Study of stability and some genetic parameters of seven genotypes of wheat (*Triticum aestivum* L.)

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Abstract

A field experiment was conducted in Agricultural Research Center in Latifia / Ministry of Science and Technology (20 km) south of Baghdad for the seasons of 2012/2013 and 2013/2014 using seven genotypes of wheat are: M_8, M_9, M_{10}, M_{11}, M_{12}, Furat and Tamoz $_3$.

Using split plot with randomized complete block design (RCBD),with three replicates. Results show that there is significant differences for the most studied traits for Furat genotype included plant height, spikes number /m^2 and tillers number/m^2 with of 82.60 cm, 200.33, and 217.66 for the first season, and of 96.26 cm, 179.66 and 194.66 for second season respectively. Genotype M_9 was superior for yield 606.66 g /m^2 for the first season, while, in the second season genotype Furat which gave of 618.33 g/m^2. Genetic variation was greater than the environment variation for the most traits, indicating the greater role of genetic variation. The Heritability percentage was high for tillers number / plant and medium for the rest of the traits. The genotypic and phenotypic variation coefficient were the average values for the most traits while, the genetic yield was high for M_8, M_{12} and $Tmoz_3$ The M_{11}, M_{10} and M_8 genotypes were highest hemostasis for two environment .

Key words*:* wheat, genetic variation, genotype

Introduction

Bread wheat (*Triticum aestivum* L.) is one of the main grain crops in Iraq. For the purpose of evaluating the new genotypes, it is necessary to take care of them in different environments and compare their performance to the local genotype. The new genotypes must possess the high yield genes as well as other important traits. Which is acceptable to the farmer? On the other hand, it is not possible to distinguish between the agricultural methods used and the breeding program. The new classification, whether it is input or derived, will eventually be applied to the agricultural methods used, including the quantity of seed used. Space (i.e.) the number of spikes per unit area, one of the main components of the sum of grain in wheat (Rashid, 1989). In addition, it is Important to estimate the phenotypic, genetic, environmental, phenotypic, genetic, and genetic factors that are expected to be inherited. Which, determines the basis of the method of election used to improve the declared qualities, especially, the grain, as it achieves the increase in the result of a number of interrelated components, so the correlation coefficient between the sum and its components to direct and indirect effects by analyzing the path coefficient helps determine the influential main component holds grain which can be on the way to improve the status quotient of grain (Sardar, *et* al., 2006)and Yunis, *et* al., 1987).

It is important to take care of plant breeders when the introduction of new genotypes in the program of the performance of good growth under different environmental conditions and different qualities of the grain. Grain comes in the forefront of these qualities, the sum of complex quantitative qualities controlled by several genes, and the response of the genetic structures of environmental changes and this, is due to the non-stability of the characteristics of these structures when planted in different environmental conditions, which is an obstacle to determining the superiority of them. Therefore, estimating the interference between the genetic and environmental structures and determining the stability of the new structures are important criteria to be considered, therefore, the performance of the genotypes is tested in different agricultural sites and parameters. The variation of the genotype is given in the field unit for several years and under different agricultural parameters. It is important to determine the stability of the genotype and its performance in a wide range of different environments (Trethowan *et* al., 2012).

This study aims to: Evaluation of the performance of some new genotypes of wheat for two seasons to determine their adaptation to environmental conditions and to compare them with local varieties.

And evaluation some genotypic parameters such as phenotypic, genetic and environmental differences, phenotypic and heritability differences, inheritance and expected genotypic improvement in new genotypes, which are selected, and study the stability of genotypes and the genotypic outcome of the study seasons.

Materials and methods

This experiment was conducted in Agricultural Research Center in Latifia / Ministry of Science and Technology, which is located 20 k south of Baghdad for the seasons of 2012/2013 and 2013/2014. Seven genotypes of soft wheat were used and obtained from the above mentioned center, which M_8, M_9, M_{10}, M_{11}, M_{12}, Furat and Tamoz $_3$.

On the first of December of 2013 and 2014, agriculture was in lines of 2.5 m and the distance between the lines was 15 cm and the distance between the plants was 10 cm. Four lines of each genotype were planted using spilt plot with RCBD design with three replicates and added 180 kg/ha, from organic fertilizer during planting and 200 kg / ha. (urea 46% N) after planting with three batches. The studies were carried out on (10) plants taken randomly from the middle lines of each genotype. The study included the following characteristics: Number of tillers / plants, the length of the spike: from the base of the spike to the top of the spike without the measured sieve / cm.

