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HOW VARIETIES AND HARVESTING DATES OF SESAME AFFECT SEED YIELD AND QUALITY

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ABSTRACT

In order to determine how varieties (Giza 32, Toshky 1, Shandawel 3, Takh 1, 2 and 3) and harvesting dates (100, 120 and 140 days from sowing ; DFS) of sesame affecting seed yield, lost and quality, two field experiments were conducted at Experimental Station Farm, Faculty of Agriculture, Mansoura University, in addition to two laboratory experiments were carried out in Seed Technology Research Unit in Mansoura during summer seasons of 2005 and 2006. The main results of this investigation could be summarized as follows:

- All yield components, seed yield and its loss as well as seed quality characters under study were significantly affected by the performance of six tested varieties of sesame in both seasons. Giza 32 and Toshky 1 varieties surpassed other studied varieties in all studied characters, except protein percentage in the two seasons. Tested varieties could be descendingly arranged according to their seed yield/fed as follows: Giza 32, Toshky 1, Shandawel 3, Takh 1, 2 and 3.
- Harvesting dates caused significant differences in all studied characters in both seasons. Delaying harvesting date up to 140 DFS resulted in the highest values of plant height, stem diameter, fruiting zone length, capsule length, number of capsules/plant and number of seeds/capsule as well as seed loss percentage in both seasons. Whereas, intermediate harvesting date (120 DFS) produced the highest values of 1000-seed weight, seed yield/fed and improved all seed quality characters in both seasons.
- The interaction between varieties and harvesting dates had significant effect on most studied characters in both seasons. Harvesting Toshky 1 or Giza 32 varieties after 140 DFS produced the highest values of most yield component characters and seed loss % in both seasons. While, the best seed yield/fed and seed quality characters resulted from harvesting Giza 32 variety after 120 DFS.
- It could be concluded that harvesting Giza 32, Toshky 1, Shandaweel 3 and Takh 1 varieties after 120 DFS, and Takh 2 and 3 after 140 DFS could maximize sesame seed productivity and quality under the conditions of Mansoura district.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the oldest cultivated plants in the world supplying seeds for confectionery purpose, edible oil, paste (Tahini), cake and flour. Sesame seed is a rich source of oil (45-60 %) and protein (15-25 %) [Shyu and Hwang, 2002]. In Egypt, sesame is an important industrial and food crop, where the total cultivated area is amounted to about 74000 feddan giving total seed yield of about 37000 tons*. Because the acute shortage of edible oil in Egypt , an intensive research work is needed to

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increase sesame productivity of the selected varieties through adjustment of cultural practices such as harvesting dates to avoid seed losses and improve quality.

There are great diversity within the several varieties of sesame. Although researchers have made significant progress in sesame breeding to minimize harvest losses. Many workers gave attention to the role of adapted varieties on growth, yield and its components of sesame. In this concern, El-Ashmoony *etal.* (1990) and Basha (1998) showed that sesame varieties significantly differed in growth and yield attributes. Also, Basha and Awaad (2000) found significant differences among the studied sesame varieties i.e. Giza 32, local Sharkia and B10. Beside, they showed that B10 variety surpassed the other studied varieties in fruiting zone length, capsule length, seed and oil yields/fed, whereas the differences in number of branches and capsule/plant were in favor of Giza 32 variety. While, local Sharkia variety gave the lowest values in plant height, fruiting zone length and capsule length. Abdel–Wahab *etal.* (2005) showed that Giza 32 variety had significantly longer fruiting zone length and gave higher number of capsules/plant, 1000-seed weight, seed yield per plant or fed and seed oil content over Toshky 1 variety. While, Toshky 1 variety was higher in protein content. Rehab and Fakkar (2007) reported that the variety Toshky 1 significantly have more plant height, fruiting zone length , capsule length , number of capsules / plant yield/fed. The variety Toshky 1 posse more seed yield/fed by 12.7 % over both seasons compared to the variety Shandawel 3. , 1000 – seed weight, oil % and seed.

In Egypt, sesame usually is harvested by hand. This simple method causes many seed yield losses. Seed loss is a major problem for sesame producers. The primary reason for this problem is that harvesting time can not be adjusted (Barut and Cagirgon, 2006). It is difficult to decide when to harvest a sesame crop for maximizing yield, because plant growth is indeterminate and capsules dehisce when mature. If plants are harvested too early, then seed quality of the whole crop is reduced by the inclusion of immature seed from near the top of the plant. If plants are harvested too late, then yield may be reduced by loss of seeds from the earliest maturing capsules. If growers could accurately assess seed and capsule maturity, then harvest times could be adjusted to maximize yield of mature seed (Day, 2000). Plants may be flower over a duration of 50 days or as long as conditions permit. This generates a succession of capsules of different developmental stages in leaf axils along the main stem. New capsules may be produced at the top of the plant, while mature capsules near the base of the plant dry, split and lose seeds (Ashri, 1998). Most of sesame capsules shatters at harvest resulting in seed yield losses at the end of the growing season. Ghanem (1989) and Basha and Awaad (2000) stated that harvesting date at 110 DFS had a significant favorable effect on most studied characters compared with the other harvesting dates at 90, 100 and 120 DFS under El-Khattara region – Sharkia Governorate conditions. However, El-Serogy *etal.* (1998) reported that the highest seed yield was recorded from harvest Giza 32 variety at 105 DFS under Mallawi region conditions. Thus, harvesting time should be studied well to reduce seed losses and increase sesame productivity.

