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EFFECT OF HARVESTING DATES AND STORAGE PERIODS ON SUNFLOWER (*Helianthus annuus* L.,) SEED VIABILITY AND SEEDLING VIGOUR

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ABSTRACT

Harvesting date and storage period have considerable influence on sunflower seed quality as measured by seed germination, germination rate, plumule and radicale length, seedlings dry weight, dehydrogenase activity, 1000-seed fresh weight and electrical conductivity and field emergence. Two field experiments were conducted at Tag El-Eiz Experiment Station, Agriculture Research Center during 2002 and 2003 summer seasons. The aim of this study was to investigate the effect of six harvesting dates i.e. 14, 21, 28, 35, 42 and 49 days after flowering (DAF) and six storage periods e.g. 0, 3, 6, 9, 12 and 15 months after harvest on sunflower (*Helianthus annuus* L. c.v. Miak) seed viability, seedlings vigour and field emergence. The results indicated that: harvesting early (from 14 to 28 DAF), at the first storage period led to a reduction in seed germination, germination rate, plumule and radicale length, seedlings dry weight, dehydrogenase activity, 1000-seed fresh weight, field emergence and an increase in electrical conductivity. Harvesting from 28 to 42 DAF and storage sunflower seed crop for 6 and 9 months resulted in maximum seed viability and seedling vigour, dehydrogenase activity and 1000-seed fresh weight, field emergence and minimum electrical conductivity. On the other hand, harvesting lately (after 42 days) caused the decrease in seed viability and seedling vigour. Also results revealed that, sunflower seed viability and seedlings vigour decreased directly after harvest and increased gradually with the increase in storage period up to 9 months after that seed viability and seedlings vigour were decreased. Meanwhile, electrical conductivity was increased. Results clear that significantly positive correlation between harvesting dates; storage periods and field emergence with the most studied traits except electrical conductivity of seeds while it was significantly and negatively correlated. In conclusion, sunflower seeds (c.v. Miak) can be harvested after 28 to 42 days after flowering and stored for 9 months with having seed viability above the standard (70%) and high seedling vigour.

INTRODUCTION

Increasing oil seed crops productivity during the last decade and in the future is one of the most important strategic targets in Egypt. The over expanding population needs to increase the productivity of oil seed crops to fill the gap between production and consumption from these crops. Sunflower is an important source of these edible oils. Cultivated area with sunflower in summer season of 2003 was about 5000 feddan with a national average of 0.953 kg /feddan.

Raising the productivity of sunflower through optimizing the culture practices especially, harvesting the seed crop at the proper time. Seed quality may be affected with many factors. While, Christian (1972) found that sunflower seed viability was influenced by temperature, moisture, heating and fungal invasion. Meanwhile, Bemett-Lartey (1991) reported that sunflower

seed viability decreased as store temperature and seed moisture content increased. Also, harvesting time and storage periods had similar effects on seed viability. The level of harvest obtained at the end of the season depends on the quality of the seed planted by the farmers. The quality of viability and germination, termed physiological quality is the most important (Louwaars and Van Marrewijk, 1996). Sunflower has a relatively long harvest period with a high quality seed can be harvested, depending on the prevailing weather conditions during maturity and harvest during this period seed viability may be affected by many factors (Adetunji, 1991). Crnobarac and Marinkovi (1994) studied some factors affecting germination of sunflower, they concluded that all the studied factors had a significant effect on germination, while harvest date contributed 74.85% to the total variation in the trait, storage period 14.55%, environment 0.2% and genotype 0.02%. They also added seed harvested from the 22nd to 40th day after flowering had a higher germination percentage.

