

PERFORMANCE OF SOME FLAX VARIETIES (*Linum usitatissimum* L.) UNDER DIFFERENT SOWING AND HARVESTING DATES:

2- SEED YIELD AND ITS COMPONENTS

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ABSTRACT

Two field experiments were conducted at El-Gemmeiza Res. Station. Gharbiua Governorate Agric. Res. Center during the two successive seasons of 2006/2007 and 2007/2008. The objectives of this research was aimed to study the performance of some flax varieties i.e. Sakha 2, Sakha 3, Sakha 4 and Giza 8 under different sowing dates (on 20th October, 10th November, 1st December) and harvesting dates (after 135, 150 and 165 days) from sowing and their effects on seed yield and its components. The main findings could be summarized as follows.

Early sowing on 20th October significantly increased seed yield/ plant in the first season. Sowing flax on 10th November significantly increased seed yield/ faddan as compared with the other sowing dates.

Delaying harvesting date to 150 days from sowing significantly increased number of capsules/ plant in the second season and delaying harvesting date to 165 days from sowing significantly increased number of capsules per plant in the first season, 1000 seed weight, seed yield per plant and seed yield per faddan in the both seasons.

Sakha 3 and Sakha 4 varieties surpassed the other varieties in number of seeds per capsules in both seasons. Sakha 2 and Giza 8 varieties surpassed the other varieties in the seed yield characters, except number of seeds per cpsules . Giza 8 superior the other varieties bor number of capsules/ plant in the first season, 1000 seed weight , seed yield/ plant and seed yield/ faddan in both seasons.

It could be concluded that sown Sakha 2 or Giza 8 early on 10th November and harvesting it after 165 days from sowing maximized seed yield/ fad. under the environmental conditions of Garbiua Governorate.

INTRODUCTION

Flax (*linum usitatissimum* L.) is still a major baste 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 and cultivated as Mediterranean sea region. It is grown as a dual purpose crop for either fibers extracting from stems by retting after soaking in water.

In Egypt during the last few years, by releasing new varieties characterized gave high yield ability and best quality in addition to improve different agricultural practices for this crop. With respect varietal differences, Abdel-Fatah (1994) and Kineber (1994) showed that seed yields as well as its components differed significantly among flax varieties. El- Kady (1995) reported that varieties differed significantly in all characters of flax.

According to sowing date, Dixit *et al.*(1994) reported that delaying sowing date after 25th October decreased seed yield. They also found that,

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seed yield was decreased by 75% when flax was sown on 15th December. Moawed (1996) reported that when flax sown on the first 15 days from November gave the highest number of capsules per plant, number of seeds per capsule, seed yield per plant or faddan. Salama (1996) reported that early planting date on 15th November significant increased number of capsules, 1000-seed weight, seed yield as well as oil percentage than the late planting on first December. Mohamed *et al.* (1998) observed that yield attributes viz number of capsules/ plant, number of seeds/ capsules, seed yield/ plant and 1000 seed weight were higher in the first early date on 21 October. Also, they observed that the oil percentage was higher at the first and second sowing dates, (20th October and 10th November) thereafter it declined with delaying sowing date. El-Deeb and Abd-El Fataha (2006) reported that sowing date had a significant effect on all characters, except 1000-seed weight and oil percentage. Sowing flax on 15th November recorded the highest mean of seed yields as well as its components. Abd-El-Daiem (2009) found that sowing flax on 25th October gave higher values seed yield/ plant, seed yield faddan, as well as per faddan, number of capsules/ plant, number of seeds/ capsule and 1000 seed weight. There were also a gradual increase in oil percentage with delaying in sowing date until 9th November.

Harvesting date play a great role in fiber length and quality of flax as well as seed yield. In this respect, Mostafa (1990) reported that there was a continuous increase in seed yields as well as its components with delaying harvesting date from 130 to 170 days from sowing. Abd-El-Daiyme *et al.* (2007) found that delaying harvesting date up to the oldest age (170 days from sowing) caused increasing in all seed yield characters in addition to all mineral contents of flax seeds.

