTRODUCTION**

Flax (*Linum usitatissimum* L.) is still of major bast fiber crops in Egypt. It is known as long as pharaoh civilization and it is grown in large scale around the world. In northern region it is grown as a fiber crop, in southern ones it is cultivated as oil crop and in Mediterranean sea region it is grown as a dual purpose crop for either fibers extracting from stems by retting and oil obtained from seeds by pressing. The fine fibers are used in textile manufacture for making clothes and the shortest one used for making twines, ropes, excellent paper and cigar filters. The fresh linseed oil used as edible for human and in some medical purposes. After boiling it is used in many industries such as paints, inks, and varnish.

In Egypt during the last few years, by releasing new varieties characterized by high yield ability and best quality in addition to improve different agricultural practices for this crop.

With respect to varietal differences, Abdel-Fatah (1994) and Kineber (1994) showed that, straw and seed yields as well as its components differed significantly among flax cultivars. El-Kady *et al* (1995), Sharma *et al* (1995), El-Sweify *et al* (1996), Kineber and El-Kady (1996), and Mostafa and Ashmawy (2003) reported that genotypes differed significantly in all characters of flax.

According to sowing date, Mohamed *et al* (1998) observed that yield attributes viz; number of capsules/plant, seed/capsules, seed yield/plant and 1000-seed weight were higher in the first date of sowing (21 October). Also they observed that the oil content was higher at the first and second sowing dates, thereafter it declined with delaying sowing date. Juric *et al* (1994) studied the effects of sowing dates (10 and 21 June or 1, 11, and 21 July) on flax straw and seed yields. They found that straw yield was highest when sown on 11 July, while the lowest yield was obtained with sowing on 21 June. Moreover, seed yield varied from 0.09 t/ha with sowing on 10 June to 0.51 t/ha with sowing on 11 July. Salama (1996) reported that early planting date (November 15) significantly increased technical length, number of capsules, 1000-seed weight, straw and seed yields as well as oil percentage than the late planting date (December 1).

Harvesting dates play a great role in fiber length and quality of flax as well as seeds yield. It is well known that varieties varying in their fiber yield and seeds as well. Mostafa (1990) reported that there was a continuous increase in straw and seed yields as well as its components with delaying harvesting date from 130 to 170 days from sowing except straw yield/plant, which decreased significantly with delaying harvesting date to 170 days after sowing. Mohamed *et al* (1998) showed that sowing on 9<sup>th</sup> Nov. and harvesting at 160 days after sowing was the suitable date to produce the highest straw, while harvesting date 170 days after sowing was the suitable time to produce the highest seed yield.

## MATERIALS AND METHODS

The present investigation was carried out at Etay El-Baroud Agricultural Research Station. Agric. Res. Center, during the two successive seasons of 2004/2005 and 2005/2006. A split-split plot design with four replicates was used. The main plots were five varieties, three sowing dates (Oct.30, Nov.15, and Dec.1) as sub plot, and three harvesting dates (135, 150, and 165 days after sowing) as sub-sub plot (Table 2). The sub-sub plot area was 6 m<sup>2</sup> (1.5 x 4 m). At harvest, ten guarded plants were randomly selected from each sub-sub plot to recoding the yield components. Straw and seed yield of flax per faddan were recorded on the whole plot area basis.

**Table 1: Pedigrees of the studied flax varieties**

Varieties	Source
Giza8	Giza6 x Santa Catalina
Sakha1	Bombay x I.1485
Sakha2	Hera x I.12348
Sakha3	Belinka ( 2E) x I.2096
Sakha4	Belinka( R 3 ) x I.2569

**Table 2: Time of Harvesting at three sowing dates**

Sowing date	Harvesting date (days of 3 sowing)		
	135 days	150 days	165 days
October 30	March 15	April 1	April 15
November 15	April 1	April 15	May 1
December 1	April 15	May 1	May 15

**Studied Characters:**

**I- Straw Yield and Its Components:**

- 1 - Technical length (cm)
- 2 - Stem diameter (mm)
- 3 - Straw yield per plant (g)
- 4 - Straw yield per faddan (ton)
- 5 - Fiber length (cm)
- 6 - Fiber percentage (%)

**II- Seed Yield and Its Components:**

- 1 - Number of capsules/plant
- 2 - Number of seed/plant
- 3 - Seed yield/plant (g)
- 4 - Seed yield/Fad (kg).
- 5 - 1000-seed weight (gm) (seed index)
- 6 - Oil percentage (%)

All data were subjected to standard analysis of variance procedures and differences among treatment means were compared by Duncan's multiple range test (Duncan,1955).

