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Genetic Variability in some Sunflower (*Helianthus annuus* L.) Hybrids Evaluated in North Agadi Area under Rainfed Conditions

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Abstract:

Twenty locally generated hybrids of Sun flower (*Helianthus annuus* L.) hybrids were evaluated in two seasons (2012 and 2013) for yield and yield components at North Agadi area, Blue Nile State under rainfed conditions. A randomized complete block design with six replications was used for laying out the field experiments. The seeds were sown in the second and third week of July in the first and second seasons, respectively. The plot size was 6x3m^2. Each plot was divided into four ridges 70cm apart and 6 meter long. Three seeds were sown in holes of 20 cm distance along the ridge then thinned into one plant per hole three weeks after sowing. Weeding was practiced three times to control weeds. The rainfall was recorded during the two seasons. Fertilizers were not applied. The heads of the sample were bagged during the seed filling period using paper bags to avoid birds attack. Data were collected on the following characters: Days to 50% flowering, days to maturity, plant height, stem diameter, head diameter (cm), number of seeds/head, percentage of empty seed, 1000-seed weight (g), seed yield/plant (g) and seed yield (t/ha). Phenotypic, genotypic and environmental variances were determined. The results in season 2012 revealed highly significant differences among the undertaken hybrids for plant height, stem diameter, head diameter, empty seed %, 1000-seed weight, seed yield/pant and seed yield (t/ha), whereas only two characters were significant in 2013. These were empty seed% and 1000-seed weight. The phenotypic coefficients of variation values were greater than their corresponding genotypic ones. Heritability values were low for all characters in both seasons. Genetic advance as percentage from the overall mean values were greater in 2012 than their corresponding ones in 2013 for most traits. More investigation should be done for the promising hybrids SHA5, SHA18 and SHA22.

Keywords: Sunflower, yield, genotype, environment, genetic advance, heritability.

Introduction:

The continuous demand for vegetable oils led to the interest in sunflower as a source of good quality oil. It ranks fourth among the world oil crops after palm oil, rapeseed and soybean (Abdalla and Abdelnour, 2001). Sunflower (*Helianthus annuus* L.) which belongs to the family *Compositae* is diploid (2n

=2X=34. The main sunflower producing countries are former USSR, Argentina, France, USA, Romania, former Yugoslavia, Bulgaria, Spain and Turkey. According to FAO (1996) the cultivated area in 1996, all over the world was 21 million hectares, producing2.5 million metric tons with an average seed yield of 1197 Kg/ha.

Commercial Production of sunflower in the Sudan was initiated in the 1987/1988 season, where 63 thousands hectares were grown under rain fed conditions by the private sector in Damazine. In the following season (1988/1989) the area was increased to 112 thousand hectares in Damazine and 34 thousand hectares in Gedarif State. The average yield was 1.5 t/ ha. As a result of increasing demand for vegetable oil and to release more sesame seed and groundnut for export, much attention was focused recently on growing sunflower under the irrigated national schemes as a winter crop.

The climatic conditions and soil requirements for sunflower, generally, indicate that the central clay plain is potentially suitable for sunflower growing. Khidir (1997) reported that the most progressive varieties grown in Sudan are imported hybrids like Hysun 33, Sunbred 281, Tec 1560, Tec 1226, Northrubking, Pioneer 6480 and Dekaln G 100 and few open-pollinated ones, like Polareo, Rodeo and Hungaria. The economic importance of sunflower is the use of oil and seeds as human food, cake and shoot are used as animal feed. The inner pith of the stem is used for making fine writing paper. The plant is grown as an ornamental, a wind break in vegetable farms and for honey bee husbandry.

Sunflower is a highly cross-pollinated crop due to protandary, characterized by a high percentage of empty seed in open-pollinated and to a lesser extent in F1 hybrid varieties and this is mainly due to self-incomatability. In the present changing agriculture scenario and water constraint, area of sun flower production has been increased significantly since 2003. Sun flower hybrids produced contain 39 – 52% oil in the seeds and still have better yield potential (Anonymous 2006).

