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Storability of some Oil Seed Crops Under Two Types of Packages

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ABSTRACT

Effect of storability on germination, viability and chemical composition of sunflower (Sakha53), canola (Sero4) and sesame seeds (Shandwel3 and Giza32) was the aim of this study was contacted at the Seed Technology Research of Sakha, Agric. Res. Station, ARC, Egypt, during the period 2012- 2014 years to investigate the effect of some storage conditions, *i.e.* storage period (6 and 18 months) and storage packages (aluminum foil and woven poly ethylene) on some seed quality parameters of some oil seed cropes. The results indicates that increasing storage period significantly reduced germination percentage, plumule length, radical length, dry seedling weight, 1000-seed weight, relative density, oil percentage, crude protein percentage, while increased electrical conductivity and acidity percentage. The highest values of germination percentage, plumule length, radical length, dry seedling weight, 1000-seed weight, relative density, oil percentage, protein percentage and the best viability characters (by decline electrical conductivity and acidity percentage were recoded by seeds stored in aluminum foil, whereas seeds stored in woven polyethylene package gave bad viability characters (by increasing electrical conductivity and acidity percentage) for sunflower, canola and sesame seeds. For the impact of sesame cultivars the results were Shandwel3 cultivar gave the highest germination percentage, plumule length, radical length, dry seedling weight, 1000-seed weight, relative density and lowest electrical conductivity value. On the other hand, Giza32 gave the highest oil percentage and lowest acidity percentage.

Keywords: Sunflower, canola, sesame, storage period, package material, germination, viability.

INTRODUCTION

The production of maximum sunflower, rapeseed and sesame yield required adequate supplied of high quality seed and improved cultivars. In general, we stored seed to maintain it's in a viable condition from the time of harvesting until the time of sowing. Storage time varies according to the purpose for which you stored the seed. Careful storage may help alleviate problems of seed availability and large seed crops may by used for several years of revegetation activity, avoiding the need to rely on the current crop alone. Seeds of most species may be safely stored for several years by careful control of temperature and relative humidity. In some parts of the world especially in the tropics, conditioned storage is necessary in order to maintain high viability of some seeds from harvesting to planting (Harrington 1973). Seeds in small package gain was lose moisture faster than seeds in large package. Therefore, small packages require better moisture-barrier materials than do large for equal moisture protection (Bass 1971). The use of high vigor planting seed for all crops in justified, however to help ensure adequate plant population across wide range of field condition encountered during emergence. In recent years, package seeds in moisture barrier containers to prevent loss of viability and resistant or hermetically seeded containers for storage and marketing has explored. The purpose of such containers is to maintain seeds at safe storage moisture levels (Copeland and Donald, 1995).

Several factors such as temperature, moisture, variety and nutrient status influence seed maturity, or maximum dry weight of the seed (Copeland and Mc Donald 1995). Germination declined 2.7% per degree (C^o) storage temperature rise. Most observations indicated that starchy seeds above 12% and oily seeds above 9% deteriorate faster in sealed storage than in nonsealed storage (Harrington 1973). The hydrolysis of phospholipids leads to the released of glycerol and fatty acides and this creation accelerates with increasing seed moisture content (Harrington 1973). El-Sayed *et al* (2004) indicated that, the high values of germination percentage, oil percentage the best oil characters of flax were recorded by seeds stored in high density polyethylene, whereas seeds stored in paper package gave bead oil characters (by increasing free fatty acid and acid value)

MATERIALS AND METHODS

The present investigation was carried out in the laboratory of Seed Technology at Sakha Agriculture. Resarch. Station, ARC, Egypt, during 2012- 2014 years to investigate the effect of two storage period (6 and 189 months) and two package materials (aluminum foil and woven polyethylene) on germination, seedling vigor, viability and some seed quality parameters of sunflower (Sakha53), canola (Sero4) and sesame seeds (Shandwel3 and Giza32). Each package was field with (1 kg of seeds). Germination percentage, seed vigor, electrical conductivity (EC), moisture content, 1000-seed weight, relative density (R.D), oil percentage, crude protein percentage and acidity percentage of all tested genotypes were determined before storage as follows: Table 1