Planting high quality seeds are essential to profitable production system and the first step to get an optimum stand. On the other hand, evaluation of seed quality is mainly based upon the results of various germination and vigor tests conducting in the laboratory (Hopper and Hinton, 1987).

Sesame seed color clearly indicated that seeds were mature and merchants grade sesame seed by color and size. Seeds may be considered mature when they attain maximum dry weight with maximum germination rate (Hilhorst and Toorop, 1997). El-Emery *etal.* (1997) found that harvested seed after 120 days exhibited greater seed quality than those harvested after 90 or 105 days. Early harvested seeds were generally characterized by lower germination percentage (immature seeds). Harvested seeds at 120 days produced larger and more vigorous seedlings than seeds which had been harvested at 95 days, while seeds harvested at 105 days produced intermediate seedlings weight.

Therefore, the purpose of this investigation was to determine the optimal time of harvesting date of some promising sesame varieties without sacrificing either seed quality or seed yield of sesame under the environmental conditions of Mansoura district.

MATERIALS AND METHODS

Two field experiments were conducted at Exp. Sta. Farm, Fac. of Agric., Mansoura Univ. in addition to two laboratory experiments were carried out under the laboratory conditions of Seed Tech. Res. Unit in Mansoura during the summer seasons of 2005 and 2006. The objective of this investigation was to study the most optimal harvesting dates on yield and its components as well as losses in seed quantity and quality of six sesame varieties performance.

Sesame varieties Giza 32, Toshky 1, Shandawel 3 were obtained from the Agric. Res. Center, Ministry of Agriculture, Egypt, while Takh 1, 2 and 3 varieties were obtained from Atomic Energy Authority, Inshas, Sharkia Governorate, Egypt. It were identified as indeterminate plant growth type, erect plant growth habit, deep thin taproot, light green main stem color, square stem shape in cross section, Toshky 1, Shandawel 3 and Takh 3 are non stem branching, while Giza 32, Takh 1 and Takh 2 are branching along stem, green leaf color, ovate leaf shape in the middle of plant and linear in the top of plant and light purple petiole color.

I- Field Experiments:

The experiments were laid-out in a strip plot design with three replicates. The vertical plots were occupied with the six sesame varieties. The horizontal plots were assigned to harvesting dates (100, 120 and 140 DFS).

The soil of the experimental site was characterized as clayey in texture and its physical and chemical properties are show in Table 1.

Table 1: Physical and chemical properties of soil at the experimental site during 2005 and 2006 seasons.

	Sand %	Silt %	Clay %	Texture	O.M.%	$CaCO_3$ %	Available (ppm)			E.C $dS.m^{-1}$	pH
							N	P	K		
2005	21.0	32.3	46.0	Clayey	2.69	2.65	19	8	140	1.64	7.82
2006	21.1	33.0	45.8	Clayey	2.80	2.55	18	7	135	1.70	7.75

The experimental basic unit area included 5 ridges each of 60 cm width and 3.0 m length occupying an area of 9.0 m^2. The preceding winter crop was Egyptian clover (*Trifolium alexandrinum* L.) in both seasons. The experimental field was well prepared and calcium super phosphate (15.5 % P_2O_5) was applied during soil preparation at the rate of 100 kg/fed.

Seeds of sesame were sown in hills 15 cm apart at one side of ridges in June 6 and 10 in the first and second seasons, respectively. After 21 DFS the seedlings were thinned to two plants per hill. Nitrogen and potassium fertilizers were applied in the form of ammonium sulphate (20.5 % N) and potassium sulphate (48 % K_2O) at the rate of 60 kg N/fed and 24 kg K_2O/fed, respectively in two equal doses (after thinning and three weeks later). The other cultural practices for growing sesame crop were conducted as recommended.

At each of the three harvesting dates, a sample of ten plants from outer ridges of each experimental unit was taken randomly and the following characters were recorded; plant height (cm), stem diameter (cm), fruiting zone length (cm), capsule length (cm), number of capsules/plant, number of seeds/capsule and 1000-seed weight (g). Samples of mature seed were cleaned, oven dried, ground finely and stored in small bags for chemical analysis. Seed oil percentage was determined after extraction with Soxhelt`s apparatus using hexan as an organic solvent according to A.O.A.C. (1990). Seed crude protein percentage was estimated according the improved Kejeldahel method of A.O.A.C. (1990).

Seed yield (kg/fed) was determined by using the inner three ridges after covering the ground below the plants with polyethylene sheet. Seeds losses were estimated by taking weight of seeds on the polyethylene sheet. Adjusted seeds weight were taken directly after gathering, collecting as swathed upright bundles, dried, conveying and translating operations to thresh and clean, then seed yield was estimated. Lost seeds (%) was calculated as follows:

- Seed loss %=Collected seeds on the polyethylene sheet / Seed yield × 100

All data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the strip plot design as published by Gomez and Gomez (1984), by means of "MSTAT-C " Computer software package. The treatment means were compared using the Newly Least Significant Differences (NLSD) according to the procedure outlined by Waller and Duncan (1969).