The main objectives of this work is aimed to determine the effect of sowing and harvesting dates on-growth, yield and quality of four flax varieties i.e., Sakha 2, Sakha 3, Sakha 4 and Giza 8 under the environmental conditions of Gahrbiua gouernorat.

MATERIALS AND METHODS

The present investigation was carried out at El- Gemmeiza agricultural Research Station, Agric .Res. Center, Gharbiua Governorate, Egypt, during the two successive seasons of 2006/ 2007 and 2007/ 2008. The objectives of this research was aimed to study the effect of sowing and harvesting dates on yield and its components of some flax (*Linum usitatissimum* L.) varieties i.e. Sakha 2, Sakha 3, Sakha 4 and Giza 8.

Three tested sowing dates planting on 20th October, 10th November and 1st December were conducted in three separate experiments. A split plot design with three replications for each sowing date was designed. The main plots were devoted to the three harvesting dates at 135,150 and 165 days after sowing as shown in Table 1. The sub plots were assigned to the following four varieties Sakha 2, Sakha 3, Sakha 4 and Giza 8 are shown in Table 2.

Table 1: Time of harvesting dates at the three studied sowing dates.

Sowing date	Harvesting dates		
	after 135 days	after 150 days	after 165 days
20 th October	March 5	March 25	April 5
10 th November	March 25	April 10	April 25
1 st December	April 15	May 1	May 15

Table 2: pedigree of studied varieties.

Varieties	Source
Sakha 2	Hera × 1.123
Sakha 3	(Belinka (2E) × 1.2096)
Sakha 4	(Belinka (R3) × 1.2569)
Giza 8	(Giza6 × Senta Catalina)

At each harvesting date, ten guarded plants were taken at random from each sub- plot to be used in recording the straw yield component characters of flax. Flax for seed yield per faddan was recorded on the whole sub plot area basis. The following seed yield and its components were determined.

- 2- Number of seeds/ capsule 1- Number of capsules/ plant
- 3-Seed yield/ plant 4- Seed yield/ faddan (Kg)
- 5-1000 seed weight

The obtained data for each planting date was statistically analysis separately by technique of analysis of variance thereafter , combined analysis for collected data of all sowing dates in both seasons were subjected to the statistical analysis according to the procedures outlined by Gomaz and Gomaz (1984). The treatment means were compared using the Newly Least Significant Difference (NLS D) test which developed by Waller and Dunckan (1969). Field experiment was carried out each season using split-plot design, where each sub- plot size was 6 m² (2 x 3 m). was corn (*Zea Maize*) crop previous in both seasons. The experimental field area was well prepared. Calcium super phosphate at a rate of 100 Kg/ faddan (15.5% P₂O₅) before sowing and potassium sulphate (48% K₂O) was applied at the rat 50 Kg/ faddan in one dose. Nitrogen was added at the rate 45kg N/ Faddan in the form of urea (46% N) in two dose, the first half was added be fore the first irrigation

RESULTS AND DISCUSSION

Sowing date effects.

Results of seed yield and elated characters for the three sowing dates showed significant affected as shown in Table 3. The results showed that Seed yield / plant and Seed yield/ faddan significantly affected by sowing dates. Sown on 20th October gave the heighest seed yield/ plant in the first season while sown on 1st December gave the heighest seed yield/ plant in the second season. Sown on 10th November came in the first ranke for seed yield per faddan during two seasons. However, the lowest seed yield / plant and seed yield/ faddan was obtained on 20th October in the second season. The highest values in seed yield characters were obtained with the early sowing date may be attributed to the suitable climate conditions

i.e. the more favorable temperature, day length and the longer duration of the growth period. These results are in harmony with those obtained by Salama (1996), Mohamed *et al.* (1998) and Abo Zaied and Mousa (2007).

Harvesting date effects.