The objectives of this study were to estimate genetic variability among sunflower hybrids and quantify the heritability estimates and genetic advance of yield and yield components in sunflower under rainfed conditions.

Materials and Methods:

Twenty hybrids of sun flower (*Helianthus annuus* L.) were used to evaluate seed yield and its components for two consecutive seasons (2012 and 2013) in North Agadi area, Blue Nile State (11˚ 48´ N. Lat. and 24˚ 11´ E. Long) under rainfed conditions. Rain falls were recorded during autumn at North Agadi (Table 1). The total rain falls were 819.0 mm and 616.5 mm in the first and the second seasons, respectively (Meteorology Authority, 2013).

Table 1: The records of the rainfall at North Agadi, seasons 2012and 2013

Month	2012	2013
May	38.0	50.0
June	179.0	100.0
July	90.0	239.0
August	249.0	175.5
September	249.0	33.0
October	14.0	19.0
Total	819.0	616.5

* Source: Damazine Agro-metrology Station, Blue Nile State.

Table 2: List of the sunflower hybrids used in the study

No	Parents	Hybrids	Code	Origin
1	R1 (Male)	Kh 99 X1	SHA1	UK
2	R5 (Male)	Kh99X5 (Salih)*	SHA5	Check
3	R6 (Male)	Kh99X6(SHhAt6)*	SHA6	Check
4	R7 (Male)	Kh 99 X7	SHA7	//
5	R11 (Male)	Kh 99 X11	SHA11	//
6	R14 (Male)	Kh 99 X13	SHA14	//
7	R15 (Male)	Kh 99 X15	SHA15	//
8	R17 (Male)	Kh 99 X17	SHA17	//
9	R18 (Male)	Kh 99 X18	SHA18	//
10	R22 (Male)	Kh 99 X22	SHA22	//
11	R25-1 (Male)	Kh 99 X25-1	SHA25-1	//
12	R25-2 (Male)	Kh 99 X25-2	SHA25-2	//
13	R29 (Male)	Kh 99 X29	SHA29	//
14	R30 (Male)	Kh 99 X30	SHA30	//
15	R32 (Male)	Kh 99 X32	SHA32	//
16	R35 (Male)	Kh 99 X35	SHA35	//
17	R37 (Male)	Kh 99 X37	SHA37	//
18	R41 (Male)	Kh 99 X41	SHA41	//
19	R42M (Male)	Kh 99 X42	SHA42-M	//
20	Hysun 33	-	-	Check

*Newly released as Commercial varieties.

Nineteen of them were derived from crossing of nineteen locally generated restorer lines with one male sterile line (Kh99). Table 2 shows the genetic materials used in this study. The seeds were provided by the Department of Agronomy, Faculty of Agriculture, University of Khartoum.

A randomized complete block design with six replications was used to lay out the field experiments. The seeds of each hybrid were sown plots of 6 metre long and 3metre width, with four ridges 70 cm apart. Three seeds were sown in holes with spacing of 20 cm along the ridge then thinned into one plant per hole three weeks after sowing. Weeding was practiced three times to control the weeds.

Fertilizers were not applied. The sample plants were randomly selected from middle two ridges then their heads were covered during the period of seed filling using paper bags to avoid birds attack. Data were collected on plant height, days to 50 % flowering , days to maturity, stem diameter , head diameter (cm), number of seeds/head, empty seed %, 1000-seed weight (g), seed yield/plant (g) and seed yield (t/ha).

Statistical Analysis: The collected data were analyzed according to the standard statistical procedure described by Gomez and Gomez (1984) The estimates obtained from the individual analysis of variance were then used to compute the coefficient of variation (***CV%***) according to the formula:

$$CV\% = \sqrt{(EMS)}/G \times 100$$

where *EMS* is the error mean sum squares, ***G*** is grand mean.

The genotypic variance ($\delta^2 g$) was estimated as follows:

$$\delta^2 g = (M_2 - M_3)/r$$

where M_2, M_3 and r are the mean sum squares for genotype, error and number of replications, respectively.