## **RESULTS AND DISCUSSION**

**I- Straw Yield and Its Related Characters:**

Mean values of straw yield and its related characters of five flax varieties as affected by planting date and harvesting date differed significantly in characters except with main stem diameter by planting date and harvesting date which did not reach the level of significance.

The relationship between flax variety and straw and its components reached the level of significance as shown in Table 3. The flax variety Sakha3 ranked and surpassed in technical length, straw yield per faddan, fiber length and fiber percentage which recorded 99.75, 100.2 cm, 4.95, 5.00 ton, 93.77, 94.01 cm, and 22.81, 22.85% in both seasons, respectively. Whereas the flax variety Giza8 achieved maximum estimates for main stem diameter(2.39, 2.41mm). Meanwhile, the flax variety Sakha2 achieved maximum estimates for straw yield per plant (2.43 g) in first season and (2.49 g) in second season. These results are in harmony with those obtained by Kineber and El-Kady (1996), Mohamed *et al* (1998), El-Shimy and Moawed (2000), and Mostafa (2003).

**B- Effect of Planting Date:**

Data presented in Table 3 show clearly that planting date affected significantly all the studied traits, except main stem diameter. Straw yield and its attributes, i.e., technical length, straw yield / plant as well as per fad., fiber length and fiber percentage were higher in the second sowing date (Nov.15), thereafter it declined with delay in sowing. The improvement and increase in flax yield and its components with sowing in Nov.15 may be attributed to the suitable climatic conditions for growth and development of the growing plants. These results are in agreement with those obtained by Salama (1995), Mohamed (1998).

Table 3 : Means of straw yield and its components of five flax varieties as affected by planting date and harvesting date during 2004/2005 and 2005 / 2006

Variable	Technical length (cm)		Main stem diameter (mm)		Straw yield (g/ plant)		Straw yield (T/ fed.)		Fiber length (cm.)		Fiber percentage (%)	
	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06
<b>Variety</b>												
Giza 8	91.78 d	92.02 d	2.39 a	2.41 a	2.21 b	2.25 b	4.230 C	4.300 c	78.90 b	79.30 b	18.58 c	19.08 b
Sakha 1	94.06 c	95.10 c	2.09 b	2.11 b	2.42 a	2.45 a	4.790 b	4.810 b	87.30 c	88.40 c	18.90 b	19.10 b
Sakha 2	92.88 d	93.00 d	2.20 a	2.25 a	2.43 a	2.49 a	4.760 b	4.790 b	87.00c	88.10 c	18.30 d	19.00 c
Sakha 3	99.75 a	100.20a	1.85 c	1.25 c	1.75 c	1.77 c	4.95 a	5.000 a	93.77 a	94.01 a	22.81 a	22.85 a
Sakha 4	98.33 b	99.30 b	1.89c	1.91 c	1.66c	1.68 c	4.880 a	4.950 a	92.80 a	93.30 a	22.30 a	22.54 a
<b>Sig</b>	**	**	**	**	**	**	**	**	**	**	**	**
<b>Planting date</b>												
30 / 10	95.30 b	96.11 b	1.97	2.00	2.11 b	2.12 b	4.640 b	4.655 b	94.72 b	94.88 b	20.88	20.89 b
15 / 11	96.50 a	97.95 a	2.05	2.10	2.45 a	2.49 a	4.890 a	4.905 a	95.55 a	95.72 a	22.05	22.15 a
1 / 12	93.80 c	93.99 c	1.95	1.98	1.70 c	1.79 c	4.100 c	4.190 c	93.13 c	93.50 c	18.98	19.00 c
<b>Sig</b>	**	**	N.S	N.S	**	**	**	**	**	**	**	**
<b>Harvesting</b>												
Date Days after sowing												
135	91.55 c	91.59 c	1.95	1.96	2.00 c	2.10 c	4.320 c	4.380 c	88.00 c	89.10 c	19.02 c	19.10 c
150	95.75 a	95.83 a	2.00	2.10	2.42 a	2.50 a	4.900 a	4.900 a	95.30 a	96.00 a	21.30 a	21.70 a
165	94.11 b	94.15 b	1.94	1.97	2.22 b	2.25 b	1.550 b	4.500 a	94.00 b	44.75b	20.10 b	20.22 b
<b>Sig</b>	**	**	N.S	N.S	**	**	**	**	**	**	**	**