II- Laboratory Experiments:

Random seed samples (400 seeds) from each treatment were drown to assess germination measurements. Seed samples were sown on top filter paper in sterilized Petri-dishes (14 cm in diameter). Each Petri-dish contains

50 seeds, and two Petri-dishes kept close together and assessed through they were one 100 seeds per replication and incubated at 25 °C for eight days for germination. Then four replicates were used to evaluate speed of germination index by dividing the number of normal seedlings removed each day by the day after planting on which they were removed according to Agrawal (1986). The percentage of germinated seeds was calculated according to I.S.T.A. (1985). Shoot and root length (cm) were determined from 10 normal seedlings taken at random per each replicate at the end of standard germination test, then dried in a forced air oven at 105 °C for 24 hours to obtain seedlings dry weight and expressed as milligrams. Collected data were subjected to the statistical analysis according to the technique of analysis of variance (ANOVA) for the completely randomized design.

RESULTS AND DISCUSSION

1- Yield component characters:

1.1- Varietal performance:

Data presented in Tables 2, 3 and 4 show significant differences between the six tested varieties for plant height, stem diameter, fruiting zone length, capsule length, number of capsules/plant, number of seeds/capsule and 1000-seed weight in both seasons. Giza 32 and Toshky 1 varieties surpassed other studied varieties in all yield component characters in the two seasons. It is worthy to mention that the differences between Giza 32 and Toshky 1 varieties did not reach the level of significance in plant height and stem diameter (in the first season) and fruiting zone length (in both seasons). Whereas significant differences between Giza 32 and Toshky 1 in number of capsules/plant, number of seeds/capsule and 1000-seed weight characters were recorded (Table 4). The highest values of plant height, capsule length, number of capsules/plant, number of seeds/capsule (in both seasons), stem diameter (in the second season) and fruiting zone length (in the first season) resulted from Toshky 1 variety. Meanwhile, the maximum values of stem diameter (in the first season), fruiting zone length (in the second season) and 1000-seed weight (in both seasons) resulted from Giza 32 variety. In the contrast, the lowest values of all studied characters were obtained from Takh 3 variety, except for fruiting zone length which resulted from Takh 2 variety in both seasons. These findings might be attributed to the differences in their genetical constitution. Similar results were stated by El-Ashmoony *etal.* (1990), Basha (1998) and Basha and Awaad (2000).

1.2- Harvesting date effects:

Harvesting dates caused significant effect on all studied yield component characters in both seasons (Tables 2, 3 and 4). Delaying harvest time up to 140 DFS resulted in the highest values of plant height, stem diameter, fruiting zone length, capsule length, number of capsules/plant and number of seeds/capsule compared with the earliest dates in both seasons. Whilst, the highest 1000-seed weight was produced from harvesting after 120 DFS in the two seasons. Also, it could be noticed that the differences between harvesting after 120 or 140 DFS were insignificant in capsule length(in the first seasons) and number of seeds/capsule (in both seasons).

On the contrary, early harvesting time (100 DFS) recorded the lowest values in this respect. The increases in yield component characters due to delaying harvesting time might be attributed to an increase in the net assimilates of sesame plants owing to prolonged growth period which increased dry matter accumulation in plant organs till it reached the full maturity stage. In addition, the reduction in 1000-seed weight from early harvesting date (100 days) might be due to high level of immature seeds, while the reduction from late harvesting (140 days) might be due to capsules shattering. Ghanem (1989), El-Serogy *etal.* (1998) and Day (2000) obtained similar results.

1.3- Interaction effects:

The effect of interaction between varieties and harvesting dates had a significant effect on plant height, number of capsules/plant, number of seeds/capsule and 1000-seed weight in both seasons as well as fruiting zone length and capsule length in the first season only (Tables 2, 3 and 4). Data in that Tables show that Toshky 1 variety harvested after 140 DFS produced the highest values of plant height, stem diameter, fruiting zone length, capsule length and number of capsules/plant in both seasons as well as number of seeds/capsule in the second season only. However, Giza 32 variety gave the heaviest 1000-seed weight when harvested after 120 DFS in both seasons. On the other hand, the lowest values of all these characters resulted from Takh 3 variety with early harvest time (100 DFS), except fruiting zone length which produced from Takh 2 when harvested in the same time in both seasons.

Table 2: Plant height and stem diameter of some sesame varieties as affected by harvesting dates and their interaction during 2005 and 2006 seasons.

Characters / Varieties	Plant height (cm)				Stem diameter (cm)			
	Harvesting dates				Harvesting dates			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
First season 2005								
Giza 32	176.6	183.6	190.3	**183.5**	1.33	1.36	1.36	**1.35**
Toshky 1	167.6	191.3	195.0	**184.6**	1.26	1.33	1.40	**1.33**
Shandaweel 3	133.6	160.6	167.0	**153.7**	0.96	1.20	1.26	**1.14**
Takh 1	153.6	166.0	173.6	**164.4**	1.23	1.26	1.30	**1.26**
Takh 2	124.0	149.6	160.0	**144.5**	1.00	1.10	1.20	**1.10**
Takh 3	115.3	131.6	140.0	**129.0**	0.90	1.00	1.03	**0.97**
Mean	**145.1**	**163.8**	**171.0**		**1.11**	**1.21**	**1.26**	
NLSD 5 %	H = 2.7	V = 4.8	H*V = 3.7		H = 0.05	V = 0.08	H*V =NS	
Second season 2006								
Giza 32	145.3	152.0	159.3	**152.2**	1.06	1.13	1.20	**1.13**
Toshky 1	154.3	163.0	168.3	**161.8**	1.16	1.26	1.30	**1.24**
Shandaweel 3	127.6	130.3	135.0	**131.0**	0.96	1.03	1.16	**1.05**
Takh 1	129.6	133.0	141.3	**134.6**	1.00	1.06	1.13	**1.06**
Takh 2	121.0	124.6	139.0	**128.2**	0.86	0.96	1.06	**0.96**
Takh 3	111.3	121.0	126.6	**119.6**	0.83	0.93	1.03	**0.93**
Mean	**131.5**	**137.3**	**144.9**		**0.98**	**1.06**	**1.15**	
NLSD 5 %	H = 0.7	V = 5.3	H*V = 2.9		H = 0.03	V = 0.04	H*V = NS	

Table 3: Fruiting zone length and capsule length of some sesame varieties as affected by harvesting dates and their interaction during 2005 and 2006 seasons.