The phenotypic variance ($\delta^2 ph$) was calculated according to the following formula:

$$\delta^2 ph = \delta^2 g + \delta^2 e,$$

The environmental ($\delta^2 e$) variance was calculated as:

$$\delta^2 e = M_3,$$

Genotypic and phenotypic coefficient of variations (*GCV%* and *PCV%*) were

calculated according to the formula of Burton and Devane (1953) as follows:

$$GCV\% = (\delta^2 g / G) \times 100$$

$$PVC\% = (\delta^2 ph / G) \times 100$$

where G is the grand mean.

Heritability estimate (h^2) in broad sense was estimated for each character according to the procedure of Johnson *et al*. (1955) as follows:

$$h^2 = (\delta^2 g / \delta^2 ph) \times 100,$$

Genetic advance (GA) and genetic advance as percentage ($GA\%$) of overall mean were estimated using the formula of Robinson *et al*. (1949) as follows:

$$GA = k (\delta^2 g / \delta^2 ph)$$

$$GA\% = (GA/G) \times 100$$

where G is the grand mean, k is the selection differential (it equals 2.06 at 5% selection intensity) as defined by Lush (1943).

Results and Discussion:

Phenotypic and genotypic variability: Days to 50% flowering and days to maturity are characters represent the reproductive stage and these characters are important in rainfed where the main factor for production is the rainfall and therefore earliness is more preferable under these conditions. Plant height and stem diameter are represent the vegetative stage.

Table 3: Means of 20 sunflower hybrids evaluated for 10 characters at North Agadi in season 2012

Hybrids	DF	DM	Pht (cm)	SD (cm)	HD (cm)	S/H	ES (%)	SW (g)	Y/P (g)	Yield (t/ha)
SHA 1	69.3 a	97.0 ab	102.7 abc	1.33 a	11.1 a	503 a	6.71 a	33.6 f	22.5 bc	1.60 b
SHA5	69.5 a	92.0 d	100.0 abc	1.22 b	10.9a	607 a	8.35 a	38.0 abcdef	43.1 a	3.07 a
SHA 6	69.8 a	93.2 bcd	90.7 de	1.11 b	10.9 a	528 a	6.56 a	40.9 abc	26.5 bc	1.89 b
SHA 7	69.5 a	94.5 abcd	94.6 cde	1.17 b	11.2 a	524 a	8.35 a	37.3 bcdef	23.1 bc	1.63 b
SHA 11	68.8 a	97.3 a	93.2 cde	1.30 a	10.8 a	518 a	9.46 a	34.0 ef	23.7 bc	1.69 b
SHA 13	70.0 a	95.2 abcd	93.7 cde	1.08 b	10.6 a	557 a	8.79 a	35.5 def	19.0 c	1.58 b
SHA15	69.3 a	92.3 cd	101.1 abc	1.27 a	10.7 a	532 a	7.46 a	35.7 def	31.3 bc	2.09 b
SHA 17	69.8 a	92.0 d	100.1 abc	1.23 b	10.8a	508 a	7.92 a	36.6 bcdef	21.9 bc	1.56 b
SHA 18	68.7 a	96.3 abc	96.5 bcde	1.11 b	11.6 a	633 a	7.47 a	42.5 a	32.2 b	2.24 b
SHA 22	69.8 a	96.5 ab	89.0 e	1.00 b	10.7 a	554 a	8.89 a	38.0 abcdef	27.9 bc	1.98 b
SHA 25-1	68.7 a	96.3 abc	101.9 abc	1.14 b	10.9 a	550 a	7.03 a	36.4 cdef	22.8 bc	1.66 b
SHA 25-2	69.8 a	95.8 abcd	99.5 abcd	1.09 b	10.3 a	605 a	7.64 a	39.6 abcd	30.6 bc	2.18 b
SHA 29	68.7 a	94.2 abcd	97.5 abcde	1.24 b	10.4 a	662 a	8.25 a	40.4 abcd	30.5 bc	2.06 b
SHA 30	70.2 a	92.3 d	102.1 abc	1.11 b	10.4 a	576 a	7.59 a	37.0 bcdef	27.2 bc	1.93 b
SHA 32	69.8a	92.5 cd	106.3 a	1.24 b	11.4 a	634 a	6.07 a	39.9 abcd	27.6 bc	1.97 b
SHA 35	70.7a	96.3 abc	94.8 bcde	1.15 b	11.1 a	572 a	7.40 a	37.8 abcdef	24.7 bc	1.78 b
SHA 37	68.5a	92.3 d	104.2 ab	1.20 b	11.0 a	555 a	7.98 a	38.5 abcdef	22.1 bc	1.59 b
SHA 41	69.7a	94.5 abcd	102.3 abc	1.36 a	10.8 a	603 a	7.22 a	41.5 ab	26.9 bc	1.92 b
SHA42-	70.7a	96.2 abc	101.9 abc	1.23 b	11.4 a	567 a	7.51 a	42.6 a	29.0 bc	2.07 b
m	70.0a	93.5 abcd	102.1 abc	1.30 a	12.1 a	624 a	7.19 a	38.9 abcde	28.6 bc	1.92 b
Hysun 33										
Mean	69.6	94.5	98.7	1.19	11.0	571.0	7.69	38.2	27.1	1.92
CV (%)	2.2	3.1	6.8	14.8	10.8	22.2	37.5	9.5	34.5	33.5