\*, \*\* and N. S Significantly at 5 % and 1 % levels and not Significantly , respectively  
 Mean yellowed by the same letter in each row are not Significantly different at 5 % level according to Duncan's Multiple Range Test

**C- Effect of Harvesting:**

Data in table 3 showed the effect of harvesting date on straw yield and its related characters in two seasons. Results indicated that there were significant difference among the three harvesting date on straw yield and its components in both seasons. These results indicated that 2<sup>nd</sup> harvesting date (150 days) gave the highest values of straw yield and its components. This 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 2<sup>nd</sup> harvesting date which in turn increased dry matter accumulation in plant organs till it reached full maturity stage (150 days from planting). After this period the reduce in yield could be due to a decline in moisture stage which often accompanied by a decline in dry matter content owing to translocation of organic compounds to be stored in seeds. These results are in agreement with those obtained by Shafshak *et al* (1992), Esmail and Morsy (1994), El-Sweify *et al* (1996), Mohamed *et al* (1998), and El-Deeb (1998).

**D- Effect of Interaction:**

Table 4 reveal that the interaction VXP, VXH, PXH, and VXPXH had significant effect on all 5 straw character studied, while the interaction between varieties and harvesting date (VXH) for all straw character under study were not significant, except technical stem length and straw yield per plant. It is clear that the highest values of technical length, fiber length and fiber percentage were recorded when seeds of Sakha3 variety were sown on (Nov.15) and harvesting after 150 days from sowing (Table 4). So, it can be concluded that the proper date for straw harvesting markedly depended on sowing date.

**II- Seed Yield and Its Related Characters:**

Table 5, show that the mean values of seed yield and it related characters of five flax varieties as affected by planting date and harvesting date. Statistical analysis showed a significant differences between the five flax varieties in all six seed characters studied i.e., number of capsules/plant, number of seeds/plant, seed yield/plant, seed yield/fad., 100 seed weight, and oil %.

**A- Effect of Varieties:**

The flax variety Sakha2 recorded highest estimates in all seed yield and its related traits. While Sakha1 ranked second in this case with mean values, for some characters arrangement previously mentioned. On the other hand, the flax variety Sakha3 had the estimates in all six seed characters. The results were in agreement with those obtained by Mohamed (1998), El-Shimy and Moawad (2000) and El-Gazzar and Abou Zaied (2001).

**B- Effect of Planting Date:**

Data in Table 5 revealed that sowing date had a significant effect on all characters under study, except 1000-seed weight and seed oil percentage. Sowing flax on Nov. 15 produced the highest means of all studied characters. On the other hand the lowest values of these traits were obtained when plants of flax were sown on 1<sup>st</sup> Dec (latest sowing date).

Table 4 Summary of significant interaction effects among five flax varieties , planting date and harvesting date on Straw yield and its components of flax during 2004/ 05 and 2005/06 seasons .

Characters	Season		VxP		VxH		PxH		VxPxH	
	2004/05	2005/06	V4xP2	V4xP2	V4xH2	V4xH2	P2xH2	P2xH2	V4xP2xH2	V4xP2xH2
Technical Length ( cm )	100.315	99.485	100.05	99.515	V4xH2	V4xH2	101.57	106.55	V4xP2xH2	V4xP2xH2
Straw yield / plant ( g )	3.036	2.880	2.490	2.560	V4xH2	V4xH2	3.538	3.100	V4xP2xH2	V4xP2xH2
Straw yield / Fad ( Ton )	5.002	4.952	N.s	N.s	—	—	5.100	5.150	V4xP2xH2	V4xP2xH2
Fiber length (cm)	99.300	97.265	N.s	N.s	—	—	100.100	103.20	V4xP2xH2	V4xP2xH2
Fiber %	22.680	22.480	N.s	N.s	—	—	22.612	22.80	V4xP2xH2	V4xP2xH2
							22.881	22.47	V4xP2xH2	V4xP2xH2

P1 = Planting date of 30 / 10  
 P2 = Planting date of 16 / 11  
 P3 = Planting date of 1 / 12

V1= Giza 8  
 V2= Sakha 1  
 V3= Sakha 2  
 V4= Sakha 3  
 V5= Sakha 4  
 H1 = harvesting date after 135 days from sowing  
 H2 = harvesting date after 160 days from sowing  
 H3 = harvesting date after 165 days from sowing

Table 5 : Means of seed yield and its components of five flax varieties as affected by planting date and harvesting date during 2004/2005 and 2005 / 2006