With respect to the effect of seed yield and its components, results in Table 3 indicated that there were significant differences among the three harvesting dates on number of capsules per plant, seed index, seed yield per plant and seed yield per faddan in the two seasons. The harvesting date after i.e. 165 days from sowing gave the highest number of capsules per plant in the first season, seed index, seed yield per plant and seed yield per faddan in both seasons. The highest values of number of capsules per plant were recorded from harvesting date after 150 days from sowing in the second season. These results are mainly due to the fact that plants did not reach their physiological maturity till 165 days from sowing and plants continued to increase in height consistently from 135 to 165 days old.

Table 3: Means of number of capsules/ plant and number of seeds/ capsule 1000 seed weight, seed yield / plant and seed yield/ faddan (kg) as affected by sowing and harvested dates and flax varieties during 2006/2007 and 2007/2008 seasons.

Characters Treatment/ seasons	Number of capsules/ plant		Number of seeds/capsule		1000 seed weight		Seed yield / plant		Seed yield/ faddan (kg)	
	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008
Sowing dates (A)										
20 th October	9.07	6.60	7.76	7.74	6.02	6.25	0.42	0.19	316.7	176.4
10 th November	8.99	6.40	7.65	7.69	5.80	5.91	0.26	0.23	538.8	249.0
1 st December	8.26	6.34	7.63	7.49	4.54	6.54	0.37	0.32	279.2	227.3
F- Test	NS	NS	NS	NS	NS	NS	**	**	**	**
NLSD 0.05	-	-	-	-	-	-	0.01	0.01	2.97	7.12
Harvesting dates (B)										
135 days	8.07	6.04	7.58	7.57	5.08	6.73	0.33	0.20	320.2	152.9
150days	8.44	7.50	7.83	7.82	6.08	6.13	0.33	0.25	395.5	222.2
165 days	9.81	5.80	7.63	7.53	6.83	6.85	0.39	0.29	419.0	277.5
F- Test	**	**	NS	NS	**	**	*	*	**	**
NLSD 0.05	0.65	0.16	-	-	0.26	0.25	0.01	0.01	2.97	7.12
Varieties (C)										
Sakha 2	7.43	6.28	7.48	7.45	7.57	7.63	0.42	0.26	454.2	254.5
Sakha 3	8.36	5.98	7.99	7.86	4.19	4.85	0.22	0.23	272.3	178.6
Sakha 4	8.98	7.38	7.94	7.91	4.31	5.49	0.25	0.23	287.5	186.2
Giza 8	10.32	6.14	7.31	7.34	7.93	7.64	0.51	0.26	499.0	251.0
F- Test	**	**	*	*	*	**	**	*	**	**
NLSD 0.05	0.70	0.46	0.42	0.39	0.31	0.43	0.01	0.01	3.39	5.15
Interaction F- Test										
A X B	*	**	NS	NS	*	*	**	**	**	**
A X C	*	NS	NS	NS	*	*	**	**	**	**
B X C	*	NS	NS	NS	**	*	**	**	**	**
AX B X C	**	*	NS	NS	NS	NS	NS	NS	**	**

These results are in agreement with those obtained by Sahseh *et al.* (1987). Shaishak *et al.* (1992), Mohamed *et al.* (1998), El-Deeb(1998), Amna *et al.* (2003) and El-Deeb and Abd El-Fatah (2006).

Performance of varieties.

Data collected in Table 3 show means of number of capsules/ plant, number of seeds/ capsule, seed index, seed yield per plant and seed yield per faddan which were markedly in all the studied varieties. Over the two seasons, Giza 8 surpassed the other varieties significantly in number of capsules/ plant (10.32), seed index (7.93 and 7.64 gm), seed yield/ plant (0.51 and 0.26 gm/ plant) and seed yield / faddan (499.0 gm / faddan) in the first season. Or both followed by Sakha 2, except number of capsules/ plant and number of seeds/ capsule. It could be concluded that sown Sakha 2 surpassed Sakha 3 57.2% and Sakha 4 49.6% as an average of both seasons. In addition, sowing Giza 8 variety surpassed Sakha 3 by 66.3% and Sakha 4 by 58.3% as an average of both seasons. However, the lowest average in seed index, seed yield per plant and seed yield per faddan was obtained sown Sakha 3 and Saka 4 in the two seasons. These results are in harmony with those obtained by Mohamed *et al.* (1998), El-Shimy and Moawed (2000), Mostafa and Ashmawy (2003), El-Deeb and Abd El-Fatah (2006) and Abd El Daiem, (2009).