1- Standard germination test: Germination percentage was expressed by the percentage of normal seedling at the end of testing period according to International Seed Testing Association (ISTA, 1993). Seed were incubated in a growth chamber at $20^oC^{\pm1}$ and were considered germinated after the emergence of radical. Germination was scored when a 2mm radical had emerged from the seed coat. The dishes were placed in germination. Seed were germinated for 7 days. Germination count was made after 4 days and daily till the end of the test. Normal seedling was counted expressed as germination percentage at final count.

$$\text{Germination \%} = \frac{Number\ of\ normal\ seedling}{Number\ of\ tested\ seed} x\, 100$$

2- Seed vigor: Ten normal seedlings from each replicate were taken to measure plumule and radical length (cm) and seedling dry weight (mg) according to ISTA 1993.

3- Viability: Electrical conductivity (EC) of leached from four replicates of 50 seeds weight and soaked in 250 ml of distilled water for 24 h was measured in µ-mhos using conductivity meter, were carried out under optimum conditions according to the international rules (I.S.TA, 1999).

The conductivity (E.C) per gram of seed weight for each sub sample is calculated:

$$E.C = \frac{Conductivity\ for\ each\ flask}{Weight(g)\ seed\ sample}$$

4- Relative density (g/mm^3):- Relative density of seeds was calculated according to Kramer, A. and B.A. Twigg (1962) as follows:

$$\text{Relative density (g/mm}^3) = \frac{100 - seed\ weight(g)}{100 - seed\ volume(mm^3)}$$

5- Chemical composition test:- Samples of about 50g of air dried seeds with three replicates for all treatments was chosen randomly and were fine ground for the following chemical determinations: total nitrogen percentage was determined using Kildahl mothod (A.O.A.C. 1990). Crude protein percentage was calculated by multiplying the total nitrogen % by 5.75. Oil percentage was determined using Soxhlet apparatus and hexane as a solvent. Acidity percentage and moisture content were determined according to the methods of (A.O.A.C. 1990).

Collected data were analyzed according to the factorial completely randomized design with three replicates. Analysis of variance computed according to Snedecor and Cochran (1981) and treatment means was compared by Duncan's multiple range test, (Duncan 1955).

Table 1. Means of germination, viability (E.C), acidity and chemical characters of sunflower, canola and sesame crops from combined analysis over storage periods.

Cultivars	Germination %	Plumul length (cm)	Radical length (cm)	Seedling dry wei (mg)	E.C µ-mhos	Moisture %	1000-seed weight (g)	(R.D)	Protein %	Oil %	Acidity %
					Sunflower crop						
Sakha53	91	14.52	20.40	248	10.32	7.03	853.30	0.9005	25.68	45.00	11.57
					Canola crop						
Sero4	97	9.51	9.97	197	10.23	4.30	3.80	3.74	28.96	45.80	11.30
					Sesame crop						
Shandwel3	93	6.05	8.50	220	9.98	3.20	46.30	2.43	29.13	44.01	11.41
Giza32	91	5.45	7.73	180	10.38	4.00	44.25	2.25	26.48	56.00	11.74

RESULTS AND DESCUSSION

1- Sunflower crop:-

The effect of storage period on studied viability parameters of sunflower seed are given in Table 2. Increasing storage period from 6 to 18 months significantly decreased in the mean germination from 83.17% to 59.17%, respectively, plumul length, radical length, seedling dry weight from (13.46 to 11.56 cm), (18.01 to 13.66 cm) and (214 to 180 mg), respectively. The moisture % decreased from 7.60% to 6.98%, 100-seed weight from 74.83 to 60.72 g, relative density from 0.854 to 0.731, while increased electrical conductivity and acidity percentage from (12.12 to 18.32 µ-mhos) and (12.43 to 15.54%), respectively. However, it can be concluded that there was a general trend towards decreased in seed germination by increasing storage time under the conditions of this study. Similar results were reported by Soad (1997), El-Aidy *et al* (2001), El-Sayed *et al* (2004), El-Sayed and Abd El-Aziz (2005), Simic *et al* (2005), Soad and Tolba (2005), Balesevic *et al* (2010) and Mrda *et al* (2010)

