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EFFECT OF PLANT SPACING ON SOME SUNFLOWER GENOTYPE CHARACTERS INDUCED BY GAMMA IRRADIATION

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ABSTRACT: *In this study, the experiment was carried out in the Experimental Farm belonging at Inchas, Plant Research Department, Nuclear Research Center, Atomic Energy Authority, Egypt, during the two growing seasons 2007 and 2008 to study the effect of plant spacing on some sunflower genotype characters and determine the response of these genotypes to these treatments and determine the best treatment which produce the high yield quantity and quality of all genotypes.*

The results summarized as follows:

The mutant lines 4 and 11 had a significant surpassed in head diameter, head weight, 100-seed weight and seed yield / plant that the other local varieties Sakha 53 and Giza 102 in the two seasons. The highest mean values of shelling percentage (%) produced from the mutant lines 4 and 11 in comparison with the local varieties Sakha 53 and Giza 102. The local varieties Sakha 53 and Giza 102 were higher than the mutant lines 4 and 11 in central zone sterility diameter in the tow growing seasons. Oil percentage (%) increased significantly in the two commercial varieties Sakha 53 and Giza 102 in comparison with the two mutant lines 4 and 11 in the two growing seasons. Seed yield kg/fed increased significantly in the mutant lines 4 and 11 in comparison with the local varieties Sakha 53 and Giza 102 in the two growing seasons. Oil yield kg/fed increased in the two mutant lines 4 and 11 in comparison with the local varieties Sakha 53 and Giza 102. Mean values of 100-seed weight, head weight (g), seed weight / Plant (g), head diameter (cm) were found increase by increasing plant spacing (decreasing plant density) up to 40 cm apart between hills. Mean values of central zone sterility diameter (cm) had not affected by plant spacing in the two seasons. Mean values of shelling percentage (%) was found to increase by increasing plant density up to 30 cm apart between hills. This increase was found to reach the level of significance in the second season only as compared with the low spacing (20 cm). As for seed yield kg/fed, mean values increased with the lowest spacing between hills 20 cm apart, on the contrast, it was decreased with increasing plant spacing in the two seasons. Mean values of oil percentage showed insignificant differences among the three tested plant spacing (20, 30 and 40 cm apart) in the first season but it decreased in the *second season by increasing plant spacing 40 cm. Finally, oil yield kg/fed increased significantly by decreasing plant spacing (increase plant density) 20 cm apart in the two seasons.*

Key words: Sunflower (Helianthus annuus L.), induced mutation, plant spacing.

INTRODUCTION

Sunflower Helianthus annuus L. is one of the most important oil crops in the world where it became the main source of edible oil in many countries due to the expanding of cultivated area with sunflower in the world attributed to some aspects. In addition to height percentage of excellent edible oil in the seed (40-55%) with a high proportion of poly unsaturated fatty acids in the oil and sunflower's protein is of high biological value. For increasing the total production of edible oil, planting high potential yield cultivars as well as conducted the best agricultural practices such as plant spacing. Many investigators showed an increase in yield and its components as affected by plant spacing and genotypes. El-Sarag (2007) studied the response of three sunflower cultivars, i.e., Sakha 53, Fedouk, and Euroflor, to three plant spacing (20, 25 and 30 cm between hills) under North Sinai environmental conditions. He explained that Fedouk and Euroflor cultivars produced the maximum seed and oil yields in both seasons under narrow plant spacing (20 cm). Contrarily, Sakha 53 cultivar gave its maximum seed and oil yields in both seasons under wide plant spacing (30 cm). Meanwhile, the highest seed oil % value (43.5 - 44.2%) was recorded with Sakha 53 planted at 25 cm plant spacing. To increase sunflower production under North Sinai environmental conditions, Fedouk cultivar with 20 cm planting distance should be recommended, as it produced the highest seed and oil yields. [1 feddan = 0.42 ha].

MATERIALS AND METHODS

The study included as follows:

1. Plant spacing (cm):

a) 20 cm between hills .i.e., 35,000 plants /fed.
b) 30 cm between hills .i.e., 26,250 plants /fed.
c) 40 cm between hills .i.e., 17,500 plants /fed.