Characters / Varieties	Fruiting zone length (cm)				Capsule length (cm)			
	Harvesting dates				Harvesting dates			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
First season 2005								
Giza 32	116.5	121.4	128.1	**122.0**	3.47	3.63	3.68	**3.59**
Toshky 1	114.6	130.1	131.3	**125.3**	3.81	3.86	3.90	**3.86**
Shandaweel 3	81.7	104.0	107.3	**97.7**	2.98	3.49	3.55	**3.34**
Takh 1	84.4	91.6	92.3	**89.4**	2.90	3.27	3.32	**3.16**
Takh 2	54.7	78.7	83.5	**72.3**	2.81	3.16	3.21	**3.06**
Takh 3	67.8	83.2	87.3	**79.5**	2.63	2.98	3.05	**2.89**
Mean	**86.6**	**101.5**	**104.9**		**3.10**	**3.40**	**3.45**	
NLSD 5 %	H = 1.3	V = 5.4	H*V = 4.8		H = 0.08	V = 0.19	H*V = 0.12	
Second season 2006								
Giza 32	98.8	100.3	106.0	**101.7**	3.29	3.57	3.59	**3.48**
Toshky 1	91.5	101.4	105.1	**99.3**	3.64	3.85	3.85	**3.78**
Shandaweel 3	83.2	84.0	85.7	**84.3**	3.01	3.27	3.33	**3.20**
Takh 1	61.3	73.5	73.8	**69.5**	3.01	3.23	3.27	**3.17**
Takh 2	52.8	58.6	64.5	**58.6**	2.76	2.91	2.93	**2.87**
Takh 3	72.4	74.1	78.2	**74.9**	2.55	2.79	2.83	**2.72**
Mean	**76.6**	**82.0**	**85.5**		**3.04**	**3.27**	**3.30**	
NLSD 5 %	H = 3.1	V = 4.7	H*V = NS		H = 0.01	V = 0.13	H*V = NS	

Table 4: Number of capsules/plant, number of seeds/capsule and 1000-seed weight of some sesame varieties as affected by harvesting dates and their interaction during 2005 and 2006 seasons.

Characters / Varieties	No. of capsules/plant				No. of seeds/capsule				1000-seed weight (g)			
	Harvesting dates				Harvesting dates				Harvesting dates			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
First season 2005												
Giza 32	73.2	82.8	93.7	**83.2**	36.9	45.7	44.2	**42.3**	3.89	4.19	4.10	**4.06**
Toshky 1	76.3	93.4	101.6	**90.4**	39.4	51.6	50.1	**47.1**	3.74	3.97	3.90	**3.87**
Shandaweel 3	68.0	74.3	83.8	**75.4**	35.2	43.1	42.4	**40.3**	3.79	4.20	3.99	**3.99**
Takh 1	67.6	73.8	89.6	**77.0**	35.3	43.3	42.5	**40.4**	3.49	3.87	3.63	**3.66**
Takh 2	61.2	67.6	73.4	**67.4**	30.1	34.6	38.4	**34.4**	3.34	3.50	3.45	**3.43**
Takh 3	53.1	61.8	67.1	**60.7**	26.1	31.1	33.6	**30.3**	3.28	3.57	3.41	**3.42**
Mean	**66.5**	**75.6**	**84.9**		**33.9**	**41.6**	**41.9**		**3.59**	**3.88**	**3.75**	
NLSD 5 %	H = 1.2	V = 2.7	H*V = 3.3		H = 1.1	V = 0.6	H*V = 0.9		H = 0.04	V = 0.07	H*V = 0.05	
Second season 2006												
Giza 32	65.1	77.8	81.6	**74.8**	34.5	43.4	41.8	**39.9**	3.83	4.06	4.02	**3.97**
Toshky 1	70.6	82.2	85.9	**79.5**	35.8	44.3	44.8	**41.7**	3.68	3.87	3.80	**3.78**
Shandaweel 3	65.6	70.3	76.6	**70.8**	33.4	40.6	39.8	**37.9**	3.77	4.08	3.82	**3.89**
Takh 1	64.4	74.0	77.1	**71.8**	32.8	40.1	38.4	**37.1**	3.42	3.74	3.59	**3.58**
Takh 2	55.4	65.6	71.5	**64.1**	27.7	31.8	34.2	**31.2**	3.26	3.44	3.35	**3.35**
Takh 3	53.4	60.5	63.7	**59.2**	24.2	28.1	31.3	**27.9**	3.22	3.36	3.29	**3.29**
Mean	**62.4**	**71.7**	**76.0**		**31.4**	**38.0**	**38.4**		**3.53**	**3.76**	**3.64**	
NLSD 5 %	H = 1.5	V = 1.9	H*V = 2.6		H = 1.4	V = 1.6	H*V = 1.6		H = 0.02	V = 0.06	H*V = 0.06	