The decline in germination percentage with time was associated with a decrease in oil and crude protein percentage of seeds. Increasing storage period from 6 up to 18 months significantly affected acidity percentage. These findings are in agreement with those obtained by El-Aidy *et al* (2001), El-Sayed *et al* (2004), Simic *et al* (2005), Ghasemnezhad and Honermeier (2007), Iskander *et al* (2011) and Denise *et al* (2014). Increasing storage period from 6 to 18 months significantly increased the mean acidity, while decreased oil and protein percentage.

There were highly significantly differences among germination percentage, radical length¸ seedling dry weight¸ E.C., moisture¸ crud protein¸ oil percent age of sunflower seeds within various packaging materials. Germination percentage, plumul length, dry weight for sunflower seeds within aluminum foil were significantly higher than woven polyethylene package (73.50 and 68.83 %), (13.10 and 12.01 cm) and (208 and 186 mg), respectively. Meantime storage with foil package recorded high value of oil percentage and protein percentage. On the other hand gave lower value of acidity percentage and electrical conductivity. Between packaging materials, aluminum foil was found to be the best packaging material for storage. These findings are in agreement with those obtained by Iskander *et al* (2011)

The interaction between storage periods and package material in Table 2 and fig 1,2 indicates that 6 month with foil package gave the highest germination percentage (85.67 %), plumul (13.83 cm), radical length (18.65cm), 100-seed weight (75.00 g), protein percentage (25.53 %) and oil percentage (45.11 %). On the other hand data showed that the lowest value of electrical conductivity obtained from seeds stored inside aluminum foil package up to 18 months compared with seeds stored in woven polyethylene package.

Table 2. Effect of period and package of sunflower seeds on germination, seed vigor, chemical composition, acidity and oil characters.

Characters / Treatments	Germination %	Plumul length(cm)	Radical length(cm)	Dry weight (mg)	E.C µ-mhos	moisture	1000-seed wei	Relative density	Protein %	Oil %	acidity %
Periods											
6 month	83.17a	13.46a	18.01a	214a	12.12b	7.60a	748.30a	0.854a	25.21a	44.46a	12.43b
18 month	59.17b	11.65b	13.66b	180b	18.32a	6.98b	607.20b	0.731b	24.16b	42.08b	15.54a
F-test	**	**	**	**	**	**	**	**	**	**	**
Packages											
Foil	73.50a	13.10a	16.38	208a	12.01b	7.50a	685.30	0.789	24.96a	43.76a	12.74
Woven	68.83b	12.01b	15.28	186b	16.54a	7.08b	670.20	0.795	24.42b	42.78b	14.23
F-test	**	**	NS	**		**	NS	NS	**	**	NS
Interaction											
6monthXfoil	85.67a	13.83a	18.64a	230	12.24d	7.02b	750.0a	0.842	25.53a	45.11a	12.77
6monthXwoven	80.67a	13.08b	17.37b	198	16.32b	8.00a	746.7b	0.865	24.89b	43.81b	14.10
18monthXfoil	69.33b	12.36c	14.12c	185	14.25c	6.97b	620.7c	0.736	24.38c	42.42c	15.00
18montXwoven	57.00b	10.94d	13.20d	174	17.65a	7.00b	593.7d	0.725	23.94d	41.74d	15.80
F-test	**	**	**	NS	**	**	**	NS	**	**	NS

***, ** and NS indicated P<0.05%, P<0.01% and not significant, respectively. Means followed by the same letter are not significantly different at the 5% level, using Duncan's multiple range test.**