* DF, DM, Pht., SD, HD, S/H, ES, SW and Y/P are days to flowering, days to maturity, plant height, stem diameter, head diameter, no. of seeds/head, empty seed, 1000-seed weight and seed yield/plant , respectively.

* Any means have the same letter(s) are non-significantly different according to Duncan multiple range test at 5% level of significance.

Days to maturity revealed highly significant differences (P≤0.01) among the hybrids in both seasons (Tables 3 and 4).

Plant height and stem diameter showed significant differences in 2012 only (Table 3). There were non-significant differences for days to flowering. Seed yield and seed weight showed significant differences in the first season, but head diameter and empty seed percentage showed highly significant differences in the second one (Tables 3 and 4). The SHA5 was the earliest hybrid in maturity in the first season (92 days) and SHA22 in the second one (90.8 days) (Tables 3 and 4). The hybrid SHA22 was the shortest in the first season. SHA18 scored the lowest value in empty seed percentage in 2013. SHA5 obtained the largest seed yield in 2013 exceeding the commercial hybrid (Tables 3 and 4). These findings are in agreement with those of Asifkhan *et al*. (2003), Rachid *et al*. (2004), Zannou *et al*. (2008) and Izquierdo and Aguirrezabal (2008) who stated significant differences among their respective materials. Moreover, Mamta *et al*. (2017a) stated that days to 50% flowering were less affected by environmental conditions.

Table 4: Means of 20 sunflower hybrids evaluated for 10 characters at North Agadi in season 2013