Harvesting usually done when the seed moisture content is too high for safe storage or delayed until complete field dryness of the crop with attendant losses due to shattering. Also, sunflower seeds showed dormancy up to 50 days (Udayakumar and Krishna Sastry, 1975) which affects the uniformity of germination. Germination vigor index and seedling dry matter were less in early harvested seeds (15 to 25 DAF) than the seeds harvested at later dates (30 to 40 DAF) throughout the 6 months storage period. Sunflower seeds harvested at (30-40 DAF) maintained viability above the seed certification standards (70%) (Mahesha *et al.*, 2001). During storage the loss of seed viability can not be stopped. Seed storage, however should minimize the loss of seed viability and vigor. Bhaskar *et al.* (1994) and Shende *et al.* (1999) found that seed maintained viability above certification standard (70%) without much loss in seed viability for 11 months in lab. and 7-8 months under field conditions. Meanwhile, White and Jayas (1993) concluded that seed germination remained > 80% for 12 months at 10 and 20 C^0. and 35, 45 and 55% Rh., it declined to 70% at 30 C^0 and 45% RH, but at 55% Rh. it fell to 30% at 6 months and 0% at 12 months. Seed germination decreased rapidly at 40 degree. Also Singh *et al.* (2001) demonstrated that sunflower seed had high viability after 9 months of storage. On the other hand, Etcheverry *et al.* (1989) reported that water activity increased during storage, germinability decreased and the content of free fatty acid was increased. Zarbakhsh *et al.* (1999) declared that the decline in germination percentage was related to decrease protein and fatty acid content. The loss of seed viability associated with a large increase in leakage of K^+ and total electrolytes (Corbineau *et al.*, 2002). The aim of this investigation was to investigate the effect of different harvesting dates i.e., 14, 21, 28, 35, 42 and 49 days after flowering and six storage periods, e.g. directly after harvest, 3, 6, 9, 12 and 15 months on sunflower seed germination percentage, germination rate, plumule and radicale length, seedlings dry weight, dehydrogenase activity, 1000-seed fresh weight and electrical conductivity and field emergence.

MATERIALS AND METHODS

Two field experiments were performed at Tag El-Eiz Research Station, ARC, during two successive seasons of 2001 and 2002. Sunflower (c.v. Miak) seeds were obtained from Agriculture Research Center (ARC) and planted in 17th May in the two seasons. The agriculture practices were applied as recommended in the region. The experimental design was Factorial Complete Block Design with four replicates. The soil of the experiment was well prepared, calcium super phosphate (15.5 P2O5%) at rate of 100 kg/fed was added before sowing. Nitrogen fertilizer was applied in the experiment as ammonium nitrate (33.5 N%) at a rate of 100 kg/fed. There were six harvesting times at 14, 21, 28, 35, 42 and 49 days after flowering at (R-5 Stage) i.e. beginning of anthesis (Schneiter and Miller, 1981). Heads were harvested and immediately thrashed by hand to avoid seed injury and cleaned from dust. The seed and seedling traits were determinated immediately after harvest (IAH). In the same time seeds were air dried before storage in cloth bags to 0, 3, 6, 9, 12 and 15 months after harvesting under laboratory conditions.

After each storage period, the studied traits were estimated while the germination percentage were performed according to International Seed Testing Association (ISTA, 1985). Sunflower seeds were sown at 25C°±2 on stap filter paper in sterilized petri dishes and defined as the total number of normal seedlings after 10 days while, germination rate defined according to Bartelts, (1937). During the final count, ten normal seedlings from each replicate were taken randomly to measure the plumule and radicale length in (mm), after that, the seedlings were dried in hot-air oven at 85 C° for 12 hours (Krishnasamy and Seshu, 1990). Four samples of 1000-fresh harvested seed were taken from the seed stock of each harvesting time to determine 1000-seed fresh weight (ISTA, 1985). Dehydrogenase activity was measured according to Krishnasamy and Seshu (1990) with minor modification while three sets of 1 gm seed (dehulled) were soaked in solution of 2, 3, 5 Triphenyl Tetrazolium Chloride (1%) and placed in dark at 30 C° for 24 h. for staining. After the seeds were washed with distilled water, 10 ml of acetone was added to extract the formazan for 1h. Optical density (OD) readings were taken at 480 nm on a spectrophotometer (Milton Roy spectronic 1201). Four replicates of 50 seed were used to measure the electrical conductivity according to (Matthews and Alison, (1987). 400 random counted seeds from each treatment were sown in randomized block design in four replicates in the field and the normal seedlings were counted after 10 days from sowing. Data collected from these experiments were subjected to analysis of variance as Randomize Complete Block Design as mentioned by Gomez and Gomez (1984), and the treated averages were compared by using the least significant differences (LSD) method. Simple correlation's coefficient between harvesting date, storage period and the studied traits were computed according to Svap (1973).