Variable	Number of capsules/plant		Number of seeds / plant		Seed yield (g/plant)		Seed yield (kg/fed.)		1000-seed weight(g.)		Seed oil percentage (%)	
	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06	2004 /05	2005/ 06
Variety												
Giza 8	8.32 b	9.09 b	64.41c	65.91 c	0.552 c	0.585 b	663.87 b	669.00 b	8.50 c	8.55 c	40.20 b	40.20 b
Sakha 1	9.52 a	10.22 b	77.50 b	78.30 b	0.654 b	0.665 d	775.50 a	780.30 a	9.22 b	9.30 b	41.52 b	41.52 b
Sakha 2	10.22 a	11.66 a	81.13 a	80.45 a	0.689 a	0.680 a	790.30 a	801.20 a	10.80 a	10.82 a	42.35 a	42.35 a
Sakha 3	5.55 d	6.17 d	30.10 e	30.50 e	0.145 e	0.150 d	440.60 d	449.10 d	4.75 d	4.80 d	34.77 c	43.77 c
Sakha 4	6.10 c	6.50 c	35.00 d	36.12 d	0.170 d	0.172 c	466.30 c	470.40 c	4.94 d	4.95 d	35.30 c	35.30 c
Sig	*	**	**	**	**	**	**	**	**	**	**	**
Planting date												
30 / 10	8.50 b	9.33 b	62.20 b	66.30 b	0.487 b	0.490 b	622.90 b	623.10 b	8.38	8.37	39.85	39.95
15 / 11	9.92 a	10.25 a	73.50 a	77.40 a	0.595 a	0.601 a	696.30 a	699.40 a	8.40	8.39	40.00	40.10
1 / 12	8.20 d	9.11 b	57.00 c	60.23 c	0.472 b	0.482 b	587.95 c	588.00 c	8.35	8.36	40.10	40.11
Sig	*	*	**	**	*	*	*	*	N.S	N.S	N.S	N.S
Date												
Harvesting												
Days after sowing												
135	8.11 b	8.10 b	49.30 b	50.10 b	0.450 b	0.455 b	630.10 a	633.00 a	8.78 b	9.00 b	40.80 c	40.39 c
150	9.17 a	9.25 a	57.25 a	58.13 a	0.599 a	0.610 a	650.30 a	649.30 a	9.22 a	9.85 a	41.00 b	41.20 b
165	9.22 a	9.30 a	58.00 a	58.32 a	0.580 a	0.600 a	600.13 b	595.50 b	9.00 b	9.33 b	42.50 a	42.39 a
Sig	*	*	*	*	**	**	**	**	*	*	*	*

\*, \*\* and N. S Significantly at 5 %, and 1 % levels and not Significantly , respectively  
 Mean yellowed by the same letter in each row are not Significantly different at 5 % level according to Duncan's Multiple Range Test

Early sown date (Nov.15) had a better chance of escaping hot, dry weather during the period of blossoming and seed setting and in addition, it will usually be less infected by diseases. These results are supported by those of Salama (1996), Mohamed *et al* (1998), and El-Gazzar and Abo Zaied (2001).

**C- Effect of Harvesting Date:**

The mean performances of the three harvesting date for seed yield and its components are presented in Table 5 which illustrated the response of seed yield and its components to harvesting date. All the studied traits were significantly affected by delaying harvesting date. There was a progressive and constant increase in all studied characters during the period from early to late (150 to 165 days after sowing). The increase in the traits previously noted with delaying the date of harvesting is attributed to the progressive development of the tissues and the increase in dry matter content of flax plants owing to the progressive building of tissues and accumulation of metabolites in the oranges of flax plants. Similar results were obtained by Esmail and Morsy (1994), El-Sweify *et al* (1996), El-Deeb (1998), and Mohamed *et al* (1998).

**D-Interaction Effect:**

Table 6 illustrated significant effect (VXPXH) interaction on all six seed yield characters under study, while VXP interaction had significant effect on length of number of capsules/plant, number of seed per plant, seed yield per plant as well as per faddan, 1000-seed weight and oil percentage. In addition VXP interaction had a significant effect on all characters under study.