Plant height: Plant lengths were measured at maturity from the surface of the soil to the top of the saplings without a sieve estimated by centimeters. Number of tillers /m^2, number of spike /m^2, grain yield: This is the product of the lines of the middle and was converted to a cloud / m^2. , biologic yield: calculated by plant weight with gm/m ^{2}. And Harvest index%: Calculated using the following equation mentioned before (Sharma, *et* al., 1987).

Harvest index= Economic yield /Biologic yield Weight of 1000 grain per grams.

Genetic analysis:

The analysis of phenotypic, genetic and environmental variance was estimated according to the method explained by (Walter, 1975).

$$\sigma_v{}^2 = \sigma_G{}^2 = \frac{Msg - Mse}{r}$$

$$\sigma_E{}^2 = Mse$$

$$\sigma_P{}^2 = \sigma_G{}^2 + \sigma_E{}^2$$

Heritability and Expected genetic advance

As estimated in the manner explained by (Hanson, *et* al., 1956) as follows:

$$H^2{}_{B.S} = \frac{\sigma_G{}^2}{\sigma_P{}^2} \times 100$$

$$G.A = K.H^2{}_{B.S}.\sigma_P$$

As:

K The intensity of the election is equal to 2.06 when electing 5% of the plants

The predicted genetic improvement was estimated in the way that it was explained (Kempthorme, 1969)

$$E.G.A = \frac{G.A}{X^{-}} \times 100$$

The predicted genetic improvement was estimated in the manner explained (Kempthorme, 1969)

$$E.G.A = \frac{G.A}{X^{-}} \times 100$$

Whereas:
E.G.A represents the expected genetic improvement as a percentage of the overall mean.
G. represents the expected genetic improvement
Represents the average character
The predicted genetic improvement was estimated in the manner explained (Kempthorme, 1969)

Determination of Phenotypic and Genotypic Different Coefficiens

The values of the phenotypic and hereditary differences were calculated according to the method explained by (Falconer, 1981) as follows:

$$P.C.V\% = \frac{\sigma_P}{X^{-}} \times 100$$

$$G.C.V\% = \frac{\sigma_G}{X^{-}} \times 100$$

As:
P.C.V Factor of phenotypic variation
G.C.V Genetic Variation Factor

Table (1) Number of tested genotypes and genealogies cultivated at the two seasons

NO.	Genotype	Origin
1	M_8	Pk2XDor85 hybrid
2	M_9	PK30X72
3	M_{10}	Tmoz 3 X PK30
4	M_{11}	Iraq X Tmoz3
5	M_{12}	PK2 X432 input
6	Furat	Registered and approved (salinity tolerant)
7	Tamoz $_3$	Registered and Approved (Salinity tolerant)

Results and Discussion:

From Table 2, there are significant differences between the genotypes in studied traits. Furat genotype exceeds the traits of the number of tillers /plant , the height of the plant , the number of spikes /$m^2$and the number of tillers/m^2 reached 34.56, 82.60, 200.33 and 217.66 of the above qualities respectively, while, the genotype $Tmoz_3$ exceeds for length spike ,yield, by giving 18.33 and cm,600g , Number of spikes/ m^2 , the number of tillers /plant ,spike number/m^2 and tillers number/m^2 was exceed M_{12} genotype reached 14.43,85.66,88.00 respectively, but the quality of the harvest index was higher than genotype $Tmoz_3$ reached 28% of these results are consistent with what he found (Reekie *et* al., 2002) and (Milken *et* al., 2008).

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Table (2) Performance of the genotypes for the season of 2012/2013

Genotype / Qualities	M_8	M_9	M_{10}	M_{11}	M_{12}	Furat	$Tmoz_3$	Mean	C.V	L.S.D
No. of tillers / plant	24.53	29.66	17.96	15.96	14.433	34.56	19.16	22.32	9.75	3.87
Length of the spike / cm	10.93	10.53	12.86	12.56	14.00	12.93	18.33	12.08	12.33	1.50
Plant height /cm	80.66	79.73	75.13	80.03	79.26	82.60	77.33	80.53	6.13	8.78
No. of spikes $/m_2$	15011	141.33	101.00	100.00	85.66	200.33	106.00	126.42	200.55	46.23
No. of tillers /spike m^2	168.0	160.00	104.33	104.33	88.00	217.66	115.33	136.57	21.24	51.62
Weight 1000 g	32.23	34.23	40.56	360.00	42.53	17.76	27.80	33.64	17.56	10.51
Yield G / m^2	420	606.66	460.00	360.00	486.66	293.33	600.00	450.95	28.91	200.3
bio. Yield g m^2	2000	2200	2010	1950	2300	1885	2115	2065.71	255.75	99.55
Harvesting index	21	27	22	18	21	15	28	21.71	7.65	6.14

Table 3 shows that there are significant differences in the second season for the studied traits, as the Furat genotype exceeded the height of the plant, number of spikes / m^2, number of tillers / m^2 and the harvest index, giving 96.26, 179.66, 194.66 and 27% respectively. M_9 with 30.66 tillers / plants, while M_{12} exceeded the length of the spike and the weight of the grain by giving 14.10 cm and 43.56 g.