RESULTS AND DISCUSSION

Recorded data in Table (1) show the effect of harvesting dates and storage periods on the studied traits in 2002 and 2003 seasons. Harvesting dates had significant effects on all the studied traits. The lowest means of the studied traits were recorded at 14 days after flowering, whereas the highest means of these traits were recorded at the harvest dates from 28 to 42 days after flowering except electrical conductivity, while the lowest means (0.63 and 0.55 umohs/g seed) were obtained in 2002 and 2003 seasons, respectively. From the same Table means of germination percentage, germination rate, plumule and radical length, seedlings dry weight, dehydrogenase activity, 1000-seed fresh weight and field emergence were increased with the increase in storage periods. The highest means in the two seasons were obtained at the storage periods (6 and 9 months). On contrast, electrical conductivity and 1000- seed fresh weight were decreased with the increase in storage periods.

Data in Table (2) show sunflower seed from earlier harvesting dates (14 DAF) generally had the lowest germination percentage in the two seasons 2002 and 2003, especially directly after harvest than sunflower seed harvested lately. This was mainly due to the high proportion of impty + immature seeds (Adetunji, 1991). While, the highest values of germination percentage 94.5% and 96% were obtained from seeds harvested 28 days after flowering and stored for 9 months in 2002 and 2003 seasons, respectively. Also, the same trend was obtained for the germination rates, while minimum value were obtained at the first harvest time, directly after harvest in the two seasons. On the other hand, means of germination rates reached its maximum values with the increase in days after flowering to harvest and storage periods.

Fresh harvested seed 14 days after flowering had the shortest plumule length (12.3 and 12mm) in the two seasons 2002 and 2003 (Table 3). Meanwhile plumule length reached its highest length 98 and100 mm in 2002 and 2003 seasons, respectively, at 28 DAF after 9 months from storage. The same trend was obtained for the radicale length while the lowest length (12.8 and 13.0mm) were recorded immediately after harvest at 14 DAF, in the two seasons. On contrast, radicale length was increased with the increase in days from flowering to harvest up to 35 days and storage periods up to 9 months in the two seasons. From these results, there was a positive relationship between seed viability, seedling length and seedlings dry weight, while seedlings dry weight was increased with the increase in seed viability and seedling length as presented in Table (5). Johnson and Jellum (1972) found that Maximum thousand seed weights, DM content, and seed germination were reached their highest values at 35 DAF, thus the cessation of assimilate transiation to the seeds and the commencement of capitula senescence appears at this time. An approximate visible indication of this point in the field was appearance of the first yellowish brown capitula.

Table (1): Effect of harvesting dates and storage [periods on the studied traits in 2002 and 2003 seasons.