Effect of interactions:

The interaction between sowing dates and harvesting dates are presented in Table 4. It is clear that 1000 seed weight and seed yield per plant were significantly affected in both seasons. The highest average seed index (7.12 and 7.23 gm) was obtained when sown on 20th October and harvesting after 165 days from sowing date and seed yield per plant (0.50 and 0.40 gm/ plant) was obtained when sown on 20th October and 1st December and harvesting dates after 165 days from sowing respectively.

Concerning the interaction among sowing dates and studied flax varieties, the results presented in Table 5 clearly showed that seed index and seed yield per plant significantly affected by the interaction between sowing dates and studied varieties in both seasons. Highest seed index values was obtained from sowing Giza 8 or Sakha 2 varieties when sown on 20th Oct. and 1st Dec. sowing dates without significant differences between them in both seasons. The highest seed yield/ plant (0.66) was obtained from sowing Giza 8 variety on 20th October in the first season and sown Giza 8 variety on 1st December in the second season. However, the lowest seed yield/ plant was obtained from sowing Sakha 3 variety on 10th November in the first season, and Sakha 4 variety on 20th October in the second season. These findings are in good accordance with those obtained by Fontana *et al.* (1996), Mostafa (1999) and Saeidi and Khodambashi (2007).

Regarding to the interaction between harvesting dates and varieties on seed index, the results in Table 6 clearly indicated that seed index and seed yield per plant significantly affected due to the interaction among harvesting dates and flax varieties in both seasons. The highest seed index was produced from harvesting Giza 8 or Sakha 2 varieties after 150 or 165 days from sowing without significant differences between them in both seasons. In this respect, maximum seed yield per plant (0.57 and 0.33 gm/ plant) was obtained from harvesting Giza 8 variety and harvesting it after 165 days from sowing in the first and second seasons, respectively. Whilst, the lowest seed index and seed yield/ plant was produced from harvesting Sakha 3 or Sakha

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4 varieties after 150 or 135 days from sowing, respectively in both season. These findings are in good accordance with those obtained by El- Deeb and Abd-El- Fatah (2006).

Table 4: Means of 1000 seed weight and seed yield/ plant as affected by the interaction between sowing dates × harvesting dates during 2006/ 2007 and 2007/ 2008 seasons.

Characters	1000 seed weight						Seed yield/ plant					
	2006/ 2007			2007/ 2008			2006/ 2007			2007/ 2008		
	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec
After 135 days	5.25	4.57	5.43	5.42	5.28	6.51	0.36	0.25	0.38	0.18	0.15	0.25
After 150 days	5.70	6.53	6.01	6.12	5.89	6.37	0.40	0.23	0.36	0.18	0.27	0.31
After 165 days	7.12	6.30	7.08	7.23	6.57	6.75	0.50	0.30	0.36	0.21	0.27	0.40
F test	*			*			*			*		
NLSD 5%	0.60			0.61			0.01			0.01		

Table 5: Means of 1000 seed weight and seed yield/ plant as affected by the interaction between sowing dates × varieties during 2006/ 2007 and 2007/ 2008 seasons.