2. Genotypes:

Four sunflower genotypes (two mutant lines of sunflower were produced from a program for improving sunflower by Atia (1996), and two local cultivars (Sakha 53 and Giza 102) were produced from Agriculture Research Center).

The experiment included twelve treatments (four genotypes X three plant spacing) were arranged in split plot design with three replicates. In this experiment the three plant spacing were allotted in the main plot and the four

g) Seed yield kg/fed:

Seed yield per feddan was found to be appreciably influenced by the plant density in both seasons. The highest population density (20 cm apart between hills) significantly out-yielded those treated at the high and intermediate plant spacing (40 and 30 cm). Seed yield per fed. in fact, is the out product of its main components, any increase in one or more of such components without decrease in the others will lead to an increase in seed yield per fed. Therefore, the increase in seed yield per feddan under plant spacing conditions found herein was logical resultant due to the increase in both of number of seeds per head and 100-seed weight at the similar conditions.

From these results, it could be concluded that the increase of a number of plant / fed as a results to decrease plant spacing was great enough to compensate the detected decrease in seed yield / plant (seed weight / head), indicating that the population density of sunflower had definite effect on seed production / fed. Similar conclusion was previously shown by Abd EL Aal and Dawam (1985), Yakout *et al.*, (1992), Sanchez Lines *et al.*, (2000), Abd El-Samie *et al.*, (2002), Zarea *et al.*, (2005), Agele *et al.*, (2007) and El-Sarag (2007), where they found that seed yield / fed increased as plant density increased (decreased plant spacing), although yield of the individual plants and their components were significantly reduced.

h) Oil percentage:

Mean values of oil percentage Table (1) show insignificant differences among the three tested plant spacing in the first season. While in the second season, the increase of plant spacing caused a significant decrease in oil percentage. The highest plant spacing 40 cm between hills gave the lowest mean values of oil percentage in comparison with lowest plant spacing 20 cm which produced the highest mean values of oil percentage. The mean values of oil percentage were 35.4%, 33.2% and 32.3% for plant spacing 20, 30 and 40 cm apart between hills, respectively.

i) Oil yield kg / fed:

Oil yield (kg)/fed Table (1) was found to be significantly decreased generally by increasing plant spacing up to the highest plant spacing (40 cm apart between hills) which produced the lowest values i.e., 268.1 and 270.1 Kg / fed in the first and second seasons, respectively. Meanwhile the highest mean values of oil yield (kg)/fed produced from the lowest plant spacing (20 cm apart between hills) where the values were 397.3 and 385.5 (kg)/fed in the first and second seasons, respectively. The superiority of oil yield (kg)/fed at dense planting could be only attributed to the increase in seed yield per unit area. Oil yield of sunflower was previously reported to be increased by increasing the population density. Also the increase in oil percentage for 20 cm apart between hills may be due to the increase of seed

Table (1): Mean values for some sunflower yield and yield components as affected by plant spacing and genotypes during 2007 and 2008 seasons