Treatments	Germination percentage		Germination rate		Plumule length (mm		Radical length (mm		Dehydrogenase activity (OD)		Electrical conductivity umohs/g seed		Seedlings dry weight (gm)		1000-seed fresh weigh (gm)		Field emergency	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
A. Harvesting dates																		
14 DAF	35.1	35.8	0.618	0.605	21.7	21.5	22.3	22.8	0.605	0.601	3.01	3.10	0.180	0.176	41.6	42.4	26.5	26.3
21 DAF	68.5	68.5	0.734	0.735	54.8	55.7	60.1	59.8	0.686	0.683	0.88	0.83	0.235	0.232	55.5	54.7	53.4	54.1
28 DAF	77.3	78.3	0.754	0.747	72.7	71.9	76.4	77.3	0.763	0.762	0.63	0.59	0.251	0.256	75.5	74.9	65.0	65.7
35 DAF	76.2	78.0	0.774	0.767	70.5	70.8	76.9	77.3	0.843	0.848	0.71	0.55	0.259	0.258	75.3	74.4	68.5	67.0
42 DAF	70.5	70.8	0.762	0.760	62.0	62.5	70.8	70.3	0.861	0.863	0.79	0.77	0.231	0.231	74.5	73.7	64.5	63.5
49 DAF	65.5	66.1	0.761	0.761	58.5	60.0	67.5	67.7	0.781	0.778	1.18	1.13	0.213	0.213	73.2	72.5	59.5	59.7
LSD 5%	0.8	0.9	0.009	0.011	1.3	2.3	1.5	1.5	0.009	0.005	0.02	0.05	0.006	0.007	1.8	1.6	0.8	1.0
B-storage periods																		
0 months	26.1	26.3	0.664	0.664	16.3	16.6	21.0	20.6	0.745	0.745	2.23	2.77	0.123	0.128	95.8	95.4	22.4	22.3
3 months	55.0	55.4	0.744	0.735	49.0	48.9	54.0	54.2	0.766	0.766	1.55	1.53	0.212	0.211	61.2	60.3	47.6	47.4
6 months	79.3	80.3	0.752	0.745	68.2	68.3	76.8	77.3	0.765	0.763	0.91	0.88	0.248	0.245	60.5	60.0	68.4	67.7
9 months	82.8	83.7	0.742	0.736	71.8	73.2	79.1	79.7	0.760	0.762	0.91	0.73	0.263	0.257	60.2	59.7	71.0	70.5
12 months	79.9	80.2	0.749	0.748	70.5	70.3	75.3	75.8	0.754	0.754	0.80	0.75	0.260	0.260	59.2	58.7	68.1	68.0
15months	70.0	70.7	0.752	0.747	64.4	65.2	67.8	67.7	0.749	0.746	0.83	0.81	0.264	0.263	58.6	58.4	59.9	60.3
LSD.: 5%	0.8	1.0	0.007	0.009	1.4	1.5	1.78	1.8	0.008	0.002	0.03	0.04	0.005	0.006	1.01	1.1	0.4	1.1

Table (2): Effect of interaction between harvesting dates and storage periods on germination percentage, germination rate of sunflower seed in 2002 and 2003 seasons.

Harvesting dates	Germination % Storage periods/ months						Germination rate Storage periods/ months					
	0	3	6	9	12	15	0	3	6	9	12	15
	2002						2002					
14 DAF	12.5	19.0	37.0	51.0	49.5	41.5	0.526	0.620	0.617	0.618	0.666	0.663
21 DAF	25.5	45.8	86.8	88.0	83.8	81.3	0.655	0.792	0.762	0.740	0.731	0.724
28 DAF	37.0	66.8	92.3	94.5	91.3	81.8	0.683	0.756	0.787	0.773	0.756	0.771
35 DAF	34.3	67.5	92.3	93.0	92.0	78.0	0.706	0.775	0.791	0.783	0.789	0.793
42 DAF	25.0	68.3	86.3	86.3	82.0	75.3	0.710	0.759	0.775	0.776	0.770	0.780
49 DAF	22.3	62.5	81.0	84.0	80.8	62.5	0.703	0.764	0.777	0.761	0.782	0.779
LSD 5%	2.1						0.019					
	2003						2003					
14 DAF	13.0	20.0	38.0	51.5	50.0	42.0	0.512	0.578	0.609	0.614	0.662	0.658
21 DAF	25.0	46.0	87.5	88.5	83.0	81.0	0.663	0.791	0.758	0.737	0.736	0.727
28 DAF	38.0	67.0	94.0	96.0	92.0	83.0	0.671	0.754	0.777	0.764	0.752	0.764
35 DAF	35.0	68.0	93.0	93.8	93.0	79.0	0.697	0.771	0.787	0.776	0.783	0.787
42 DAF	25.0	69.0	87.0	87.0	82.0	75.0	0.710	0.753	0.771	0.772	0.774	0.782
49 DAF	22.0	62.5	82.0	85.3	81.0	64.0	0.732	0.765	0.770	0.754	0.780	0.767
LSD 5%	2.6						0.024					