2- Seed yield and seed loss percentage:

2.1- Varietal performance:

Data presented in Table 5 indicate significant differences among the six tested varieties in seed yield/fed and seed loss % in both seasons. The highest seed yield/fed resulted from Giza 32 then Toshky 1 varieties being insignificantly different in the two seasons. While, the maximum seed loss % resulted from Toshky 1 variety in both seasons. On the contrary, the lowest seed yield and seed loss % were produced from Takh 3 and Takh 2 in the first and second seasons, respectively. The differences among the six sesame varieties in seed yield/fed and seed loss % might be attributed to the genetical make up factors and heredity variation among the varieties as well as variation of environmental conditions to which plant were subjected in the field. Similar results were confirmed by El-Emery *etal.* (1997), El-Serogy *etal.* (1998), Basha and Awaad (2000) and Day (2000).

2.2- Harvesting date effects:

The results recorded in Table 5 show that intermediate harvesting time of sesame plants (120 DFS) recorded the highest seed yield/fed, conversely the lowest values were obtained from early harvest time (100 DFS) in both seasons. Also, late harvesting time (140 DFS) caused higher seed loss %, whilst the minimum seed loss % resulted from early harvesting time in both seasons. During seed filling, the maximum chlorophyll concentration was reached in the capsule wall. This supports that photosynthesis occurring in the capsule wall assists with provision of assimilates to seed as reported by (King *etal.*, 1998) then declined with time in capsule wall, chlorophyll concentration was gradually yellowing of capsule, which has been used to indicate when seeds were mature. This is an imprecise measure of seed maturity (Day, 2000). Thus, there is a period of mature seeds which could be harvested before capsules begin to split. Harvesting early before this period (100 days) may produce more immatured seeds with non – shattering capsules, while late harvesting (140 days) may gave more seed drop from shattering capsules and less immatured seeds. El-Serogy *etal.* (1998) and Basha and Awaad (2000) reported similar conclusion.

2.3- Interaction effects:

The effect of interaction between varieties and harvesting dates was significant for seed yield/fed and seed yield loss % in both seasons (Table 5). It could be stated that the highest seed yield/fed produced from Giza 32 variety under the intermediate harvesting date (120 DFS) and significantly surpassed other studied varieties in the two seasons, except Toshky 1 in the second season only. Whereas, the lowest seed yield resulted from Takh 3 when harvested after 100 DFS in both seasons. Concerning seed yield loss %, the highest values came out from Toshky 1 under late harvesting date (140 DFS), while the lowest values were obtained from early harvesting date (100 DFS) when Takh 3 and Takh 2 varieties planted, respectively in the first and second seasons.

Table 5: Seed yield/fed and lost seed yield % of some sesame varieties as affected by harvesting dates and their interaction during 2005 and 2006 seasons.

Characters / Varieties	Seed yield (kg/fed)				Seed yield loss (%)			
	Harvesting dates				Harvesting dates			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
First season 2005								
Giza 32	378.0	527.0	345.6	416.8	11.44	16.09	28.29	18.61
Toshky 1	411.6	477.0	315.3	401.3	12.01	19.65	33.66	21.78
Shandaweel 3	349.3	409.3	318.0	358.8	11.16	15.75	27.23	18.05
Takh 1	313.3	363.6	316.0	331.0	11.21	17.05	27.26	18.51
Takh 2	237.6	312.0	360.0	303.2	6.24	8.81	13.07	9.37
Takh 3	185.6	225.3	274.0	228.3	5.55	8.93	15.55	10.01
Mean	312.6	385.7	321.5		9.60	14.38	24.18	
NLSD 5 %	H = 6.8	V = 16.7	H*V = 9.7		H = 0.65	V = 0.43	H*V = 0.74	
Second season 2006								
Giza 32	332.0	461.0	309.0	367.3	11.68	17.10	28.80	19.19
Toshky 1	349.0	458.0	289.6	365.5	12.30	18.85	32.94	21.36
Shandaweel 3	305.0	362.3	271.3	312.8	11.33	16.40	29.85	19.19
Takh 1	297.6	340.0	265.6	301.1	11.14	16.20	27.61	18.31
Takh 2	207.3	270.3	313.0	263.5	5.91	9.02	13.66	9.53
Takh 3	150.6	207.3	245.0	201.0	6.52	8.91	15.46	10.29
Mean	273.6	349.8	282.2		9.81	14.41	24.72	
NLSD 5 %	H = 3.3	V = 13.1	H*V = 7.0		H = 0.48	V = 0.46	H*V = 0.43	

3- Seed quality characters:

3.1- Varietal performance:

The results recorded in Tables 6, 7 and 8 exhibit significant differences among the six tested varieties in seed quality characters *i.e.* oil, protein, germination percentages, speed of germination index, shoot and root length and seedlings dry weight in both seasons. From the obtained data, it could be concluded that Giza 32 surpassed all studied varieties and produced the highest values of the all previously mentioned traits, with the exception of protein %, where Takh 3 exceeded other varieties in both seasons. Varieties could be descendingly arranged according to seed quality traits as follows: Giza 32, Toshky 1, Shandaweel 3, and Takh 1, 2 and 3. Differences among the six varieties may be due to the genetical makeup and environmental conditions to which the mother plants were subjected in the field. These results are partially in accordance with those stated by El-Emery *etal.* (1997), El-Serogy *etal.* (1998), Basha (1998), Basha and Awaad (2000) and Day (2000).