Treatments	Head diameter (cm)		C.Z.S.d. (cm)		Head weight / plant (g)		Seed weight (g) / plant		100-seed weight (g)		Shelling percentage (%)		Seed yield Kg/fed		Oil percentage (%)		Oil yield kg/fed	
Plant spacing(A)	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
20 cm	15.9	16.3	1.1	1.6	78.28	62.0	47.4	32.7	7.1	6.8	0.59	0.50	1162	1207	36.7	35.4	397.3	385.5
30 cm	17.4	17.1	1.1	1.5	95.65	67.8	59.5	39.1	7.6	7.2	0.61	0.55	1062	1043	35.4	33.2	354.0	316.6
40 cm	19..1	17.6	1.1	1.7	102.42	65.3	68.8	36.8	7.7	7.6	0.64	0.52	751	793	34.5	32.3	268.0	270.1
F.Test	**	**	N.S	N.S	*	N.S	*	**	*	*	N.S	*	**	**	N.S	*	*	**
L.SD0.05	0.76	0.48	-	-	21.45	-	20.7	2.4	0.4	0.46	-	0.06	111	38.6	-	2.5	70.8	33.9
Genotypes (B)	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Mutant 4	19.2	19.3	0.0	0.0	115.8	81.0	79.1	44.0	9.0	9.2	0.67	0.53	1331	1221	29.7	28.6	360.8	348.4
Mutant 11	18.9	19.0	0.0	0.0	111.3	79.4	73.2	48.0	9.4	9.2	0.64	0.60	1283	1135	31.0	27.1	361.1	357.7
Sakha 53	16.2	14.7	2.1	3.0	72.2	48.6	40.6	25.8	5.6	5.3	0.55	0.50	775	742	41.4	37.9	321.7	279.8
Giza 102	15.9	15.1	2.1	3.4	69.7	51.2	41.3	26.9	5.6	5.1	0.59	0.47	787	759	40.12	40.9	315.6	310.3
F.Test	**	**	**	**	**	**	**	**	**	**	*	*	**	**	**	**	N.S	*
L.SD0.05	0.98	0.72	0.18	0.25	9.04	3.44	14.02	3.95	0.42	0.38	0.1	0.07	101	88	3.05	3.26	-	52.5
Interaction AB	N.S	**	N.S	N.S	N.S	**	N.S	N.S	N.S	*	N.S	N.S	*	N.S	N.S	N.S	N.S	N.S

genotypes were assigned in the sub-plots with three replicates. The area of experimental plot was 10.8 m^2 containing 6 rows (ridges) each of 3 meter length and 60cm apart. Sowing was carried out on 24 of April in the first season and on 24 May in the second season. The cultural practices were done as usual in sunflower fields.

Characters studied: The folowing data were recorded:

a) Head diameter (cm).
b) Central zone sterility diameter (cm) / head.
c) Head weight (g).
d) Seed weight / head (g).
e) 100-seed weight (g).
f) Shelling percentage (%).
g) Seed yield Kg / fed: It estimated from seed yield per unite area as which calculated for the seed yield Kg /fed.
h) Oil percentage (%): It was determined by using extraction method by A.O.A.C. (1980) using hexane with a boiling range of 60-80°C for eight hours from duplicating the random samples.
i) Oil yield Kg / Fed.

Statistical analysis:

The data were statistically analyzed according to the method described by Sendecor and Cochran (1967). L.S.D method test was used to compare between the treatments mean.

RESULTS AND DISCUSSION

-Effect of plant spacing on yield and its components:

a) Head diameter (cm):

The mean values in Table (1) indicated that, head diameter decreased by increasing population density (decreased plant spacing up to 20 cm). This reduction was found to reach the significance level of probability for head diameter in the two seasons. This reduction may be attributed to the high population density of sunflower which implies severe intra-specific competition among the plants for the environmental factors, i.e., light, water, nutrients and CO2...etc., which caused a depression in the amount of metabolites synthesized by the plant and this in turn affects the dry matter accumulation in the different plant organs. Similar results were obtained by Abdel-Aal and Dawam, (1985), Bassal (2003), Mojiri and Arazani (2003), El-Sarag, (2007) and Sedghi *et al.*, (2008). They found that increasing plant spacing led to increase head diameter.

b) Central zone sterility diameter (cm):

Mean values of central zone sterility diameter in Table (1), was not affected by plant spacing in the two seasons, but it can be said that the increase of plant spacing of sunflower up to 40 cm caused insignificant increase in this trait in the two seasons as compared with the other plant spacing.

c) Head weight / plant (g):

Mean values of head weight / plant in Table (1) were found to be increases by increasing hill spacing up to 40 cm apart between hills. This increase was found to reach the level of significance in the first season. The mean values of head weight / plant were 78.28, 95.65 and 102.42 in the first season and 62.00, 67.8 and 65.3 in the second season for plant spacing 20, 30 and 40 cm apart between hills, respectively.

d) Seed weight / plant (g):