Characters	1000 seed weight						Seed yield/ plant					
	2006 / 2007			2007/2008			2006 / 2007			2007 / 2008		
	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec
Sakha 2	8.02	7.57	7.12	7.64	7.45	7.81	0.50	0.31	0.45	0.23	0.21	0.34
Sakha 3	3.99	4.25	4.31	5.00	4.74	4.80	0.27	0.14	0.25	0.17	0.22	0.30
Sakha 4	3.91	4.13	4.88	4.14	4.31	5.75	0.24	0.20	0.30	0.14	0.28	0.27
Giza 8	8.17	7.24	8.39	7.97	7.16	7.82	0.66	0.38	0.47	0.21	0.21	0.37
F test	*			*			**			**		
NLSD 5%	0.74			0.75			0.01			0.01		

Table 6: Means of 1000 seed weight and seed yield/ plant as affected by the interaction between harvesting dates × varieties during 2006/ 2007 and 2007/ 2008 seasons.

Character	1000 seed weight						Seed yield/ plant					
	Harvesting dates						Harvesting dates					
	2006 / 2007			2007/2008			2006 / 2007			2007 / 2008		
135 days	150 days	165 days	135 days	150 days	165 days	135 days	150 days	165 days	135 days	150 days	165 days	
Sakha 2	6.32	7.50	8.91	6.63	7.83	8.44	0.41	0.39	0.46	0.21	0.29	0.28
Sakha 3	3.55	4.61	4.39	4.44	4.62	5.47	0.22	0.20	0.24	0.19	0.23	0.27
Sakha 4	3.89	4.20	4.83	4.34	4.39	4.74	0.22	0.25	0.28	0.17	0.25	0.27
Giza 8	6.57	8.02	9.20	6.53	7.67	8.75	0.47	0.47	0.57	0.21	0.24	0.33
F test	**			*			**			**		
NLSD 5%	0.77			0.75			0.01			0.02		

Table 7: Means of number of capsules per plant and seed yield/ faddan as affected by the interaction among sowing dates, harvesting dates and varieties during both seasons.

Characters		number of capsules per plant						Seed yield/ faddan					
Treatments		Sowing dates 2006/ 2007			Sowing dates 2006/2007			Sowing dates 2006/2007			Sowing dates 2007/2008		
Harvesting dates	Varities	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec	20 th Oct	10 th Nov	1 st Dec
After 135 days	Sakha 2	4.11	6.76	8.30	5.71	6.56	6.58	263.7	460.3	297.3	109.6	132.6	257.5
	Sakha 3	8.60	6.00	7.83	5.77	6.17	3.72	186.2	345.9	178.7	103.1	124.2	149.4
	Sakha 4	7.78	6.53	6.70	7.86	7.56	5.58	164.2	387.3	210.7	103.4	178.9	155.9
	Giza 8	8.38	15.10	10.77	5.80	6.26	4.96	298.4	593.6	456.6	74.8	154.2	291.0
After 150 days	Sakha 2	7.76	7.06	7.31	7.13	9.00	7.10	398.5	802.9	319.4	175.5	302.9	354.9
	Sakha 3	9.13	7.63	8.03	8.16	6.80	7.63	240.3	410.9	138.1	144.3	203.7	156.1
	Sakha 4	6.23	10.50	10.86	10.03	8.12	5.83	240.1	423.9	199.5	130.3	240.7	174.6
	Giza 8	10.46	8.80	7.50	7.26	7.30	5.60	389.8	713.7	469.4	153.7	317.6	174.4
After 165 days	Sakha 2	13.66	6.02	5.93	5.13	3.40	5.96	427.4	725.6	392.9	343.9	338.5	274.9
	Sakha 3	11.36	9.66	6.98	4.48	5.67	5.47	381.7	450.0	119.3	245.5	324.3	156.7
	Sakha 4	12.00	10.16	10.06	6.56	5.56	9.30	361.9	435.8	164.5	245.9	310.5	135.2
	Giza 8	9.43	13.65	8.83	5.33	4.40	8.33	448.8	716.1	404.3	286.5	359.8	308.8
F Test		**			*			**			**		
NLSD 0.05		2.89			1.83			10.1			17.1		