**Table 6 Summary of significant interaction affects among five flax Varieties , planting date and harvesting date on seed yield and it components of flax during 2004 / 05 and 2005 /06 seasons .**

Characters	Season		VxP		VxH		PxH		VxPxH
Number of Capsules/ p	2004/05	V3xP2	10.75	V3xH3	10.72	N.s	—	N.s	—
	2005/06	V3xP2	10.95	V3xH3	10.72	N.s	—	Ns	—
Number of Seed /p	2004/05	V3xp2	82.31	V3xH3	75.65	P2xH3	77.75	V3xP2xH3	83.90
	2005/06	V3xP2	83.92	V3xH3	79.80	P2xH3	79.83	V3xP2xH3	85.10
Seed yield g/ plant	2004/05	V3xP2	0.741	V3xH2	0.694	P2xH2	0.795	V3xP2xH2	1.000
	2005/06	V3xp2	0.775	V3xH2	0.700	P2xH2	0.788	V3xP2xH2	0.972
Seed yield kg/ fad	2004/05	V3xP2	759	V3xH2	775.20	P2xH2	790.20	V3xP2xH2	798.00
	2005/06	V3xP2	754	V3xH2	777.10	P2xH2	782.00	V3xP2xH2	787.00
1000 seed Wight(g)	2004/05	—	N.s	V3xH2	11.00	P2xH2	11.30	—	N.s
	2005/06	—	N.s	V3xH2	11.10	P2xH2	11.25	—	N.s
Oil %	2004/05	—	N.s	V3xH3	42.30	P3xH3	42.00	—	N.s
	2005/06	—	N.s	V3xH3	42.50	P3xH3	41.75	—	N.s

V1= Giza 8

V2= Sakha 1

V3= Sakha 2

V4= Sakha 3

V5= Sakha 4

H1 = harvesting date after 135 days from sowing

H2 = harvesting date after 135 days from sowing

H3 = harvesting date after 135 days from sowing

P1 = Planting date of 30 / 10

P2 = Planting date of 15 / 11

P3 = Planting date of 1 / 12



Except numbers of capsules per plant were not significantly affected by PXH interaction and also VXPXH. From the same Table it is clear that the highest values of all seed characters were recorded by flax variety Sakha2 when plants were sown in Nov.15 and harvested 165 days from sowing. So, it can be also concluded that proper date for seed harvesting markedly depended on sowing date. The suitable date for seed harvesting was 165 days after sowing when seeding was done on Nov.15.

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**تأثير مواعيد الزراعة و الحصاد على محصول و جوده بعض أصناف الكتان  
الديب إبراهيم الديب و أحمد عبد الحي عبد الفتاح  
معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية**

تم إجراء تجربة حقلية مكررة خلال موسمي ٢٠٠٤/٢٠٠٥، ٢٠٠٥/٢٠٠٦ في محطة البحوث الزراعية بإيتاي البارود لدراسة تأثير ثلاثة مواعيد زراعة وهي ١٠/٣، ١١/١٥، ١٢/١ و ثلاثة مواعيد حصاد وهي ١٣٥، ١٥٠، ١٦٥ يوم من الزراعة على محصول ومكونات خمسة أصناف من الكتان وهي جيزة ٨، سخا ١، سخا ٢، سخا ٣، سخا ٤ و تم استخدام تصميم القطع المنشقة مرتين في أربع مكررات و كتبت أهم النتائج التي تم للتوصل إليها هي ما يلي :-

- ١- اختلفت الأصناف تحت الدراسة معنويا في كل الصفات المدروسة و تفوق الصنف سخا ٣ على بقية الأصناف في الطول الفعال و محصول القش للفدان و طول الألياف و نسبة الألياف . كما تفوق الصنف جيزة ٨ على باقي الأصناف في سمك النبات بينما تفوق الصنف سخا ٢ على باقي الأصناف في محصول القش للنبات و محصول البذرة للنبات و كذلك للفدان و عدد كبسولات النبات و عدد بذور النبات و وزن ١٠٠٠ بذرة و النسبة المئوية للزيت .
- ٢- كان لميعاد الزراعة أثر معنوي على كل الصفات المدروسة ما عدا قطر الساق و وزن البذرة و نسبة الزيت و قد سجلت الزراعة في ١٥ نوفمبر أعلى المتوسطات لصفات البذرة و القش و مكوناتها.
- ٣- لوضحت النتائج أن مواعيد الحصاد كان لها أثرا معنويا على الصفات المدروسة ما عدا قطر الساق .
- ٤- اختلف موعد الحصاد الأمثل باختلاف مواعيد الزراعة فعند الزراعة في ١٥ نوفمبر كان أنسب ميعاد حصاد للحصول على أعلى محصول من القش هو ١٥٠ يوم من الزراعة بينما كان أنسب ميعاد حصاد للحصول على أعلى محصول من البذرة هو بعد ١٦٥ يوم من الزراعة .