Evaluation of Genetic behavior of Sunflower (Helianthus annuus L.) As Effect by Planting Dates

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Abstract: **Afield experiment was carried out during the spring and autumn seasons of 2016 and 2017 in AL-Musaib city / 40 km north of Babylon Provence. Two hybrids of sunflower(shamus, French hybrid (Euroflor) were used to evaluate the performance of the two cultivars at both growing seasons as well as knowledge of genetic behavior by studying the genetic and phenotypic variations, heritability percent, genetic and phenotypic coefficient, stability and persistence of the two cultivars .**

The results showed significant differences of the studied traits, as the genetic genotype (Shamus) most of the characteristics, especially in yield for two seasons.

The genetic variance was higher than the environmental variance for the two seasons indicating that the two cultivars followed the same behavior. The heritability percent the dominant sense was high for most of the traits. The genetic and phenotypic variations between the mean and the high were different for the two seasons, the correlation coefficient was significant, for both cultivars, indicating the appropriateness of the two genotypes for the country's environmental conditions.

Keyword: **Genotype, Variations, Heritability, Correlation.**

I.   INTRODUCTION

Sunflower (Helianthus annuus L.) was one of the most important oil crops in the world. It was the first oil crop in Iraq [1]. The significance of the sunflower crop as the seeds contains high percentage of oil of more than 50%. Some varieties and improved hybrids possess high quality of oil as well as the use of raw materials for many food and chemical industries and contain important vitamins such as A, B, which increased the use of seeds in the production of table oil on a large scale. It also has a high importance in feeding livestock and poultry because it contains high protein content of up to 35% and a high proportion of acids and is one of the best vegetable oil for human consumption, It occupies a prominent place in the programs of expansion in the cultivation of annual summer oil crops as tracheae family[2].The total cultivated area in Iraq in 2002 was about 31.25 thousand hectares and the total production was about 51 thousand tons with an average production of 1.63tons/h [3] .In addition, it is important to assess the phenotypic, hereditary, environmental, phenotypic and genetic differences, the expected genetic improvement and the heritability that were determined. On the basis of the method of screening and selection used to improve the declared qualities, especially the grain, as it were achieves the increase in the result of a number of yield components [4], [5].

The purpose of the current research is to evaluate the performance of genotypes and their genetic parameters for use in breeding programs and improving sunflower crop.

II. Materials and Methods

This experiment was carried out during the spring and autumn seasons of 2016 and 2017 in the region of AL-Musaib city / Bedaa al-Musaib 40 km north of Babylon Provence. Two cultivars of sunflower shamus, France hybrid (Euroflor) were used to evaluate the performance of cultivars at the two growing seasons as well as the genetic behavior of the two genotypes under the influence of the growth seasons by studying the genetic and phenotypic variation, heritability percent and genetic result to show the stability structures. Genetics and their suitability to environmental conditions. The experiment was arranged as factorial using RCBD design with three replicates.

The soil was prepared for cultivation from tillage and softening and was then divided to lines where the length was 3 m in length and the distance between lines was 70 cm and between plant and the other 25 cm. Urea fertilizer was used at the rate of 200 kg N / h in the first after a month of cultivation and the second phase (4- 3) leaves, and 200 kg P2O5 / h before planting[6]. Cultivation was carried in mid-March for the spring and mid-July season for the autumn season of the 2016 and 2017. Agricultural practices were conducted as needed. Harvesting was carried out in the first half of July for the spring season and the first half of november for the autumn season of the experiment. The Measurements were taken for five plants from each experimental unit.

1.Characters Studied :

1. Disc diameter (cm). By measuring the disc diameter of the part containing the seeds only.
2. Number of seeds in the disc.
3. Weight of 1000 grain (g).
4. Plant yield (gm –l .plant).
5. Oil percent (%) A random sample from each treatment was used to estimate the oil content of the seeds using Soxhlet and on the dry weight of the seeds according to the method using the organic solvent (Hexane) and temperature (69 ° C) [7].