Table (3) Performance of the genotypes for the season of 2013/2014

Genotype / Qualities	M_8	M_9	M_{10}	M_{11}	M_{12}	Furat	$Tmoz_3$	Mean	C.V	L.S.D
No. of tillers/ plant	24.53	29.66	17.96	15.96	14.433	34.56	19.16	22.32	9.75	3.87
Length of the spike / cm	10.93	10.53	12.86	12.56	14.00	12.93	18.33	12.08	12.33	1.50
Plant height / cm	80.66	79.73	75.13	80.03	79.26	82.60	77.33	80.53	6.13	8.78
No. of spikes / m^2	15011	141.33	101.00	100.00	85.66	200.33	106.00	126.42	200.55	46.23
No. of tillers /spike m^2	168.0	160.00	104.33	104.33	88.00	217.66	115.33	136.57	21.24	51.62
Weight 1000 g	32.23	34.23	40.56	360.00	42.53	17.76	27.80	33.64	17.56	10.51
Yield G / m^2	420	606.66	460.00	360.00	486.66	293.33	600.00	450.95	28.91	200.3
bio. Yield g m^2	2000	2200	2010	1950	2300	1885	2115	2065.71	255.75	99.55
Harvesting index	21	27	22	18	21	15	28	21.71	7.65	6.14

Table 4 shows the genotypic, environment and phenotypic values of the first season. The genetic variance was 56.49 for number of tillers / plant. The value of environmental variation was 4.73. This is a small comparison to the genetic variance, which confirms the greater role of genetic variation, because it has a relatively larger variance of 61.43, While, the length of the spike was 1.26, compared with the environmental variance of 2.21, indicating that the environmental variance was superior to the genetic variance by giving a greater percentage of phenotypic variation of 3.48. Pat 27.27 compared to the value of environmental variation, which amounted to 24.38 while, phenotypic variation was 51.64, as for the number of ears / m $_2$, the value of genetic variance is 1615.91 and the value of environmental variability is 675.31. These are few compared to genetic variance, which confirms the greater role of genetic variation because it is relatively larger compared to the descriptive variance of 2291.32. M 2 2072.76 For grain weight, the genetic variance was 76.85 and the environmental variance was 34.90 compared to the phenotypic variance of 111.75, the genetic variance was 13532.27 compared to 15387.30, which indicates the greater role of genetic variability of this characteristic. The variance of the phenotypic variance was 28919.59, whereas the biogenic yield exceeded 2025.15 compared with the genetic variance 1687.57. The harvest guide 1775.24 on environmental variability was 1385.35 because it is relatively larger compared to the phenotypic variation of 3160.59.The percentage of heritability in the broad sense was high for the number of tillers / plant was 92.28% while the number of tillers / m2 and the number of tillers / m 2 70.52 and 71.11% respectively, and decreased the length of spike and weight of the grain by 36.31% and 25.23% For plant height, yield, biologic yield and harvest index were 52.81, 46.76, 45.45 and 56.16%. The values of the phenotypic and genotypic variation coefficients of the studied traits, where these values varied within the single genotype for the seasons. Based on the ranges used by (Rashid, 1989), which are less than 10%, 10-30%, and more than 30% ranged between low, medium and high for all attributes and for both seasons. In the first season, the values of the phenotypic and hereditary differences were low for plant height and the genetic difference coefficient for the length of the spike and the biologic. The values of the genetic variation were medium for the weight of the grain, the grain yield and the harvest index. The values of the genetic and phenotypic differences were high for the number of tillers/ m^2 and the number of tillers/m^2 this is consistent with what was found by (Ibrahim *et* al., 2002) , (Peters *et* al., 2008)and Singh, and Chaudhary ,1985)

Table (4) Genetic, environmental and phenotypic varian's for season of 2012/2013

Varian's / Qualities	ɕ ^{2} E	ɕ ^{2} G	ɕ ^{2} P	P.C.V	G.C.V	H^2bs
Number of tillers / plant	4.733	56.694	61.432	35.110	33.729	92.288
Length of the spike / cm	2.219	1.265	3.484	15.450	9.310	36.314
Plant height / cm	24.386	27.274	51.642	8.923	6.435	52.815
Number of spikes / m^2	675.31	1615.915	2291.3	37.861	31.795	70.526
Number of tillers /spike m^2	841.96	2072.767	2914.735	39.531	33.336	71.113
Weight 1000 g	34.904	76.853	111.759	31.423	26.068	25.237
Yield G / m^2	15387.3	13532.27	28919.59	36.893	25.237	46.763
Bio. Yield g m^2	2025.15	1687.57	3712.72	17.97	8.16	45.45
Harvesting index	1385.35	1775.24	3160.59	14.55	14.69	56.16