Mean values of seed weight / head in Table (1) revealed that increasing plant spacing caused a significant increase in seed yield / plant in the two growing seasons. On the average of the two seasons, it is clear that using the high spacing (40 cm) in the first season and the high and intermediate (40 and 30 cm) in the second season caused a significant increase in seed yield / plant as compared with 20 cm apart between hills. The mean values were 45.53% and 16.05% in the first and second seasons, respectively. The decrease in mean values of seed weight / plant at 20 cm apart between hills (high population densities) was logically expected and could attributed to the reduction in the mean values of its components i.e., head diameter and 100-seed weight. Bassal (2003), Agele *et al.*, (2007) and Sedghi *et al.*, (2008) found that seed yield / ha increased as plant density increased. Meanwhile, yield of the individual plants and their components were significantly reduced.

e) 100-seed weight (g):

100-seeds weight was significantly affected by increasing plant density. Mean values of 100-seed weight in Table (1) were found herein to be increase by increasing plant spacing (decreasing population density) up to 40 cm apart between hills. These increases reach to the level of significance in the two seasons. On the average of the two seasons, it is clear that using the high and intermediate plant spacing (40 and 30 cm) caused an increase in 100-seeds weight amounted to 6.88% and 8.88% in the first seasons and 5.88% and 9.30% in the second season, respectively, more than the lowest planting space (20 cm). This trend was seen by Abdel-Aal and Dawm (1985) and Saliva and Schmidt (1986).

f) Shelling percentage (%):

Mean values for shelling percentage Table (1) was found to be increased by increasing plant density up to 30 cm apart between hills. This increase reach to the level of significance in the second season only as compared with the lowest spacing (20cm). The increase in the first season did not reach to the level of significance.

shelling percentages compared with the local varieties (Sakha 53 and Giza 102) in the first season, while the mutant line 11 only produced a significant increase as compared with the other three genotypes under study. The increase of shelling percentage may be due to the decrease in C.Z.S.D trait in the mutant lines (4 and 11) as compared with the local varieties (Sakha 53 and Giza 102). The same trend was seen by Atia (1996).

g) Seed yield Kg/fed:

With regard to seed yield (kg) / fed, the results indicated that the to seed yield (kg) / fed of the two mutant lines (4 and 11) in the two seasons increased significantly as compared with the two local varieties (Sakha 53 and Giza 102). These results were expected since seed yield and its components were increased. The increase of mutant line 4 compared to the local varieties ; Sakha53 and Giza102 were 57.92% and 42.47% in the first season and 65.83% and 60.67% in the second season, respectively. On the other hand, the increase of the mutant line 11 relative to the local varieties; Sakha53 and Giza 102 were 52.75% and 45.23% in first season and the values were 79.85% and 75.68%in the second season, respectively.

h) Oil percentage:

Mean values of oil percentages as affected by the four genotypes are presented in Table (1). The results revealed that seed oil percentage was significantly decreased in the mutant lines (4 and 11) as compared with local varieties (Sakha 53 and Giza 102) which produced the highest values in the two seasons.

i) Oil yield Kg/fed:

The mutant lines (4 and 11) caused a significant increase in this trait in the second season only as compared with the local varieties Sakha 53 and Giza102. On the other hand, the increase did not reach to the level of significant in the first season. The increases of oil yield/fed for the mutant line 4 were 24.5% and12.3 % relative to Sakha 53 and Giza 102 and 27.8% and 15.3% for mutant 11 relative to the same varieties, respectively. However, these increases could be attributed to the increase of seed oil (Kg)/fed of the mutant lines than that of the local varieties.