2. Genetic analysis:

Genetic, environmental and phenotypic, genetic and phenotypic variations, heritability percent in the broad sense, genetic and phenotypic correlations, and genetic result were calculated according to the following equations [3]

$$\sigma 2e = MSe \quad \text{environment variations}$$
$$\sigma 2g= (MSg-MSe)/3 \quad \text{genetic variations}$$
$$\sigma 2p = \sigma 2g+ \sigma 2e \quad \text{phenotypic variations}$$
$$P.C.V= \frac{\sqrt{\sigma 2p}}{\bar{x}} \times 100 \quad \text{phenotypic coefficient variation}$$
$$\text{Variation Genetic coefficient} \quad \times 100 \ \frac{\sqrt{\sigma 2g}}{\bar{x}} = G.C.V$$
$$h2\ b.s= \frac{\sigma 2g}{\sigma 2p} \times 100 \quad \text{heritability percent (broad sense)}$$
$$GR = \% \text{ Stab.} \times \overline{X}_{ci} / \overline{X}_{Ci} \quad \text{genetic result}$$
$$\% \text{ Stab.} = 1 - C.V$$

3. Phenotypic, Genotypic and Environmental Correlations:

Estimate the correlation of the genetic and the descriptive after calculating the variance of each studied property and the calculation of the common variation between the qualities in the form of pairs, and the following [8]:

$$r_{gij} = \frac{\delta g_i g_j}{\sqrt{\sigma 2 g_i \sigma^2 g_j}} \cdot$$

$$r_{pij} = \frac{\delta p i p j}{\sqrt{\cdot \delta 2 p_i \sigma^2 p_j}}$$

$\delta g_i g_j$: **Cov.**g1g2 INTERACTION GENETIC VARIATION

$\delta p_i p_j$: **Cov.**p1p2 INTERACTION PHENOTYPIC VARIATION

The data were statistically analysis in (5%) probability level.

Table. 1 shows that there were significant differences between the cultivars used in this research, with the highest values of the parameters for the year 2016 as 20.5 cm, 1210.8, 127.5 g, -1, 109 g and 42% for the diameter of disc, number of seeds, plant yield, grain weight and the percentage of oil. respectively for the spring season for autumn season to the same varieties the values were 22.1 cm, 1215.8, 130 g, 111.6 g and 44%, respectively for the autumn season respectively. 3 g, 82 g and 39.1% respectively for the above qualities for the autumn season and this result was found with [8],[9].

Table 1: Averages of the studied traits for 2016

Character / Caltivar.	Disc diameter /cm		No. of seed		weight of 1000 grain.g-1		grain Yield .g. Plant-1		Oil (%)	
	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	spr	Aut
Shamus	٢٠.٥	22.1	1210.8	1215.8	109	١١١.٦	127.5	130	٤٢	٤٤
Euroflor	١٨.٣	19.5	955.3	963.7	73	٨٢	٨٢.٨	٨٩.٣	٣٦.٣	٣٩.١
L.S.D cult.	١.٨	1.8	٨.٦	٨.٩	٥.٤	٤.٥	١١.٤	٥.٧	٢.٩	٢.٩
Planting date	N.s	N.s	N.s	N.s	٢.٩	N.s	N.s	N.s	٢.٩	N.s
Interaction	٢.٦	2.5	12.2	١٢.٦	٧.٧	٦.٤	١٦.١	٨	٤.١	٤.١

cult×planting dat										

Table 2 shows significant differences between the two varieties used in this research. Shamus cultivar was superior in most of the studied traits for the year 2017 with values of 22.5 cm, 1215, 122 g, 110 g and 40.5% for the characteristics of diameter of the disc, number of seeds, plant yield, and grain weight for spring season. While the same varieties had values of 25, 1224, 124.5, 113.6 g and 42.8%, respectively were for the autumn season. the suitability of the cultivars for the environmental conditions of the seasons compared to the France hybrid species (which gave 20 cm, 984.2, 84 g and 79.5 g 38.3 % Of the above characteristics respectively for the autumn season while there were no significant differences of seasons for planting dates, this result agree with [10],[11].

Table 2: Averages of the studied traits for 201٧

Character / Caltivar.	discDiam. /cm		No. of seed		weight of 1000 grian /g		grain Yield ./g-1. Plant		Oil perc.%	
	Spr	Aut	Spr	Aut	Spr	aut	Spr	Aut	spr	aut
Shamus	22.5	٢٥	١٢١٥	١٢٢٤	١١٠	١١٣.٦	١٢٢	١٢٤.٥	٤٠.٥	٤٢.٨
Euroflor	١٨.٣	٢٠	٩٤٢.٥	٩٨٤.٢	٧٥.٨	٧٩.٥	٧٧.٣	٨٤	٣٥	٣٨.٣
L.S.D culti	١.٦	١.٢	٢٥	٢٢	٥.٥	٢.٦	٧.٨	١١.٢	١.٢	١.٢
Planting date	١.٦	١.٢	N.s	N.s	N.s	N.s	N.s	N.s	1.2	1.2
Interaction cult×planting dat	٢.٣	١.٧	٣٥.٤	٣١	٧.٨	٣.٧	١١	١٥.٩	١.٧	١.٧