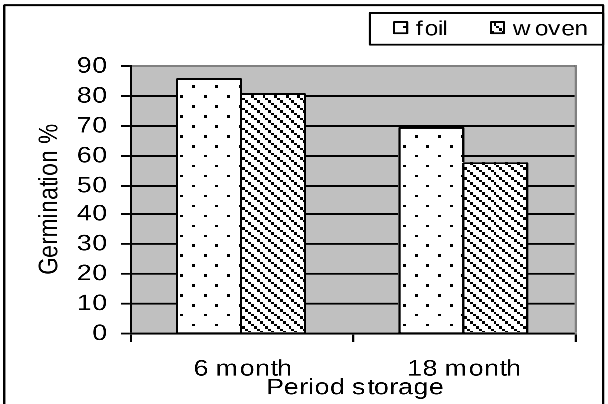

Fig.(1):The interaction betw een period and package of sunflow er on Germination %

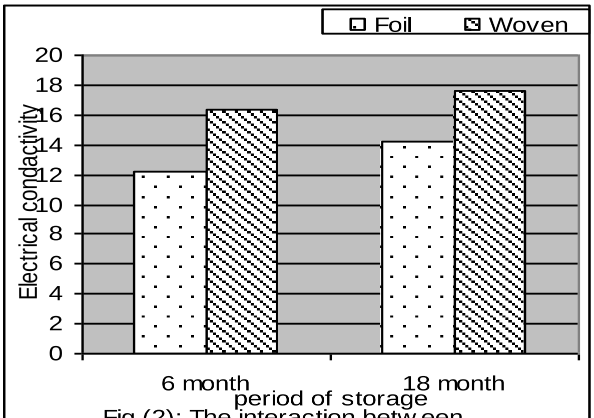

Fig.(2): The interaction betw een period and package of sunflow er on

2- Canola crop

The effect of storage period on the studied viability parameters of canola seed are given in Table (3). Increasing storage period from 6 to 18 months significantly decreased the mean germination percentage from 87.83 to 62.67%, plumul length from 8.78 to 8.05 cm, radical length from 9.51 to 9.33 cm, dry weight from 170 to 160 mg, 1000-seed weight from 3.40 to 3.03 g and relative density from 3.28 to 3.09 %, while increased in electrical conductivity from 12.34 to 16.25 µ-mhos. These findings are in agreement with those obtained by Elias and Copeland (1994). El-Aidy *et al* (2001), El-Sayed and Abd El-Aziz (2005), El-Sayed *et al* (2004), Soad and Tolba (2005).

The decline in germination percentage with storage time was associated with a decreased in oil percentage and crude protein percentage of seeds. Increasing storage period from 6 to 18 months highly significantly affected acidity percentage. Similar results were reported by El-Aidy *et al* (2001), El-Sayed (2004), El-Sayed and Abd El-Aziz (2005).

Data indicated that the highest germination percentage was obtained in canola seeds incubated inside aluminum foil compared with storage inside woven polyethylene. Meantime storage with aluminum foil recorded high value of plumul length, radical length, dry weight, moisture, 1000-seed weight, relative density, protein%, oil % and acidity are given in Table (3).On the other hand gave lower value of EC and acidity percentage. Similar results were reported by El-Sayed *et al* (2004).

The interaction between package materials and storage period Table (3) and fig. 4,5 and 6 indicated that the highest germination percentage was recorded from seeds stored inside aluminum foil. Also, oil percentage and protein percentage up to months storage were observed compared with seeds stored inside woven polyethylene. On the other hand, data showed that the lowest value of acidity obtained from seeds stored inside aluminum foil packages up to 18 months compared with seeds stored in woven polyethylene package

Table 3. Effect of period and package of canola seeds on germination, seed vigor, chemical composition, acidity and oil characters.