Table (3): Effect of interaction between harvesting dates and storage periods on plumule and radical length of sunflower seed in 2002 and 2003 seasons.

Harvesting dates	Plumule length (mm)						Radical length (mm)					
	Storage periods/ months						Storage periods/ months					
	0	3	6	9	12	15	0	3	6	9	12	15
	2002						2002					
14 DAF	12.3	13.5	21.3	27 0	28.0	28.3	12.8	15.0	24.5	24.5	28.5	28.3
21 DAF	20 3	59.5	54.0	67.3	64.8	63 3	26.5	63.8	64.3	71.0	68.0	67.0
28 DAF	17.0	61.8	96.5	98.0	86.8	76.0	18.5	66.3	100.8	101.5	89.3	82.3
35 DAF	17.8	57.8	91.8	88 3	88.8	79.0	25.0	56.8	99.0	102.0	95.0	83.5
42 DAF	17.8	53.5	73.8	77.0	77.8	72.0	120.5	160.5	87.5	90 5	90.0	71.5
49 DAF	13.0	48 0	72 0	73.3	77.3	67 8	20.5	59.5	84.5	85 3	81.0	74.0
LSD 5%	3.9						3.3					
	2003						2003					
14 DAF	12.0	14.3	21 0	26.0	28.0	28.0	13.0	16.0	25.0	26.0	30.0	27.0
21 DAF	21 0	60.0	54 0	67 0	65.0	67 0	25.0	62.0	64.0	71 0	69.0	68.0
28 DAF	17 8	58.0	93.5	100	85.0	77.0	19.0	69.0	102.0	103.0	89.0	82.0
35 DAF	17.0	58.0	94.0	91.0	88.0	77.0	25.0	56.0	100.0	103 0	97.0	83.0
42 DAF	18 0	53.0	75.0	79.0	78.0	72.0	21.0	63.0	88.0	89 0	89.0	72.0
49 DAF	14 0	50.0	72.0	76.0	78.0	70.0	20.8	59.8	85.0	86 3	81.0	74.0
LSD 5%	3.7						4.4					

From Table (4), electrical conductivity significantly was affected by the interaction between harvesting dates and storage periods. Electrical conductivity was decreased from 3.57 and 3.97 umohs/gm seed in 2002 and 2003 seasons, respectively. For sunflower seed harvested after flowering with 14 day, directly after harvest to 0.26 and 0.22 umohs/gm seed in 2002 and 2003 seasons, respectively, for seed harvested after flowering with 35 days after 12 months from storage. Dehydrogenase activity was significantly increased with the increase in days from flowering to harvest from 14 to 42 DAF and storage periods to 9 months after that it reduced in seed harvested later and stored more than 9 months.

The fresh weight of 1000-seed increased with delayed harvest up to 28 DAF and declined after that (Table 5). Meanwhile, with the increase in storage periods, sunflower seed harvested after 35 DAF gave the heaviest weight 69.3 and 68.0 gm in 2002 and 2003 seasons, respectively after storage with 3 months, after that thousand-seed weights was decreased with the increase in storage periods.

Table (4): Effect of interaction between harvesting dates and storage periods on Dehydrogenase activity and electrical conductivity of sunflower seed in 2002 and 2003 seasons.