Table 3 shows that the values of genetic variations were higher than that of the environmental variations for all studied traits. Values of diameter of disc, number of seeds, plant yield, grain weight, and oil percent were 5, 65292.3, 2016.6, 1352.3, and 60% for genetic variations values of compare to environmental variations which were 1.7, 37.4, 65. 1, 14.9, and 4.3respectively.These are few compared to genetic variance, which confirms the greater role of genetic variation because it has a relatively larger variance in phenotypic variation values of 6.7, 65329, 2018.2, 1366.3 and 64.3 for the above characteristics respectively for the spring season. Environmental variation of the autumn season, which indicates the positive role of genetic variation, because the differences genetics was desirable for plant breeding and when superior plant species were found to be superior in quality and productivity.

Difference between plants under single or controlled environmental conditions is expressed by genetic variance. Differences between plants with heterozygous and cultivated genotypes under different environmental conditions are known as environmental variance. The high value of heritability indicates the importance of genetic differences in heritability of each possibility of improving that genotype while the low value of heritability is either due to the non-incremental genetic effects of that characteristic or the large environmental effects of both [12]. Naturally, the low value of inheriting an attribute is reduced for the efficiency of the selection because it was difficult to predict or inferred from the shape phenotypic recipe on the genetic composition. The percentage of heritability was high for the studied traits,(98_99%) for the characteristics of the number of seeds and plant yield and weight of the grain for spring and autumn seasons, indicating the possibility of improving the characteristics of selection and continuation programs breeding and improvement of this crop and that the assessment of heritability in the broad sense can determine the contribution of both genetic and environmental effects in the appearance. It is therefore possible that the value of heritability was a measure to determine the relationship between parents, phenotypic variation coefficient is defined as the percentage of the standard deviation of the phenotypic variation of the characteristic on the general mean of that characteristic, whereas the genetic variation coefficient is defined as the percentage of the standard deviation of the genetic variation of the characteristic on the general mean of that characteristic.

According to the estimates of the difference between phenotypic and hereditary differences between the tribes in which the election takes place [13]. In the tribes with the large difference coefficient, the coefficient of genetic and phenotypic differences was confirmed. The researchers stressed the dimensions of these factors. When the less than 10% is low and 10-30% From 30% to be high for the plant value of 34.6 and 30.7 for the spring and autumn seasons, while the weight of grain ,the coefficient of phenotypic difference 32.9 and the coefficient of imbalance (32.7) for the spring season

while the average range for the rest of the traits ranged from 11 to 27, whereas the oil content for the autumn season was low at 9.5 and 8.5 for the phenotypic and genetic differences. The results were consistent with[13],[14],[15].

Table 3: Genetic, environmental and phenotypic variation of P.C.V%, G.C.V% and h2b.s for some characteristics of sunflower varieties for 2016.

Charac.	σ2g		σ2e		σ2P		P.C.V%		% G.C.V		h2 b.s%	
	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut
Diam.dis	5	7	1.7	1.6	6.7	8.6	12.5	11.3	11.5	10.4	٨٣	٨١
Num. of seed	65292.3	63601	37.4	39.8	65329	63640	27.2	1.4	11.5	20.7	٩٩	٩٩
weight of 1000 grian	2016.6	1659	65.1	16.4	2081.2	1675.4	34.6	30.7	30.7	34.7	٩٦	٩٩
Plant yield	1352.3	768.6	14.9	10.5	1366.3	779.1	32.9	24.9	32.7	24.7	٩٨	٩٨
Oil perc.	60	13.3	4.3	4.2	64.3	17.5	18.1	9.5	15.9	8.5	٩٣	٧٦

Table. 4 shows that the values of genetic variations are higher than the environmental variations values for all the studied traits. The characteristics of the diameter of the disk, number of seeds, plant yield, grain weight, oil ratio 16, 74151.3, 1985, 1162.3 and 30, compared to values of environmental variation which were 1.4, 314.1, 30.8 and 15. 5 and 0.75. These are few compared to genetic variance, which confirms the greater role of genetic variation because it has a relatively larger variance in phenotypic variation of at values 18, 74465.4, 2015.8, 11.77 and 30.75 respectively for the spring seasons, which shows the positive role of genetic variation, and the percentage of inheritance as the percentage of inheritance was a measure of the relationship between parents. The heritability is considered as the most important genetic features. Knowledge of any quantity as it was depends on its determination is the best way to cultivate an attribute for its improvement, and its assessment is important to determine the amount of genetic improvement expected. The results of the same table indicated the difference in the values of the genetic and phenotypic variation coefficient of the two seasons, where the coefficient of phenotypic and genetic variation were high for the traits of the plant and the weight of the grain was more than 30% and for the spring and autumn seasons while the average range for the rest of the traits ranged between 13-26% The possibility of adopting the two grades of the crop and weight of the grain as a criterion for the selection in breeding programs and improving sunflower .The results were consistent with results of [12],[16],[17].