Characters Treatments	Germination %	Plumul length(cm)	Radical length(cm)	Dry weight(mg)	E.C (µ mhos)	Moisture %	1000-seed weight (g)	R .D	Protein %	Oil %	Acidity %
Periods											
6 month	87.83a	8.78a	9.51a	170a	12.34b	5.00	3.40a	3.28a	25.70a	44.46a	12.24b
18 month	62.67b	8.05b	9.33b	160b	16.25a	5.13	3.03b	3.09b	24.21b	40.85b	16.39a
F-test	**	**	**	*	**	NS	*	*	**	**	**
Packages											
Foil	78.17a	8.58a	9.51a	170a	12.45b	5.25a	3.13	3.27a	27.76a	43.47a	12.67b
Woven	72.33b	8.25b	9.33b	160b	16.30a	4.88b	3.30	3.11b	22.15b	41.84b	15.96a
F-test	**	**	**	*	**	**	*	*	**	**	**
Interaction											
6monthXfoil	91.33a	8.95	9.60	180	12.56b	5.03b	3.30	3.35	28.88a	45.80a	13.33c
6monthXwoven	84.33b	8.60	9.42	160	14.56a	4.97b	3.50	3.21	22.51c	43.13b	15.15b
18monthXfoil	75.00c	8.20	9.41	170	12.90b	5.47a	2.97	3.18	26.64b	41.14c	16.01a
18monthXwoven	60.33d	7.90	9.25	160	14.90a	4.80b	3.10	3.00	21.78c	40.55d	18.76d
F-test	**	NS	NS	NS	**	**	NS	NS	**	**	**

***, ** and NS indicated P<0.05%, P<0.01% and not significant, respectively. Means followed by the same letter are not significantly different at the 5% level, using Duncan's multiple range tests.**