3.2- Harvesting date effects:

Data pertaining in the Tables 6, 7 and 8 reveal that significant differences were found among the three harvesting dates of sesame plants on seed quality characters in both seasons. The maximum values of all seed quality characters (oil, protein, germination percentages, speed of germination, shoot and root length and seedlings dry weight) resulted from intermediate harvesting date (120 DFS) followed by late then early harvesting dates in both seasons. Seed oil and protein contents were probably near maximum levels at the intermediate harvesting date (120 days) which due to that maximum seed dry weight as well as oil and protein contents were recorded at the this developmental stage (Kang, 1985 and Day, 2000). Also, Day (2000) found that seeds achieved best germination after one or two weeks from sesame seeds, which reached the maximum maturation. Since, the early harvesting date had a high level of the immatured seeds. Moreover late harvesting date contained also a high level of the immatured seeds after the matured seeds were dropped due to capsule shattering and those flowers lately in the fruit period. So, the main reason of the lowest values of seed quality measurements due to early or late harvesting dates might due to a high percent of seeds which have not achieved physiological maturity and failed to germinate or to give vigorous seedlings under the optimal laboratory growth conditions. Hopper and Hinton (1987), El-Emery *et al.* (1997) and Hilhorst and Toorop (1997) came out to similar results.

3.3- Interaction effects:

The effect of interaction between varieties and harvesting dates was significant for seed quality characters in both seasons (Tables 6, 7 and 8). It could be reported that the maximum values of oil %, germination percentages, speed of germination, shoot and root length and seedlings dry weight were realized by Giza 32 variety under the intermediate harvesting date (120 days) in both seasons. Nevertheless, the lowest values of these traits were obtained from Takh 3 variety under the early harvesting date (100 days) in both seasons.

Table 6: Oil and protein percentages in seeds of some sesame varieties as affected by harvesting dates and their interaction during 2005 and 2006 seasons.

Characters / Varieties	Oil (%)				Protein (%)			
	Harvesting dates				Harvesting dates			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
First season 2005								
Giza 32	50.3	51.9	51.3	**51.2**	18.2	18.5	18.3	**18.3**
Toshky 1	48.4	49.9	49.2	**49.2**	19.7	20.4	20.2	**20.1**
Shandaweel 3	49.7	50.5	50.0	**50.1**	18.8	19.9	19.5	**19.4**
Takh 1	49.3	50.0	49.9	**49.7**	19.3	20.7	19.8	**19.9**
Takh 2	49.8	51.0	50.8	**50.5**	18.8	18.9	18.8	**18.8**
Takh 3	47.9	49.4	48.3	**48.6**	19.9	21.0	20.8	**20.6**
Mean	**49.3**	**50.4**	**49.9**		**19.1**	**19.9**	**19.6**	
NLSD 5 %	H = 0.1	V = 0.2	H*V = 0.3		H = 0.1	V = 0.2	H*V = 0.3	
Second season 2006								
Giza 32	49.5	51.1	50.4	**50.3**	17.9	18.3	18.1	**18.1**
Toshky 1	47.9	50.3	48.7	**49.0**	19.4	19.6	19.8	**19.6**
Shandaweel 3	49.0	50.3	49.8	**49.7**	18.7	19.2	19.0	**18.9**
Takh 1	48.4	50.2	49.1	**49.3**	19.3	19.8	19.7	**19.6**
Takh 2	49.2	50.8	50.2	**50.0**	18.5	18.7	18.6	**18.6**
Takh 3	47.8	49.0	48.0	**48.3**	19.7	20.7	20.5	**20.3**
Mean	**48.6**	**50.3**	**49.4**		**18.9**	**19.4**	**19.3**	
NLSD 5 %	H = 0.1	V = 0.2	H*V = 0.3		H = 0.1	V = 0.1	H*V = 0.2	

Table 7: Germination percentage and speed of germination of some sesame varieties as affected by harvesting dates and their interaction during 2005 and 2006 seasons.

Characters / Varieties	Germination (%)				Speed of germination			
	Harvesting dates				Harvesting dates			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
First season 2005								
Giza 32	84.6	92.0	88.6	**88.4**	39.3	50.0	43.3	**44.2**
Toshky 1	82.0	89.0	85.0	**85.3**	37.6	45.0	41.0	**41.2**
Shandaweel 3	71.3	79.0	66.3	**72.2**	31.0	38.0	35.6	**34.8**
Takh 1	68.6	77.0	65.0	**70.2**	29.6	36.6	33.0	**33.1**
Takh 2	65.3	71.3	63.3	**66.6**	27.0	32.0	29.6	**29.5**
Takh 3	58.6	67.0	63.0	**62.8**	24.0	28.0	27.0	**26.3**
Mean	**71.7**	**79.2**	**71.8**		**31.4**	**38.2**	**34.9**	
NLSD 5 %	H = 0.7	V = 0.9	H*V = 1.1		H = 0.2	V = 1.1	H*V = 0.8	
Second season 2006								
Giza 32	82.6	91.0	86.0	**86.5**	48.0	52.0	50.0	**50.0**
Toshky 1	79.0	83.0	81.0	**81.0**	45.0	48.0	46.6	**46.5**
Shandaweel 3	69.0	76.6	73.0	**72.8**	39.0	45.6	42.3	**42.3**
Takh 1	66.6	74.0	69.6	**70.1**	34.0	41.0	37.3	**37.4**
Takh 2	59.6	69.0	64.3	**64.3**	31.0	35.3	33.0	**33.1**
Takh 3	55.0	64.3	59.6	**59.6**	26.3	31.0	29.0	**28.7**
Mean	**68.6**	**76.3**	**72.2**		**37.2**	**42.1**	**39.7**	
NLSD 5 %	H = 0.7	V = 0.7	H*V = 1.5		H = 0.7	V = 0.9	H*V = 1.0	

Table 8: Shoot length, root length and seedlings dry weight (for 10 seedlings) of some sesame varieties as affected by harvesting dates and their interaction during 2005 and 2006 seasons.