Effect of the interaction between plant spacing and genotypes on yield and yield components of sunflower:

The genotypes x plant spacing interaction mean square was significant for head diameter, head weight and 100-seed weight in the second season, while it was significant for seed yield (kg)/fed in the first season. This would indicate that the behavior of the studied genotypes could be differed with the change of plant spacing for trait in question. The other interactions did not reach to the level of significant, indicating that the performance of a genotype could be stable with changing plant varieties.

a) Head diameter (cm):

Data presented in Table (2-a) indicated that, mutant lines 4 and 11 in the second season had more values of head diameter than the other genotypes under different plant spacing. Mutant lines (4 and 11) at 40 cm apart between hills produced the highest mean values of head diameter. On the contrast, both commercial varieties; Sakha53 in 20cm and Giza 102 at 30 and 40 cm produced the lowest mean values of head diameter.

b) Head weight (g) / plant:

Mean values of head weight (g) / plant were presented in Table (2-b). The highest mean values produced from mutant line 11 at 30 cm and 40 cm spaces between hills and mutant line 4 at 30 cm apart between hills. On the contrast, the lowest head weight produced from the interaction between Sakha 53 x 20 cm and Giza 102 x 30 cm.

c) 100-seed weight, g (seed index):

Data presented in Table (2-c) Showed that genotypes x plant spacing (GD) interaction for 100-seed weight. The highest 100-seed weight produced by the interactions; mutant 4x30cm, mutant 4x40cm , mutant 11 x30cm, mutant 11x40cm where the values were 9.2,9.8,9.6 and 9.7(g), respectively. On the contrast, the lowest 100-seed weight produced by the interaction Giza 102 x 30 cm and Sakha 53 x 20 cm where the values were 4.8 and 5.0 g, respectively. Generally, 100-seed weight increased for all genotypes by increasing plant spacing.

d) Seed yield kg/fed:

Data presented in Table (2-d), showed the effect of genotypes x plant spacing interaction on seed yield (kg) / fed. It could be observed that the mutant 11x20cm, the mutant 4x30cm and the mutant 4x20cm interactions gave the highest seed yield kg/fed. However, the four genotypes produced the highest seed yield (kg)/fed in the lowest plant spacing 20 cm apart between hills. On the contrary, the four genotypes produced the lowest seed yield (kg)/fed at the highest plant spacing 40 cm apart between hills. The increases of seed yield (kg)/fed may be due to the increase of number of plants per unit area. The significance of the interaction between plant densities and varieties was previously reported by El-Keredy *et al.,* (1981) and El-Mohandes (1984).

yield / fed. These results agree with those obtained by El-Mohandes (1984), Harmati (1990), Abd El-Samie *et al.,* (2002), Bassal (2003), Al-Thabet (2006) El-Sarag (2007), and Szoba and pepo (2007). They found that the increase of plant density increased seed and oil yield / fed.

-Effect of genotypes on yield and its components:

Data in Table (1) declare that mean values of yield and its components were significantly affected by genotypes during 2007 and 2008 growing seasons.

a) Head diameter (cm):

Data in both seasons revealed that the two mutant lines (mutant.4 and mutant.11) caused a significant increase than the commercial varieties Sakha 53 and Giza 102 in head diameter in the two seasons. Mean values for genotypes mutant 4, mutant 11, Sakha 53 and Giza 102 were 19.27, 18.94, 16.0 and 15.93 in the first season and were 19.3, 19.0, 14.7 and 15.1 in the second season respectively. Differences in head diameter are mainly due to genetic make up of the tested genotypes. From these results it could be concluded that the head diameter of the mutant lines 4 and 11 were higher than the commercial varieties (Sakha 53 and Giza 102). The increases between mutant 4 and the two local varieties (Sakha 53 and Giza 102) were (20.43% and 20.87%) in the first season and (31.29% and 27.81%) in the second season. Meanwhile, the increase between mutant 11 and the two commercial varieties (Sakha 53 and Giza 102) were (16.6, 18.86) and (29.25, 32.45) in the first and second seasons, respectively. On the other hand, Abdel-Aal (1992) and Atia (1996) found no significant differences between mutant lines as well as the commercial varieties.

b) Central zone sterility diameter (cm):

The data in Table (1) shows clearly that the mutant lines 4 and 11 were significantly decreased in C.Z.S.D than the other two commercial varieties, i.e., Sakha 53 and Giza 102 in the two growing seasons. These results agree with those obtained by Atia (1996).

c) Head weight / plant (g):