Hybrids	DF	DM	Pht (cm)	SD (cm)	HD (cm)	S/H	ES (%)	SW (g)	Y/P (g)	Yield (t/ha)
SHA 1	70.7 a	93.7 cde	122.7 a	1.49 a	14.5 ab	822 a	7.88 ab	53.2 a	30.4 a	2.17 a
SHA5	70.2 a	93.3 def	116.5 a	1.46 a	14.0 ab	733 a	8.49 ab	50.7 a	31.1 a	2.22 a
SHA 6	70.3 a	91.8 ef	122.4 a	1.51 a	15.0 ab	764 a	8.13 ab	53.4 a	31.9 a	2.28 a
SHA 7	69.3 a	92.7 cdef	123.4 a	1.52 a	14.9 ab	892 a	4.85 cd	50.9 a	37.7 a	2.67 a
SHA 11	69.7 a	94.0 abcde	120.2 a	1.52 a	13.0 ab	633 a	8.69 a	54.5 a	29.0 a	2.07 a
SHA 13	70.8 a	93.0 cdef	116.8 a	1.32 a	12.5 bc	821 a	8.00 ab	52.0 a	33.1 a	2.29 a
SHA15	70.7 a	95.0 abc	117.2 a	1.42 a	13.7 ab	710 a	6.70 abcd	53.1 a	31.1 a	2.22 a
SHA 17	71.0 a	93.8 bcde	129.2 a	1.48 a	15.3 a	796 a	7.93 ab	49.2 a	31.1 a	2.22 a
SHA 18	69.8 a	93.5 cde	143.3 a	1.43 a	14.8 a	765 a	4.54 d	53.3 a	30.7 a	2.20 a
SHA 22	70.7 a	90.8 f	126.9 a	1.51 a	14.6 ab	843 a	6.19 abcd	54.4 a	36.3 a	2.51 a
SHA 25-1	69.7 a	92.7 cdef	117.0 a	1.38 a	13.9 ab	771 a	7.15 abcd	50.4 a	31.2 a	2.23 a
SHA 25-2	70.3 a	19.7 ef	132.0 a	1.48 a	14.4 ab	635 a	6.43 abcd	50.4 a	29.6 a	2.12 a
SHA 29	70.5 a	93.0 cdef	121.1 a	1.48 a	14.9 ab	735 a	8.07 ab	52.9 a	30.0 a	2.14 a
SHA 30	70.7 a	96.5 a	110.4 a	1.28 a	10.2c	610 a	8.64 a	50.6 a	24.0 a	1.72 a
SHA 32	70.8 a	96.3 ab	105.0 a	1.46 a	12.3 bc	543 a	5.74 bcd	51.3 a	22.2 a	1.58 a
SHA 35	70.5 a	92.5 cdef	126.0 a	1.55 a	14.4 ab	766 a	6.12 abcd	53.8 a	31.1 a	2.23 a
SHA 37	70.5 a	94.0 abcde	121.1 a	1.54 a	13.3 ab	661 a	8.94 a	49.6 a	26.9 a	1.92 a
SHA 41	70.3 a	94.7a bcd	120.1 a	1.58 a	14.1 ab	724 a	6.36 abcd	53.7 a	30.4 a	2.18 a
SHA42-m	70.3 a	92.0 def	116.7 a	1.46 a	13.5 ab	638 a	7.39 abc	55.7 a	26.0 a	1.86 a
Hysun 33	70.5 a	93.7 cde	121.3 a	1.65 a	14.3 ab	909 a	7.59 abc	55.9 a	36.9a	2.64 a
Mean	70.4	93.4	121.5	1.48	13.9	739.0	7.19	52.5	30.6	2.17
CV (%)	1.4	2.1	13.3	16.5	14.3	26.6	29.2	7.8	28.0	27.6

* DF, DM, Pht., SD, HD, S/H, ES, SW and Y/P are days to flowering, days to maturity, plant height, stem diameter, head diameter, no. of seeds/head, empty seed, 1000-seed weight and seed yield/plant , respectively.

* Any means have the same letter(s) are non-significantly different according to Duncan multiple range test at 5% level of significance.

Phenotypic, genotypic and environmental variances: Estimation of phenotypic (δ^2_{ph}), genotypic (δ^2_g) and environmental variances (δ^2_e) indicate the potentially variable genetic background that reflects the divergent differences among the materials. In this study, phenotypic variances were greater than genotypic ones for all characters in both seasons (Table 5). The values of all variances for most characters in season 2012 were greater than their respective ones in season 2013 (Table 5). This may due to the expression of the genetic

background which was reflected in the response of these hybrids to the effects of the environmental factors in the different seasons. On the other hand in season 2013, the phenotypic (δ^2_{ph}), genotypic (δ^2_g) and environmental (δ^2_e), variances were greater in characters of days to maturity, plant height, number of seeds/head, empty seeds% and seed yield/plant, except in genotypic variance in characters days to flowering, stem diameter, head diameter, and empty seeds% (Table 5). Similar results were reported by Arshad *et al*. (2007), Zannou *et al*. (2008), Izquierdo and Aguirrezabal (2008), Mahmood and Mehdi (2003) and Fadlalla (2010) who reported that genotypic variances were smaller than their corresponding phenotypic one for all characters studied in sunflower. In contrast, Sajid (2004) showed that genotypic and phenotypic coefficient of variation was high for all seedling traits.