Table 4: Genetic, environmental and phenotypic variation values of P.C.V%, G.C.V% and h2b.s for some characteristics of sunflower varieties for 2017

Qult.	σ2g		σ2e		σ2P		P.C.V%		% G.C.V		h2 b.s%	
	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut
Diam.dis	1.6	24.6	1.4	0.75	18	25.3	26	20	16	19.2	88	96
Num. of seed	74151.3	76002.3	314.1	245.3	74465.4	76247.6	22.3	22.7	22.3	22.4	99	99
weight of 1000 grian	1985	1619	30.8	63.4	2015.8	1682.4	36.6	33	36.4	32.4	98	96
Plant yield	1162.3	1166	15.5	3.4	11.77	1169.6	30.9	30	30.8	30.1	98	99
Oil perc.	30	30	0.75	0.77	30.75	30.77	13.7	13	13.5	13.7	97	97

Table 5 shows the values of the genetic correlations. A positive correlation was found between the yield, diameter of the disc, grain weight, oil ratio which recorded values of 0.90, 0.8 and 0.73, as well as a positive correlation between the oil percent, disc diameter and number of seeds which recorded values of 0.75 and 0.70 and the diameter of the disc -0.27 and the weight of the grain and seed number -0.10 for the spring season, while in the autumn season there was a positive correlation between the plant yield and the number of seeds of values of 0.90 and the weight of the grain and the plant yield 0.90, A negative correlation between the number of seeds and grain weight (-0.15). Genetic correlations was fond between traits pairs were useful in planning and evaluating breeding programs basis for more efficient breeding programs. In general, it was possible to say that genetic correlation describes the degree to which multiple genes that control a certain quantity attribute in multiple genes, which in turn controls the other quantitative properties or multiplicity of effects of multiple genes on the two levels. This results were consistent with result [3],[11],[18].

Table 6 shows significant correlation between yield and disc diameter (0.85) and between yield the number of seeds (0.90)and between the oil percent and the number of seeds (0.75), while there was negative and insignificant correlation between the weight of the grain and the diameter of the disk and the number of seeds(-0.25 and 0.15respectivly) for the spring season A significant correlation was found between the yield and diameter of the disk(0.90) and the weight of the grain and the yield of (0.78) and also between the oil percent and the number of seeds (0.77), while found a negative correlation was found between the weight of the grain and diameter of disc(-0.22). This results were consistent with results of [19]. [20].

Table 6 :Genetic correlations of the studied characters for two seasons 2017

Characters	Diam. Disc	N0.of seeds	Weight of grain	Plant yield	% 0il
Diam. disc	-	0.45	-0.25	0.85*	0.65
No.of seeds	0.55	-	-0.15	0.90*	0.75*
Weight of grain	-0.22	0.10	-	0.78	0.44
Plant yield	0.90*	0.78*	0.78*	-	0.77
Oil perc.	0.75	0.77*	-0.10	0.72	-

Results of Table 7 indicate differences between the values of the genetic result and the genetic stability values of the studied traits, exceeding the recommended limit of 85% for the diameter of the disc, the number of seeds, the weight of the grain and the percent of oil for Shamus variety. As for the French hybrid, the values of genetic stability and genetic result differed from 0.82 to 0.80 and 0.81 to 0.89 respectively and genotypes that are characterized by good performance under different environmental conditions. The results were consistent with results [20], [21].

Conclude current result performance and stability of the genotypes is desirable for its use in agriculture and its suitability to the environmental conditions in the country.

Table. 7: Values of genotypic resultant and genetic stability for studied cultivars

Cultivar \ Charac.		Shamus	euroflor
Diam. Of disc	Homeostasis	٠.٩٠	٠.٨٢
	G.R	٠.٨٥	٠.٨٠
Numb. Of seed	Homeostasis	٠.٩٥	٠.٨٨
	G.R	٠.٩١	٠.٨٦
Weight of grain	Homeostasis	٠.٩٢	٠.٨٩
	G.R	٠.٨٥	٠.٨٦
Plant yield	Homeostasis	٠.٩٣	٠.٨٧
	G.R	٠.٩٠	٠.٩٠
Oil perc.	Homeostasis	٠.٩٢	٠.٨٤
	G.R	٠.٩٠	٠.٨١

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