Data in Table (1) reveal that, mean values of head weight / plant were significantly affected by the four genotypes during 2007 and 2008 growing seasons. Head weight / plant was significantly increased for the two mutant lines 4 and 11 compared with other commercial varieties i.e., Sakha 53 and Giza 102 in both seasons. Head weight / plant of mutant 4 and mutant 11 were 115.8, 111.3 in the first season and 81.0 and 79.4 in the second season, respectively, compared with Sakha 53 and Giza 102 which were 72.28, 69.73 in the first season and 48.6, 51.2 in the second season, respectively. The superiority of mutant lines may be due to the increase in head diameter. Atia and Abo-Hegazi (1996) and Atia (1996), came to the same conclusion in sunflower varieties.

d) Seed yield/ plant (g):

Data in Table (1) showed that mean values of seed yield / plant were significantly affected by the four genotypes during 2007 and 2008 growing seasons.

Seed yield / plant were significantly increased in the mutant lines 4 and 11 compared with the other commercial varieties in both seasons. The values were 79.14, 73.28 and 44, 48 g / plant for mutant lines 4 and 11 in the first and second seasons respectively, as compared with 40.6, 41.31 and 25.8, 26.9 for Sakha 53 and Giza 102 in the first and second seasons, respectively.

The increases of seed yield / plant in the mutant lines (4 and 11) were expected since the head diameter, 100 seed weight and head weight were increased. On the other hand, the central zone sterility diameter was decreased in these mutants. These led to an increase in seed yield / plant than that of the commercial varieties (Sakha 53 and Giza 102) which were decreased. In This respect Abdel-Aal (1991), Sorour *et al.,* (1994), and Atia and Abo-Hegazi (1996) came to the same conclusion in sunflower varieties.

e) 100-seed weight (g):

Regarding to 100-seed weight, the results indicated that, there were significant differences among the four genotypes in 100 seed weight in both seasons. Seeds of mutant lines 4 and 11 appeared to be significantly lighter than those of Sakha53 and Giza102. The values of 100 seed weight were 9.04, 9.48, 5.66 and 5.68 four mutant lines 4 and 11, Sakha53 and Giza 102 in the first season, respectively. While the values were 9.2, 9.2, 5.3 and 5.1 for mutant lines 4 and 11, Sakha53 and Giza 102 in the second season, respectively. From these results it could be concluded that the mutant lines 4 and 11 exceeded significantly the other two tested varieties Sakha 53 and Giza 102 for the trait in concentration. These findings could be due to the genetic variance which led to a relatively late maturing, and caused larger vegetative organs (plant height, head diameters) and hence produced high assimilator which was Tran located to seeds which led to the detected increase in seed weight.

Similar results were previously obtained by Sorour *et al.,* (1981) and (1994); Atia (1996) and Atia &Abo-Hegazi (1996) where they found that, some mutant lines increased significantly for 100-seed weight in comparison with other varieties.

f) Shelling percentage (%):

Mean values for shelling percentage are presented in Table (1). The analysis of variance showed significant differences between the four genotypes, the two mutant lines (4 and 11) caused a significant increase in

Table (2-a): Mean values of head diameter (cm) as affected by the interaction between plant spacing and genotypes in 2008 season:

Plants pacing (A) / Genotypes(B)	20cm	30cm	40cm
Mutant 4	18.0	19.8	20.0
Mutant 11	17.3	19.0	20.6
Sakha53	13.7	15.4	15.1
Giza102	16.2	14.3	14.8
LSD_5	1.25		

Table (2-b): Mean values of head weight (g) as affected by the interaction between plant spacing and genotypes in 2008 season:

Plants pacing (A) / Genotypes(B)	20cm	30cm	40cm
Mutant 4	79.1	88.8	75.5
Mutant 11	67.8	85.2	85.3
Sakha 53	45.6	52.4	47.8
Giza 102	55.5	45.5	52.5
LSD_5	5.95		

Table (2-c): Mean values of 100-seed weight (g) as affected by the interaction between plant spacing and genotypes in 2008 season:

Plants pacing (A) / Genotypes(B)	20cm	30cm	40cm
Mutant 4	8.7	9.2	9.8
Mutant 11	8.3	9.6	9.7
Sakha 53	5.0	5.2	5.7
Giza 102	5.2	4.8	5.3
LSD_5	0.66		

Table (2-d): Mean values of seed yield kg/fed as affected by the interaction between plant spacing and genotypes in 2007 season

Plants pacing (A) / Genotypes(B)	20cm	30cm	40cm
Mutant 4	1329.3	1413.4	921.5
Mutant 11	1478.7	1128.9	941.8
Sakha53	901.6	879.4	542.3
Giza102	937.6	824.3	599.3
LSD_5	175.09		

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تأثير مسافات الزراعه على صفات بعض طرز عباد الشمس المستحدثة بأشعة جاما

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الملخص العربي

في هذه الدراسة تم إجراء دراسه بالمزرعة التجريبية بقسم البحوث النباتية – مركز البحوث النووية – هيئة الطاقة الذرية – انشاص خلال الموسمين الزراعيين ٢٠٠٧ ، ٢٠٠٨ لدراسة تأثير مسافات الزراعة على صفات بعض طرز عباد الشمس، ففي هذه الدراسه تم تقييم أربعة طرز من عباد الشمس وهما سلالتان منتجتان من خلال برنامج لتحسين عباد الشمس بالتربية بالطفرات المستحدثة بأشعة جاما وهما السلالة رقم ٤ والسلالة رقم ١١ وكذلك صنفان تجاريان من عباد الشمس هما الصنف جيزة ١٠٢ والصنف سخا ٥٣.

قيمت هذه الطرز الأربعة (السلالتان والصنفان) تحت تأثير ثلاث مسافات للزراعة وهى ٢٠، ٣٠ ، ٤٠ سم بين الجور.

وتتلخص النتائج المتحصل عليها فيما يلي:

أولا: تأثير الطرز المختلفة على المحصول ومكوناته:

- قطر القرص: بالنسبة لقطر القرص أظهرت النتائج أن السلالتان ٤ ، ١١ أعطيتا أعلى زيادة في قطر القرص بالمقارنة بالأصناف المحلية سخا ٥٣ ، جيزة ١٠٢ في كلا الموسمين الزراعيين وكانت نسبة الزيادة ٢٠ % ، ٢٠,٩ % في الموسم الأول و ٣١,٢٩ % ، ٢٧,٨ % في الموسم الثاني عند مقارنة السلالة ٤ بالأصناف المحلية سخا ٥٣ ، جيزة ١٠٢ على الترتيب بينما كانت الزيادة ١٨,٣ % ، ١٨,٨ % في الموسم الأول وكانت ٢٩,٢ % ، ٢٥,٨ % فى الموسم الثاني عند مقارنة السلالة ١١ بكلا الصنفين المحليين.

- أظهرت النتائج أن السلالتان ٤ ، ١١ كانتا متفوقتان على الأصناف المحلية سخا ٥٣ ، جيزة ١٠٢ في وزن القرص.
- أعطت السلالة ٤ أعلى زيادة في وزن القرص تليها السلالة١١ بينما الصنفين المحليين أعطيا أقل وزن للقرص في كلا الموسمين الزراعيين.
- أظهرت النتائج اختلافات عالية المعنوية بين الطرز المختلفة في وزن المائة بذرة حيث أعطت السلالتان ٤، ١١ أعلى زيادة في وزن المائة بذرة بمقارنتها بالصنفين المحليين.
- أعطت السلالة ١١ أعلى زيادة معنوية في نسبة التصافي في الموسم الثاني بينما لم تصل الزيادة إلى حد المعنوية في الموسم الثاني.
- أظهرت النتائج نقصا معنويا جدا في قطر المنطقة المركزية العقيمة بالنسبة للسلالتان ٤ ، ١١ بمقارنتهما بالصنفين سخا ٥٣ ، جيزة ١٠٢ و أن قطر المنطقة المركزية العقيمة في السلالتين ٤ ، ١١ يساوى صفر بينما تراوحت من ٢-٣سم في الأصناف المحلية سخا ٥٣، جيزة ١٠٢.
- زاد محصول النبات الفردي زيادة معنوية في السلالتين ٤، ١١ عن الأصناف المحلية سخا ٥٣، جيزة ١٠٢ في كلا الموسمين الزراعيين وكانت نسبة الزيادة ٧٩,١٤ % ، ٧٣,٢٨ % في الموسم الأول وكانت ٤٤ % ، ٤٨ % في الموسم الثاني في السلالة ٤ بينما كانت الزيادة ٤٠,٦% ، ٤١,٣١% في الموسم الأول و ٢٥,٨% ، ٢٦,٩% في الموسم الثاني للسلالة ١١
- أظهرت النتائج نقصا معنويا في نسبة الزيت في السلالتين ٤ ، ١١ بمقارنتهما بالأصناف المحلية سخا ٥٣، جيزة ١٠٢ التي أعطت أعلى زيادة بينما سلكت كمية الزيت الكلية في الفدان سلوكا معاكسا حيث أعطت السلالتان ٤ ، ١١ زيادة معنوية في كمية الزيت الكلية في كلا الموسمين الزراعيين.