Harvesting dates	Dehydrogenase activity (OD)						Electrical conductivity umohs/g seed					
	Storage periods/ months						Storage periods/ months					
	0	3	6	9	12	15	0	3	6	9	12	15
	2002						2002					
14 DAF	0.595	0.615	0.612	0.606	0.602	0.598	3 57	3.54	3 17	2 76	2.65	2 37
21 DAF	0.672	0.699	0.699	0.694	0.690	0.663	2.15	1.38	0.46	0.41	0 44	0.44
28 DAF	0.750	0.763	0.768	0.760	0.755	0.780	1.42	0.95	0.42	0.35	0.31	0.32
35 DAF	0.837	0.858	0.850	0.842	0.837	0.833	1.42	0.83	0.41	1.09	0 26	0 27
42 DAF	0.836	0.865	0.872	0.876	0 860	0.56	1 82	1.02	0.48	0.37	0 51	0.56
49 DAF	0.780	0.795	0.791	0.782	0.780	0.761	2.98	1.59	0.45	0.48	0 63	1.00
LSD 5%	NS						0.38					
	2003						2003					
14 DAF	0.592	0.610	0.609	0.603	0.600	0.593	3.97	3.62	3.20	2 68	2.60	2.53
21 DAF	0.666	0.696	0.693	0.692	0.681	0.672	2.14	1 33	0.37	0.36	0.39	0.42
28 DAF	0.753	0.762	0.765	0.764	0.753	0.774	1.40	0 91	0.39	0.33	0 25	0.25
35 DAF	0.842	0.863	0.854	0.849	0.846	0.832	1 41	0.81	0.36	0 29	0.22	0.22
42 DAF	0.838	0.869	0.873	0.880	0.867	0.854	1 80	1.01	0.46	0.33	0 49	0 51
49 DAF	0 777	0.797	0.785	0.783	0.774	0.752	2.91	1 52	0.49	0.41	0 56	0.91
LSD 5%	0.008						1.15					

Table (5): Effect of interaction between harvesting dates and storage periods on seedlings dry weight and 1000-seed fresh weight of sunflower seed in 2002 and 2003 seasons.

Harvesting dates	Seedlings dry weight (gm)						1000-seed fresh weight (gm)					
	Storage periods/ months						Storage periods/ months					
	0	3	6	9	12	15	0	3	6	9	12	15
	2002						2002					
14 DAF	0.109	0.159	0.192	0.214	0.201	0.204	60 0	41 0	39 1	38.5	36 0	35 0
21 DAF	0 137	0.215	0.244	0 269	0.270	0.274	80 0	52.0	51.5	51.0	49 3	49.0
28 DAF	0.130	0 220	0.285	0.285	0 292	0.296	116.0	68 2	68 0	67.5	66 8	66 3
35 DAF	0 136	0 238	0.288	0.298	0 296	0.298	110.0	69 3	68 6	68.3	68 1	67.4
42 DAF	0 115	0 225	0 247	0 268	0 264	0.267	106 0	68 9	68.5	68 4	67 8	67 3
49 DAF	0 108	0.213	0 231	0 241	0 240	0.264	103 0	68.0	67.5	67 2	67 0	66 5
LSD 5%	0.014						2 5					
	2003						2003					
14 DAF	0.108	0.159	0 190	0.194	0 200	0.204	62.6	40.2	39.7	39.0	37 0	35.8
21 DAF	0.122	0.215	0.243	0 267	0.270	0 274	81.3	50.6	50.2	50.0	48.2	47.8
28 DAF	0.181	0.216	0.280	0.278	0.288	0.294	114.0	67 8	67.5	67 0	66.8	66.5
35 DAF	0 137	0 238	0.283	0.295	0.297	0.297	107.0	68 0	68 0	67 8	67.3	68 0
42 DAF	0.116	0 226	0.247	0.268	0.263	0.265	105 0	67.8	67.8	67 5	67.1	66.8
49 DAF	0 104	0.211	0 229	0.243	0 242	0.247	102 3	67.4	67.0	66 9	66.0	65.4
LSD 5%	0.015						2.7					

From Table (6), field emergence significantly affected by the interaction between harvesting dates and storage period. While the field emergence was increased from 9.6% and 9.4% for seeds harvested after 14 days from flowering, directly after harvest to 83.4% and 81.8% for seeds harvested after 35 days from flowering after storage with 9 months, at 2002 and 2003, respectively.