Characters / Varieties	Shoot length (cm)				Root length (cm)				Seedlings dry weight (mg)			
	Harvesting dates				Harvesting dates				Harvesting dates			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
First season 2005												
Giza 32	5.16	5.76	5.43	**5.45**	4.56	5.16	4.83	**4.85**	42.9	47.8	44.6	**45.1**
Toshky 1	4.30	4.63	4.53	**4.48**	3.53	4.13	3.90	**3.85**	39.5	44.8	41.7	**42.0**
Shandaweel 3	4.10	4.50	4.30	**4.30**	3.30	3.90	3.46	**3.55**	35.9	40.1	38.3	**38.1**
Takh 1	3.76	3.96	3.86	**3.86**	3.06	3.70	3.26	**3.34**	29.9	36.2	32.8	**32.9**
Takh 2	3.40	3.83	3.53	**3.58**	2.46	3.13	2.76	**2.78**	23.7	30.5	29.5	**27.9**
Takh 3	3.16	3.70	3.43	**3.43**	2.33	2.90	2.53	**2.60**	19.1	24.4	22.5	**22.0**
Mean	**3.98**	**4.40**	**4.18**		**3.21**	**3.82**	**3.46**		**31.8**	**37.3**	**34.9**	
NLSD 5 %	H = 0.09	V = 0.11	H*V = 0.23		H = 0.02	V = 0.05	H*V = 0.06		H = 0.3	V = 0.3	H*V = 0.5	
Second season 2006												
Giza 32	4.96	5.50	5.26	**5.24**	4.76	5.46	5.10	**5.11**	42.2	49.1	45.8	**45.7**
Toshky 1	3.93	4.56	4.23	**4.24**	4.00	4.50	4.26	**4.25**	37.7	43.9	39.8	**40.5**
Shandaweel 3	3.70	4.20	3.93	**3.94**	3.73	4.23	4.00	**3.98**	34.0	38.3	36.1	**36.1**
Takh 1	3.46	4.00	3.66	**3.71**	3.46	3.96	3.66	**3.70**	30.6	37.4	34.1	**34.0**
Takh 2	2.96	3.56	3.30	**3.27**	2.76	3.46	3.20	**3.14**	22.4	32.4	27.3	**27.3**
Takh 3	2.70	3.40	2.80	**2.96**	2.56	3.26	3.00	**2.94**	19.1	25.9	22.4	**22.4**
Mean	**3.62**	**4.20**	**3.86**		**3.55**	**4.15**	**3.87**		**31.0**	**37.8**	**34.2**	
NLSD 5 %	H = 0.07	V = 0.04	H*V = 0.11		H = 0.05	V = 0.10	H*V = 0.11		H = 0.3	V = 0.2	H*V = 1.2	

REFERENCES

A.O.A.C. (1990) Official Methods of Analysis Association of Official Analytical Chemists. 15th Ed., Washington D.C., USA.

Abdel – Wahab, A.M. ; A.A. Awad ; M.H. Adbel-Mottaleb ; M.S.H.A. Yousef and E.E.A. Abdel-Latief (2005). The response of two sesame varieties to irrigation regimes and fertilization under surface and drip irrigation systems. 2- Yield, yield components and WUE. The 11th Conf. of Agron., Fac. of Agric. Assiut Univ., 15-16 Sept. 2005, I: 274-296.

Agrawal, P.K. (1986). Seed vigor: Concepts and measurements. In Seed production technology. Edited by J.P. Srivastava and L.T. Simarsk. Intern. Center for Agric. Res. In Dry Areas (ICARDA).

Ashri, A. (1998). Sesame breeding. Plant Breed. Rev., 16: 179-228.

Barut, Z.B. and M.I. Cagirgon (2006). Effect of seed coating in the accuracy of single seed sowing of sesame under field conditions. Australian J. of Exp. Agric., 46: 71-76.

Basha, H.A. (1998). Response of some sesame varieties to different row and hill spacing in newly cultivated sandy soil. Zagazig J. Agric. Res., 25 (3): 385-397.

Basha, H.A. and H.A. Awaad (2000). Effect of harvesting date on three sesame varieties under newly cultivated sandy soil conditions. Zagazig J. Agric. Res., 27 (1): 31-41.

Day, J.S. (2000). Development and maturation of sesame seeds and capsules. Field Crops Res., 67: 1-9.

El-Ashmoony, M.S.F. ; A.A. El-Sherbeny and S.T. El-Serogy (1990). Effect of hill spacing combined with number of plants per hill on two sesame varieties. Minia J. Agric. Res., 12 (1): 187-198.

El-Emery, M.I. ; S.T. El-Serogy and H.G. Elrabie (1997). Effect of irrigation and harvesting treatments on yield and quality of some sesame (*Sesamum indicum* L.) genotypes. Egypt. J. Appl. Sci., 12 (11): 168-187.