ثانيا: تأثير مسافات الزراعة على المحصول ومكوناته:

- أظهرت النتائج اختلافات عالية المعنوية على المحصول ومكوناته بين المسافات المختلفة بين الجور حيث زاد قطر القرص بزيادة المسافة بين الجور وأعطت المسافة ٤٠ سم أعلى قيمة لقطر القرص تليها المسافة ٣٠ سم بينما أعطت المسافة ٢٠ سم اقل قطر للقرص في كلا الموسمين الزراعيين.

- لم يتأثر قطر المنطقة المركزية العقيمة بالمسافات بين الجور في كلا الموسمين الزراعيين.
- أظهرت النتائج زيادة في وزن المائة بذرة بزيادة المسافة بين الجور وكانت الزيادة معنوية في الموسم الثاني حيث أعطت الزراعة بمسافة ٤٠ سم أعلى وزن في المائة بذرة بالمقارنة بالمسافة ٢٠ سم التي أعطت اقل قيمة لوزن المائة بذرة.
- أظهرت النتائج أن الزراعة بمسافة ٣٠ بين الجور أعطت زيادة معنوية في نسبة التصافي مقارنة بالزراعة على مسافة ٢٠ سم.
- أظهرت النتائج زيادة في وزن القرص بزيادة المسافة بين الجور حيث كانت نسبة الزيادة في وزن القرص بمسافة ٤٠ سم هى ٢٩ % عن الزراعة بمسافة ٢٠ سم بينما كانت الزيادة ٧,١١ % عن الزراعة بمسافة ٣٠ سم.
- أظهرت النتائج زيادة في محصول النبات بزيادة المسافة بين الجور حيث أعطت المسافة ٤٠ سم أعلى محصول تليها المسافة ٣٠ سم بينما أعطت المسافة بين الجور ٢٠ سم اقل قيمة لمحصول النبات الفردي.
- أظهرت النتائج أن زيادة المسافة بين الجور تؤدى إلى نقص النسبة المئوية للزيت حيث أعطت الزراعة بمسافة ٢٠ سم أعلى نسبة للزيت تليها الزراعة على مسافة ٣٠ سم بينما أعطت الزراعة بمسافة ٤٠ سم اقل قيمة للنسبة المئوية للزيت في كلا الموسميين الزراعيين.
- زيادة المسافة بين الجور يؤدى إلى نقص المحصول الكلى للزيت بالفدان حيث أعطت الزراعة على مسافة ٢٠ سم بين الجور أعلى محصول للزيت بالفدان بينما أعطت الزراعة بمسافة ٤٠ سم اقل كمية للزيت بالفدان.

الخلاصة:

من هذه النتائج يمكن القول بأن السلالتان ٤، ١١ كانتا أفضل الطرز في جميع الصفات المدروسة ما عدا صفة النسبة المئوية للزيت في البذور. كما أعطت الزراعة بمسافة ٢٠ سم بين الجور أفضل النتائج في الصفات المدروسة.