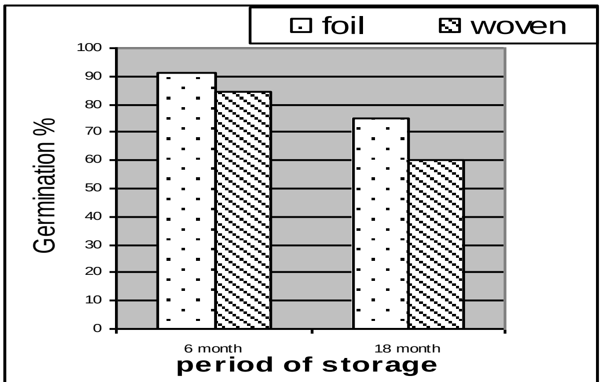

Fig.(4): The interaction between period and package of canola on germination

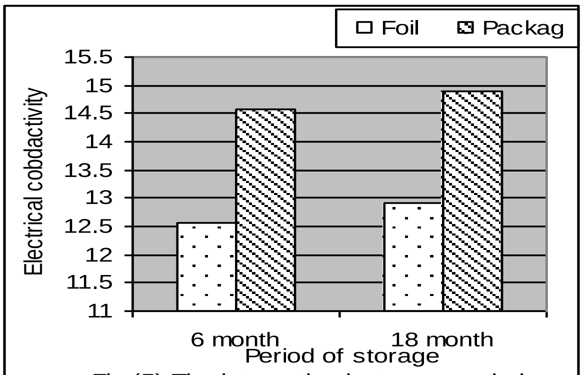

Fig.(5):The interaction betw een period and package of canola on EC

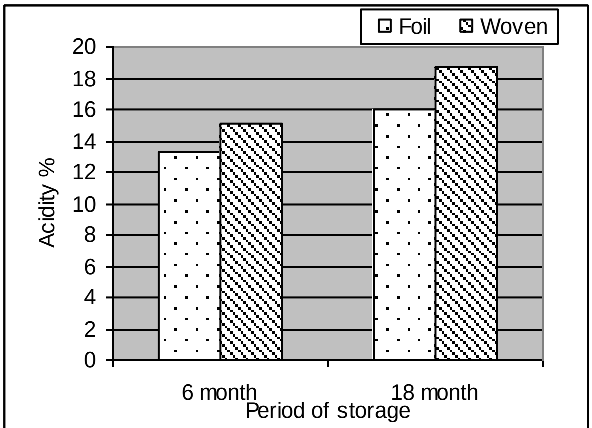

Fig.(6)The interaction betw een period and package of canola on acidity %

3-Sesame crop

The effect of storage period on germination percentage and studied viability parameters (plumule length, radical length, seedling dry weight, EC and acidity percentage) of sesame seed lots are given in Table (4). Increasing storage period from 6 to 18 months significantly decreased the mean germination percentage from 82.00% to 78.17%, respectively. However, results revealed that the above mentioned traits suffered considerable reduction as storage period increased. Prolonging storage from 6 to 18 months recorded plumule length from 6.81 to 6.58 cm, radical length from 5.32 to 5.18 cm, seedling dry weight from 170 to 160 mg, 1000-seed weight from 42.11 to 41.11 g and relative density from 2.18 to 2.03, respectively. While, increased the electrical conductivity from 15.01 to 15.67 µ-mhos and acidity from 13.32 to 18.10%. These finding are in agreement with those obtained Soad (1997), El-Aidy *et al* (2001), El-Sayed *et al* (2004), Soad and Tolba (2005), Denise *et al* (2014).

The decline in germination percentage with storage time was associated with decreased in oil and crude protein percentage of seeds. Similar results were reported by El-Borai *et al* (1993), El-Sayed (1997), El-Aidy *et al* (2001), El-Sayed (2004).

Mean characters of sesame seeds as affected by different storage package (foil and woven packages) are given in Table (4). Data indicated that the highest germination percentage, plumul length cm, radical length cm, seedling dry weight g, 1000-seed weight, relative density were obtained from sesame seeds incubated at foil packaged. On the other hand, the lowest values of EC were recorded with aluminum foil package. Meantime, foil package recorded the highest value of crude protein and oil percentage (24.89 and 48.66 %, respectively).

Table (4) indicated that the germination %, plumul length cm, radical length cm, seedling dry weight g, EC, 1000-seed weight and relative density of sesame seeds were significantly affected by cultivars. Shandwel3 was significantly the highest in germination % (84.92 %), plumul lengthy (5.58 cm), radical length (6.98 cm), dry weight (180 mg), 1000-seed weight (43.12 g) and relative density (2.18), while decreased electrical conductivity (14.68 µ-mhos), respectively. Also Giza 32 was significantly the highest in oil percentage (55.00 %) and lower in acidity percentage (17.42 %).

Regarding the interaction between storage period and storage package Table 5 and fig.7,8, and 9 indicates that germination, and oil percentage decline from (83.00 and 49.58%) to (80.00 and 47.58 %) after 6 and 18 months, respectively, at incubated inside aluminum foil mean, while germination percentage decline from 81.00 to 76.33% after 6 and 18 months, respectively at incubated inside woven polyethylene. On the other hand the electrical conductivity increased with 18 month irrespective on types of storage.

Table 4. Effect of period, package and cultivars of sesame on germination, seed vigor, chemical composition, acidity and oil characters.

Characters Treatment	Germination %	Plumul length (cm)	Radical length (cm)	Dry weight (mg)	E.C (µ-mhos)	Moisture %	1000-seed weight (g)	R.D	Protein %	Oil %	Acidity %
Periods											
6 month	82.00a	5.32a	6.81a	170a	25.22b	4.34	42.11a	2.18a	23.96	49.13a	13.32b
18 month	78.17b	5.18b	6.58b	160b	25.67a	4.32	41.11b	2.03b	21.33	47.66b	18.10a
F-test	**	**	**	*	**	NS	**	**	NS	**	**
Packages											
Foil	81.50a	5.51a	7.68a	180a	25.12b	4.37	42.13a	2.17a	24.89a	48.13a	17.69
Woven	78.67b	5.00b	5.71b	150b	25.78a	4.29	41.14b	2.04b	20.40b	48.66b	17.73
F-test	**	**	**	*	**	NS	**	**	**	**	NS
Cultivars											
Shandwel3	84.92a	5.58a	6.98a	180a	24.68b	4.33	43.12a	2.18a	23.58	41.79b	17.42b
Giza32	75.25b	4.93b	6.41b	150b	26.20a	4.33	40.09b	2.03b	21.71	55.00a	18.00a
F-test	**	**	**	*	**	NS	**	**	NS	**	**

***, ** and NS indicated P<0.05%, P<0.01% and not significant, respectively. Means followed by the same letter are not significantly different at the 5% level, using Duncan's multiple range tests.**