Table 5: The phenotypic (δ^2_{ph}), genotypic (δ^2_g) and environmental (δ^2_e) variances for 10 characters of 20 sunflower hybrids evaluated at North Agadi for two seasons 2012 and 2013

Characters	Season 2012			Season 2013		
	(δ^2ph)	(δ^2g)	(δ^2e)	(δ^2ph)	(δ^2g)	(δ^2e)
Days to 50% flowering	2.34	- 0.03	2.38	1.01	0.03	0.98
Days to maturity	10.42	2.14	8.26	5.36	1.43	3.93
Ph. Height (cm)	60.00	14.66	45.34	280.84	20.03	260.81
Stem diameter	0.03	0.00	0.03	0.06	0.00	0.06
Head diameter (cm)	1.37	- 0.04	1.40	4.74	0.79	3.95
No. of seed / head.	15490	- 522	16012	41359	2917	38442
Empty seed (%)	7.64	- 0.70	8.34	5.30	0.89	4.41
1000-seed weight (g)	17.63	4.53	13.10	17.92	1.08	16.85
Seed yield/ plant (g)	99.87	12.77	87.09	76.00	2.87	73.13
Seed yield (t/ha)	0.46	0.05	0.41	0.37	0.01	0.36

Phenotypic and genotypic coefficient of variations, heritability and genetic advance: Estimates of phenotypic (PCV%) and genotypic (GCV%) coefficient of variations, heritability in abroad sense (h^2), genetic advance (GA) and genetic advance as percentage of the grand mean (GA%) for the first and the second seasons are displayed in Tables 6. In this study all the undertaken characters showed greater phenotypic coefficient of variations than their respective genotypic ones. The estimate of days to maturity, 1000-seed weight, seed yield/plant and seed yield (t/ha) were greater in season 2012 than those in 2013 and it was vis versa for plant height and stem diameter. The highest PCV estimate (36.93%) was scored for seed yield/plant, while the lowest PCV% (3.42%) was scored by days to maturity in season 2012. However, in 2013 the highest PCV was 50.67% recorded by stem diameter, whereas the lowest was 1.43%%, recorded by days to flowering (Table 6). Regarding the heritability ($\boldsymbol{h^2}$) estimates, most of the characters had low values (h^2<0.60) in both seasons (Table 6). Similar to the trend of the heritability estimate, the values of the expected genetic advance under selection (GA%) changed over seasons. GA% value scored for seed yield/plant (g) was 3.48% as highest score in 2012, but it scored 0.43% in 2013. The highest estimate of GA% (4.55%) was recorded for empty seeds%, whereas the lowest one 0.00% was scored by stem diameter and plant height in 2013 (Table 6). These findings are in agreement with that of Mamta *et al*. (2017b) and Fadlalla (2010) who stated that PVC was slightly high than

GCV in sunflower hybrids. They also reported that heritability was high for seed yield/plant. Also, similar results were reported by Farooq *et al*. (2006). On the other hand, Monica and Lauren (2003) told that heritability was lower in inbreeding species. Similar results for genetic advance were reported by Mamta *et al*. (2017a) who stated that genetic advance as percent from mean was high for seed yield/plant followed by seed weight.

Table 6: The phenotypic (PCV %), genotypic (GCV %) coefficient of variations, heritability (h^2) estimates, genetic advance (GA) and genetic advance as percentage of the mean (GA %) in 10 characters of 20 sun flower hybrids evaluated at North Aagadi for two seasons 2012 and 2013