The interaction between sowing and harvesting dates of the studied flax varieties significantly affected number of capsules/ plant and seed yield/ faddan as presented in Table 7. The highest seed index were obtained by sowing flax Giza 8 or Sakha 4 varieties on 10th November and 20th October and harvesting after 135 or 150 days from sowing, respectively without significantly differences between them in the first season. Heights seed yield/ faddan was obtained from sowing Giza 8 variety on 10th November and harvesting after 165 days from sowing in the first season. (716.1 gm) However, the lowest number of capsules/ plant was obtained from sowing Sakha 2 variety on 20th October and harvesting dates after 135 days from sowing dates and the lowest seed yield/ faddan was obtained from sowing Sakha 3 variety on 1st December and harvesting after 165 days from sowing in the first season and from sown the flax Giza 8 variety on 20th October and harvesting after 135 days in the second season. These results are in harmony with those obtained by Mohamed *et al.* (1998) Jankauskien and Mikelonis (2001) and El-Deeb and Abd El-Fatah (2006).

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سلوك بعض أصناف الكتان تحت تأثير مواعيد الزراعة و الحصاد المختلفة
احمد أبو النجا قنديل ، عبد الرحيم عبد الرحيم ليلة ، طه عبد المنعم ابو زيد و
هبة عبد الحليم حامد تركي
* قسم المحاصيل كلية الزراعة جامعة المنصورة .
** قسم محاصيل الألياف مركز البحوث الزراعية.

لكيتم تجربتان حقليتان بمحطة البحوث الزراعية بالجميزة - محافظة الغربية خلال الموسمين الزراعيين ٢٠٠٦/٢٠٠٧ و ٢٠٠٧/٢٠٠٨. وتهدف هذه الدراسة إلى دراسة تأثير ثلاثة مواعيد للزراعة (٢٠ أكتوبر ، ١٠ نوفمبر ، الأول من ديسمبر) و ثلاثة مواعيد الحصاد (الحصاد بعد ١٣٥ و ١٥٠ و ٦٥ يوم من الزراعة) على محصول البذور لأربعة أصناف من الكتان (سحا ٢، سحا ٣، سحا ٤ ، جيزة ٨). ويمكن تلخيص أهم النتائج التي تم التوصل إليها كما يلي:-

- ١- أشارت النتائج أن الزراعة في ٢٠ أكتوبر أدت إلى زيادة معنوية في وزن بذور النبات فسي الموسم الأول ، بينما أدت الزراعة في ١٠ نوفمبر إلى زيادة معنوية في محصول البذور للفدان.
 - ٢- أوضحت النتائج أن ميعاد الحصاد الأمثل يختلف باختلاف مواعيد الزراعة ، فعند الزراعة في الميعاد المبكر وهو ٢٠ أكتوبر و ١٠ نوفمبر كان تنسب ميعاد للحصاد هو ١٦٥ يوم من الزراعة.
 - ٣- أظهرت النتائج أن الأصناف تحت الدراسة تختلف باختلاف ميعاد الحصاد في كل الصفات المدروسة ولوضحت النتائج تفوق الصنفين سحا٢ و جيزة ٨ في محصول البذرة للفدان مقارنة بالأصناف الأخرى .
 - ٤- أظهرت للنتائج أن للتفاعل بين مواعيد الزراعة ومواعيد الحصاد والتفاعل بين مواعيد الزراعة والأصناف والتفاعل بين مواعيد الحصاد والأصناف تأثيرا معنويا علي معظم الصفات التالية وزن بذرة النبات و وزن الإلف بذرة بينما قد تثر لتفاعل الثلاثي تأثيرا معنويا على عدد الكبسولات على ثبات وعدد البذور في الكبسولة
- توصى هذه الدراسة بزراعة صنف جيزة ٨ في ١٠ نوفمبر والحصاد بعد ١٦٥ يوم من الزراعة للحصول على أعلى إنتاجية من محصول البذرة بوحدة المساحة تحت ظروف الأراضي بمحافظة الغربية .

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