El-Serogy, S.T. ; S.A.A. Attaallah and Nagwa R. Ahamed (1998). Optimal time of terminal irrigation and harvesting date of some sesame varieties. Egypt. J. Agric. Res., 76 (3): 1063-1075.

Ghanem, S.A.I. (1989). Sesame yield as affected by nitrogen and harvesting time. Zagazig J. Agric. Res., 16 (1): 65-75.

Gomez, K.N. and A.A. Gomez (1984). Statistical procedures for agricultural research. John Wiley and Sons, New York, 2nd ed., 68 P.

Hilhorst, H.W.M. and P.E. Toorop (1997). Review on dormancy, germinability and germination in crop and weed seeds. Adv. Agron., 61: 111-165.

Hopper, N.W. and H.R. Hinton (1987). Electrical conductivity as a measure of planting seed quality in cotton. Agron. J., 79: 147-152.

I.S.T.A. (1985). International rules for seed testing. Seed Sci. and Technol., 13: 307-355.

Kang, C.W. (1985). Studies on flowering, capsule bearing habit and maturity of different plants types in sesame (*Sesamum indicum* L.). Ph D. Thesis, Korea Univ., Seoul, South Korea.

King, S.P. ; M.R. Badger and R.T. Furbank (1998). CO_2 refixation characteristics of developing canola seeds and silique walls. Austral. J. Plant Physiol., 25: 377-386.

Rehab, H.K.A. and A.A.O. Fakkar (2007). Response of two sesame varieties to nitrogen fertilizer and some weed control treatments. J. Agric. Sci. Mansoura Univ., (In press).

Shyu, Y.S. and L.S. Hwang (2002). Antioxidative activity of the crude extract of lignan glycosides from unroasted Burma black sesame meal. Food Res. Inter., 35: 357-365.

Waller, R.A. and D.B. Duncan (1969). A bays rule for the symmetric multiple comparison problem. J. Amer. Assoc., 64: 1484-1503.

كيف تؤثر الأصناف ومواعيد الحصاد على محصول البذور وجودتها فى السمسم

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لتحديد كيف تؤثر الأصناف (جيزة ٣٢ ، توشكى ١ ، شندويل ٣ ، طاقة ١ ، ٢ و ٣) ومواعيد الحصاد (١٠٠ ، ١٢٠ و ١٤٠ يوم من الزراعة) على محصول البذور والفاقد منه وصفات جودة البذور فى السمسم أجريت تجربتان حقليتان بمحطة التجارب والبحوث الزراعية بكلية الزراعة – جامعة المنصورة وكذلك تجربتان معمليتان فى وحدة بحوث تكنولوجيا البذور بالمنصورة خلال الموسمين الصيفيين ٢٠٠٥ و٢٠٠٦.

يمكن تلخيص أهم نتائج هذه الدراسة فيما يلى:

- تأثرت جميع صفات مكونات المحصول ومحصول البذور والفاقد منه وكذلك صفات جودة البذور معنوياً بأصناف السمسم تحت الدراسة فى كلا الموسمين. تفوق الصنفان جيزة ٣٢ وتوشكى ١ على جميع الأصناف تحت الدراسة فى جميع الصفات المدروسة فيما عدا النسبة المئوية للبروتين فى موسمى الدراسة. يمكن ترتيب الأصناف تحت الدراسة من حيث كمية محصول البذور للفدان كما يلى: جيزة ٣٢ ، توشكى ١ ، شندويل ٣ ، طاقة ١ ، ٢ ،٣ فى كلا الموسمين.
- كان لمواعيد الحصاد تأثيرا معنويا على جميع الصفات تحت الدراسة فى الموسمين. وأدى تأخير ميعاد الحصاد حتى ١٤٠ يوم من الزراعة للحصول على أعلى القيم لطول النبات ، قطر الساق ، طول المنطقة الثمرية ، طول الكبسولة وعدد الكبسولات للنبات وعدد البذور للكبسولة وكذلك النسبة المئوية لمحصول البذور المفقودة فى كلا الموسمين. فى حين أعطى ميعاد الحصاد المتوسط (١٢٠ يوم من الزراعة) أعلى وزن لكل ١٠٠٠ بذرة ومحصول البذور للفدان وكذلك جميع صفات جودة البذور فى موسمى الدراسة.
- كان للتفاعل بين الأصناف ومواعيد الحصاد تأثيراً معنوياً على معظم الصفات تحت الدراسة فى كلا الموسمين. ونتجت أعلى القيم لمعظم صفات مكونات المحصول وكذلك محصول البذور المفقود من حصاد الصنفين توشكى ١ وجيزة ٣٢ بعد ١٤٠ يوم من الزراعة فى كلا الموسمين. بينما كان أعلى محصول بذور للفدان وكذلك جميع صفات جودة البذور أمكن الحصول عليها من حصاد الصنف جيزة ٣٢ بعد ١٢٠ يوم من الزراعة.
- عموماً يمكن التوصية بحصاد الأصناف جيزة ٣٢ وتوشكى ١ وشندويل ٣ وطاقة ١ بعد ١٢٠ يوم من الزراعة والصنفان طاقة ١ و٢ بعد ١٤٠ يوم من الزراعة للحصول على أعلى إنتاجية وصفات جودة جيدة للبذور من السمسم تحت ظروف منطقة المنصورة.