Characters	Season 2012					Season 2013				
	PCV %	GCV %	h2	GA	GA %	PCV %	GCV%	h2	GA	GA %
Days to 50% flowering	-	-	-	-	-	1.43	3.68	0.07	0.66	0.54
Days to maturity	3.42	1.55	0.21	0.62	0.65	2.48	1.28	0.27	0.66	0.70
Ph. Height (cm)	7.85	3.38	0.24	1.93	1.95	13.80	3.68	0.07	0.00	0.00
Stem diameter	16.64	5.04	0.10	0.01	1.08	50.67	18.07	0.00	0.00	0.00
Head diameter (cm)	-	-	-	-	-	15.68	6.68	0.17	0.30	2.18
No. of seed / head.	-	-	-	-	-	27.54	7.31	0.07	7.85	1.06
Empty seed (%)	-	-	-	-	-	32.02	13.14	0.17	0.33	4.55
1000-seed weight (g)	10.98	5.57	0.26	1.13	2.95	8.07	1.98	0.06	0.13	0.25
Seed yield/ plant (g)	36.93	13.21	0.13	0.94	3.48	28.54	5.54	0.04	0.13	0.43
Seed yield (t/ha)	35.43	11.50	0.11	0.05	2.50	28.04	4.80	0.03	0.01	0.29

- = not calculated because of its negative genetic variance.

Conclusion:

From the results of this study it concluded that there were significant differences among the undertaken hybrids. The phenotypic coefficients of variation values were greater than their corresponding genotypic ones. Heritability values were low for all characters in both seasons. Genetic advance as percentage from the overall mean values were greater in 2012 than their corresponding ones in 2013 for most traits. More investigation should be done for some promising hybrids i. e, SHA5, SHA18 and SHA22.

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التباين الوراثي في بعض هجن محصول زهرة الشمس (*Helianthus annuus* L.) تم تقييمها في منطقة شمال أقدي تحت الظروف المطرية

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المستخلص

تم تقييم عشرين هجين من نبات زهرة الشمس (*Helianthus annuus* L.) للانتاجية ومكوناتها في موسميين 2012 و2013 في منطقة أقدي شمال، بولاية النيل الازرق أقدي جنوب تحت ظروف الري المطري. تم استخدام التصميم الاحصائي ذو القطاعات الكاملة العشوائية لتنفيذ التجارب الحقلية. تم زراعة البذور في الاسبوعين الثاني والثالث من شهر يوليو للموسمين الاول والثاني علي التوالي. تمت الزراعة في احواض 6x3 م . كل حوض تم تقسيمه الي سرابات طولها 6 امتار والمسافة بينها 70 سم. تمت زراعة في حفر بمعدل 3 بذور لكل حفرة والمسافة بين الحفر 0 سم وبعد ثلاث اسابيع من الزراعة تم خف البادرات الي نبات واحد لكل حفرة. تمت ازالة الحشائش ثلاث مرات. تم تسجيل كميات هطول الامطار اثناء شهور الخريف في الموسمين. لم يتم اضافة اي اسمدة للنباتات. النباتات التي تم اختيارها عشوائيا كعينة لتسجيل البيانات تم تغطية قناديلها باكياس ورقية لحمايتها من مهاجمة الطيور. تم تسجيل البيانات علي الصفات الاتية: فترة ظهور 0 % من الازهار، فترة النضج، طول النبات (سم)، سمك الساق (سم)، قطر القندول (سم)، عدد البذور/قندول، نسبة بذورالخالية (%)، وزن الـ 1000 حبة (جم)، الانتاجية/ نبات (جم) والانتاجية (طن/هكتار). اظهرت نتائج تحليل التباين فروقات معنوية لصفات طول النبات، سمك الساق، قطر القرص، نسبة البذور الخالية%، وزن الالف بذرة، اللانتاجية من البذور/ نبات والانتاجية من البذور طن/هكتار في موسم 2012 ، بينما في الموسم الثاني (2013) ظهرت الفروقات المعنوية لصفتين فقط، هما نسبة البذور الخالية% ووزن الاف بذرة. تقديرات معامل التباين المظهري (PCV%) كانت اكبر من قيم معامل التباين الوراثي (GCV%). قيم درجة التوريث (h^2) كانت ضعيفة لكل الصفات (h^2<0.60) في الموسمين. التقدم الوراثي كنسبة مئوية من المتوسط العام كان اكبر في 2012 منه في 2013 لكل الصفات. مزيد من البحث مطلوب لبعض الهجن الواعدة، وهي: SHA5، SHA18 و SHA22 .