Table (6): Effect of interaction between harvesting dates and storage periods on field emergence of sunflower seed in 2002 and 2003 seasons.

Harvesting dates	Seedlings dry weight (gm)					
	Storage periods/ months					
	0	3	6	9	12	15
	2002					
14 DAF	9.6	14.8	28.6	38.1	37.0	31.0
21 DAF	19.5	35.9	68.3	69.0	64.7	63.2
28 DAF	31.5	55.6	78.0	79.7	76.4	68.9
35 DAF	31.2	60.5	82.8	83.4	82.8	70.3
42 DAF	22.8	62.8	79.2	79.2	74.6	68.3
49 DAF	19.8	56.3	73.8	76.7	72.9	57.6
LSD 5%	1.8					
	2003					
14 DAF	9.4	14.3	27.8	38.3	37.1	31.1
21 DAF	20.1	36.1	68.5	69.5	66.2	64.2
28 DAF	31.5	56.7	78.4	80.3	77.6	69.5
35 DAF	30.1	59.4	81.2	81.8	81.0	68.6
42 DAF	22.5	61.4	77.6	77.6	73.8	67.7
49 DAF	20.0	56.3	72.9	75.6	72.7	60.8
LSD 5%	2.3					

Coefficient of the simple correlation's between harvesting date, storage periods and the studied traits are presented in Table (7). Highly significant positive correlation was found between harvesting dates and Germination percentage (r=0.305), germination rate (r=0.624), plumule length (r=0.370), radical length (r=0.430), dehydrogenase activity (r=0.805), seedlings dry weight (r=0.166), 1000-seed fresh weights (r=0.0 090) and field emergence (r=0.430) while highly significant negative correlation between harvesting dates and Electrical conductivity (r=-0.445) were noticed. Correlation between storage period and the studied traits were positively and significantly except dehydrogenase activity and electrical conductivity were negatively. The correlation's coefficient between field emergence and the other traits are found in Table (8) all the tested characters were positively correlated with field emergence whereas electrical conductivity were negatively correlated with field emergence Ray and Gupta (1980) reported negative correlation of electrical conductivity with field parameters in rice. The results of this study suggested harvesting sunflower crop after 28 days from beginning of flowering in order to obtain high quality seed for 9 months in storage.

Table (7): Simple correlation of harvesting dates and storage period with the studied traits.

Treatments	Harvesting dates	Storage periods
Germination percentage	0.305**	0.580**
Germination .rate	0.624**	0.327**
Plumule length	0.370**	0.553**
Radical length	0.430**	0.503**
Dehydrogenase activity	0.805**	-0.015**
Electrical conductivity	-0.445**	-0.441**
Seedlings dry wt	0.166**	0.716**
1000- Seed fresh weight	0.090**	0.222**
Field emergence	0.430**	0.547**

Table (8): Simple correlation coefficient of field emergence with the studied traits

Treatments	8	7	6	5	4	3	2	1	y
y-Field Emergence	0.217**	0.898**	-0.889**	0.580**	0.956**	0.947**	0.790**	0.987**	1.000
1-Germination percentage	0.206**	0.919**	-0.878**	0.474**	0.936**	0.935**	0.749**	1.000	
2-Germination rate	0.146*	0.680**	-0.848**	0.732**	0.810**	0.791**	1.000		
3-Plumule length	0.207**	0.899**	-0.852**	0.528**	0.983**	1.000			
4-Radical length	0.199**	0.876**	-0.855**	0.557**	1.000				
5-Dehydrogenase activity	0.116*	0.357**	-0.639**	1.000					
6-Electrical conductivity	-0.171**	-0.782**	1.000						
7-Seedlings dry weight	0.991**	1.000							
8-1000- seed fresh weight	1.000								

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تأثير مواعيد الحصاد و فترات التخزين على حيوية بذور وقوة بادرات عباد الشمس.