Table 5. Effect of interaction between period and package, period and cultivar, package and cultivars and period with package and cultivars of sesame on germination, root length, EC, oil and acidity

Interaction	Germination %	Radical length cm	E.C (µ-mhos)	Oil %	Acidity %
Periods X packages					
6monthXfoil	83.00a	7.82	24.75b	49.58a	13.32
6monthXwoven	81.00b	5.81	24.98b	48.69b	13.56
18monthXfoil	80.00c	7.54	25.48a	47.58c	13.06
18monthXwoven	76.33d	5.61	25.87a	47.73c	13.15
F-test	**	NS	**	**	NS
Periods X cultivars					
6monthX Shandwel3	86.83a	7.15a	24.37c	42.27c	12.78d
6monthXG32	77.17c	6.47c	26.06a	56.00a	13.85c
18monthX Shandwel3	83.00b	6.80b	25.00b	41.31d	18.99b
18monthXG32	73.33d	6.35c	26.35a	54.00b	19.21a
F-test	**	**	**	**	**
Packages X cultivars					
Foil X Shandwel3	86.50a	7.77a	24.18c	42.79c	17.65b
FoilXG32	76.50c	7.59b	26.06a	55.48a	17.73 b
Woven X Shandwel3	83.33b	6.19b	25.19b	40.79d	17.20a
WovenXG32	74.00d	5.23c	26.36a	54.52b	18.27a
F-test	**	**	**	**	**
Periods x packages x cultivars					
6monthXfoilX Shandwel3	88.00	8.00	23.64d	41.40f	12.79f
6monthXfoilXG32	78.00	7.63	25.86ab	55.98a	13.84e
6monthXwovenX Shandwel3	85.67	6.30	25.10c	43.13d	12.78f
6monthXwovenXG32	76.33	5.31	26.27a	56.02a	13.86e
18monthXfoilX Shandwel3	85.00	7.53	24.71c	40.17g	18.45c
18monthXfoilXG32	75.00	7.55	26.25a	54.98b	18.67b
18monthXwovenX Shandwel3	81.00	6.07	25.28bc	42.45e	18.54f
18monthXwovenXG32	71.67	5.15	26.45a	53.02c	19.76a
F-test	NS	NS	**	**	**

The interaction effect between storage period and cultivars of sesame Table 5 significant effect was found on germination percentage, radical length, EC oil % and acidity %. The highest germination and radical length were noted with Shandawel3 cultivar at 6 and 18 months (86.83 to 83.00%),(7.15 to 6.80), respectively. On the other hand, the highest oil percentage were noted with Giza32 cultivar at the same periods (56.00 to 54.00 %), respectively. After 18 months Giza 32 gave the highest value of EC and acidity. In spit of EC and acidity were increased significant by increasing the same period.

Data concerned with the effect of the interaction between package material and cultivars of sesame on germination percentage, radical length and oil percentage are presented in Table (5) significant effects were obtained for germination percentage, radical length, and oil percentage. The highest mean of germination percentage and radical length with Shandawel3 cultivar with foil package. While the highest oil percentage was recorded Giza 32 with foil package (55.48 %). On the other hand, the lowest value of acidity percentage was recorded with woven package with Shandawel3 cultivar (17.20 %).

Regarding the interaction effect among storage period, storage package and cultivars of sesame in Table 5 significant effect was found on EC,oil percentage and acidity. The highest oil percentage were noted with Giza 32 cultivar at 6 and 18 months with two types of package. On the other hand, the lowest values of EC and acidity were recorded with seeds stored inside aluminum foil up to 18 month. Meantime, Shandwel3 gave the lowest values of EC and acidity up to 18 months.

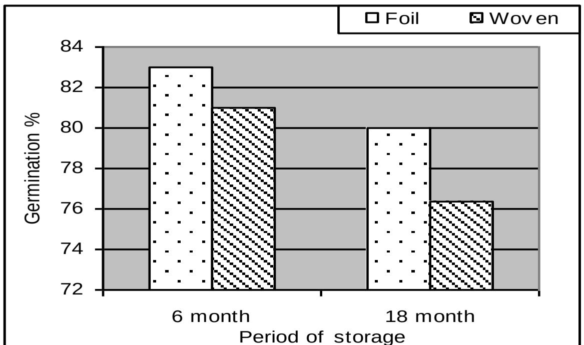

Fig.(7):The interaction between period and package of sesame on germination

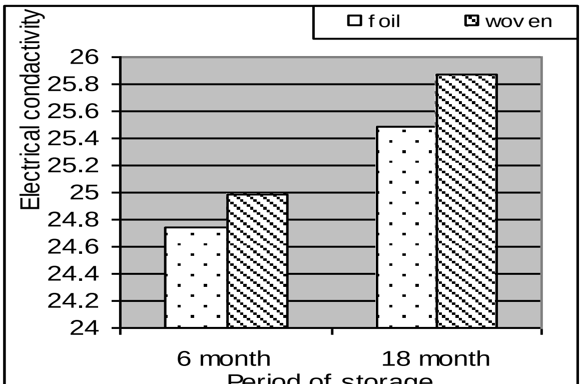

Fig.(8):The interaction between period and package of sesame on EC

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القدرة التخزينية لبعض المحاصيل الزيتية تحت نوعين مختلفين من العبوات

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أقيمت هذه الدراسة بمحطة البحوث الزراعية بسخا- كفر الشيخ خلال الفترة من ٢٠١٢/٢٠١٤ لدراسة بعض ظروف التخزين علي تقاوي ثلاث محاصيل زيتية (دوار الشمس صنف سخا ٣ ، الكانولا صنف سرو ٤ ، سمسم صنف شندويل ٣ و جيزة ٣٢) و تخزينها لموسمين زراعيين (٦ ، ١٨ شهر) باستخدام نوعين من العبوات إحداهما منفذ للرطوبة (بولي إيثلين المنسوج) و الثاني غير منفذ للرطوبة (رقائق الألمونيوم) و تم دراسة التغيرات في نسب الإنبات و قوه البادرة (طول الريشة بالسم ، طول الجذير بالسم ، الوزن الجاف للبادرة بالمجم) و مدلولات الحيوية (التوصيل الكهربي ، الحموضة الكلية) ووزن ١٠٠٠ بذرة ، الرطوبة ، الكثافة النوعية و بعض صفات الجودة للتقاوي كالبروتين و الزيت.و قد أوضحت الدراسة ما يلي:-- أدت زيادة فترة التخزين إلي نقص في نسبه الإنبات و قوة البادرة (طول الريشة ، طول الجذير ، الوزن الجاف للبادرة) و تدهور في حيوية التقاوي بارتفاع مدلولات الحيوية (التوصيل الكهربي و الحموضة الكلية) و نقص في وزن ١٠٠٠ بذره و الكثافة النوعية للبذور و كذلك نقص في نسبه البروتين و الزيت.- سجلت تقاوي دوار الشمس ، الكانولا ، السمسم المخزنة في عبوات من رقائق الألمونيوم أعلي نسبة إنبات و كذلك الحيوية (بانخفاض قيم التوصيل الكهربي و الحموضة الكلية) كذلك نسب البروتين و الزيت مقارنة بالتخزين في البولي إيثلين المنسوج الذي أعطي قيم للحموضة الكلية و معامل التوصيل الكهربي.- سجل محصول السمسم صنف شندويل ٣ أعلي نسبة إنبات و حيوية (بانخفاض في قيم الحموضة الكلية و التوصيل الكهربي).- من النتائج المتحصل عليها يمكن استنتاج أن الظروف المثلي لتخزين المحاصيل الزيتية لفترة موسمين زراعيين هي تخزينها في عبوات غير منفذة للرطوبة علي أن تكون رطوبة التقاوي أقل من ٨% عند تخزينها حيث أن اختيار العبوات الغير مسامية ضروريا للمحافظة أو الإبطاء من معدل تدهور التقاوي لأقل حد ممكن.