إبراهيم فتحي مرسال
قسم بحوث تكنولوجيا البذور- معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية- مصر.

يعتبر ميعاد الحصاد وفترة التخزين من العوامل المؤثرة على جودة تقاوي عباد الشمس. تقاس جودة التقاوي بتقدير نسبة الإنبات، معدل الإنبات ، طول الريشة و طول الجذير،الوزن الجاف للبادرات ، نشاط إنزيم الديهيدروجينيز ، الوزن الطازج لل ١٠٠٠ بذرة ، درجة التوصيل الكهربي و نسبة الإنبات فى الحقل للبذور. أجريت تجربتان حقليتان بمحطة البحوث الزراعية – تاج العز محافظة الدقهلية مركز البحوث الزراعية خلال موسمي ٢٠٠٢ و٢٠٠٣ م وذلك بهدف دراسة تأثير مواعيد الحصاد المختلفة ١٤، ٢١، ٢٨، ٣٥، ٤٢، ٤٩ يوم بعد بداية التزهير وفترات التخزين المختلفة صفر، ٣، ٦، ٩، ١٢، ١٥ شهر بعد الحصاد على حيوية وقوة إنبات بذور عباد الشمس صنف مياك.

ويمكن تلخيص أهم النتائج كما يلي:

-أدى التبكير في ميعاد الحصاد من(١٤ : ٢٨ يوم) بعد الأزهار إلى تناقص نسبة الإنبات وقوة البادرات في المعمل وتناقص نسبة الإنبات في الحقل وخاصة بعد الحصاد مباشرة. في مواعيد الحصاد (٢٨ :٤٢ يوم) أدى إلى زيادة تدريجية في نسبة الإنبات وقوة البادرات فيما عدا تناقص درجة التوصيل الكهربي في المعمل وزيادة نسبة الإنبات فى الحقل خاصة بعد ٦ ، ٩ شهور من التخزين.وأدى التأخير في مواعيد الحصاد عن ٤٢ يوم بعد التزهير الى الانخفاض تدريجيا في حيوية وقوة إنبات بذور عباد الشمس.كما أوضحت النتائج تناقص حيوية وقوة إنبات بذور عباد الشمس بعد الحصاد مباشرة وزيادتها تدريجيا حتى ٩ شهور من التخزين وتناقصها بعد ذلك. أوضحت النتائج وجود ارتباط معنوي موجب بين مواعيد الحصاد ومعظم الصفات المدروسة فيما عدا درجة التوصيل الكهربي حيث وجد ارتباط معنوي سالب. بينما وجد ارتباط غير معنوي موجب بين الوزن الجاف للبارات والوزن الطازج لـ١٠٠٠ بذرة. أيضا كان هناك نفس الارتباط لفترات التخزين مع جميع الصفات المدروسة فيما عدا ونشاط إنزيم الديهيدروجينيز و درجة التوصيل الكهربي للبذور حيث وجد ارتباط معنوي سالب. أيضا كان هناك نفس الارتباط لنسبة الإنبات فى الحقل مع جميع الصفات المدروسة فيما عدا درجة التوصيل الكهربي للبذور حيث وجد ارتباط معنوي سالب. وتوصى الدراسة بإمكانية حصاد بذور عباد الشمس (صنف مياك) بعد ٢٨ يوم من التزهير مع الحصول على بذور عالية الحيوية والجودة لمدة ٩ شهور.