Table 5 shows the genetic, environmental, and phenotypic values of the second season. The variance of the genetic variance was 65.69 for the number of tillers / plant. The value of the environmental variance was 37.93. This is a small comparison to the genetic variance, which confirms the greater role of genetic variability, because it has a relatively larger variance of 103.62 as for the length of the spike, it is noted that the value of the genetic variance was 2.39 compared to the environmental variance of 2.50 indicating that the environmental variation was superior to the genetic variance by giving a greater percentage of phenotypic variation of 4.89 while, the genetic variance of plant height was 45.25 compared to the environmental variation was 43.34 while, the phenotypic variation was 88.59 and the number spike /m^2 was observed. The value of the genetic variance was 1195.76 and the environmental variability was 1274.54 compared to the phenotypic variation of 2470.30. The genetic variance of the number of tillers / m 2 was 1444.36 and the weight of the grain was 86.64 and the environmental variance was 3.03 Compared to the descriptive variation of 89.68, the variance was 7425.30 compared to the environmental variability of 9529.76 while, the variance of the phenotype was 16955.19 whereas the biological yield exceeded 2314.25 compared with the germination of 1854.36 while, the genetic variance of the harvesting index was 1870.12 compared to the descriptive variance 3460.32.

The percentage of inheritance in the broad sense was high for the weight of the grain and the number of tillers/plant was 96.61 and 92.28%, respectively, while the characteristics of the number of spike /m^2 and the number of tillers / m^2 48.40% and decreased the length of the spike as it was 18.91% the biologic index and harvest index were 51.08, 43.79, 44.48 and 54.04%, respectively.

In the second season, the values of the genotypic difference coefficient were low for the height of the plant. The values of the genetic and phenotypic differences were medium for the length of the spike, the weight of the grain, the grain yield, the biologic yield and the harvest index, whereas the values of the genotypic and phenotypic differences were high for the number of tillers / plants. For the characteristics of the number of spike/m^2 and the number of tillers/ m^2 this is consistent with what was found by (Ibrahim, 2002) , (Milken *et* al.,2008) and (Trethowan *et* al., 2012).

Table (5) Genetic, environmental and phenotypic Varian's for season of 2013/2014

Varian's / Qualities	ς^2 E	ς^2 G	ς^2 P	P.C.V	G.C.V	H²bs
Number of tillers / plant	37.935	65.694	103.62	35.110	33.729	92.288
Length of the spike / cm	2.500	2.394	4.894	17.691	12.373	18.914
Plant height / cm	43.341	45.258	88.599	11.382	8.135	51082
No. of spikes / m^2	1274.540	1195.767	2470.30	41.000	28.520	48.400
No. of tillers / spike m^2	1424.246	1444.360	2868.600	42.030	29.825	48.400
Weight 1000 g	3.037	86.647	89.684	25.741	25.301	96.614
Yield G / m^2	9529.762	7425.300	16955.196	26.678	17.654	43.794
Bio. Yield g m^2	2314.25	1854.36	4168.71	19.59	8.71	44.48
Harvesting index	1590.20	1870.12	3460.32	15.43	8.34	54.04

Stability of genotypes is useful and desirable for extensive use in agriculture, and well-functioning genotypes are characterized under varying environmental conditions. The results of Table (6) indicate that there is a difference between the values of the genetic yield of the studied traits. It was found that there was a difference between the values of genetic stability and that the values of the genetic yield were high for M_8, M_{12} and July, 1.02 (1.0) (1.01) respectively, indicating that the genotypes behaved the same way. M_{11}, M_{10} and M_8 were highly stable by giving them 0.99, 0.987, and 0.985 respectively, indicating that these structures were suitable for the cultivated environments.(Rashid, 1989).

Table (6) Stability of genotypes and genetic outcome of the study seasons

Genotypes	E_1	E_2	$\bar{y}$	S^2	S	Hemostasis	G.H
M_8	1260	1235	1147.5	512.5	7.677	0.985	1.020
M_9	1820	1640	1730	5942.142	2437.65	0.400	0.486
M_{10}	1380	1355	1367.5	312.5	17.677	0.987	0.448
M_{11}	1080	1090	1085	50	7.071	0.993	0.758
M_{12}	1460	1570	1515	6050	77.78	0.948	1.008
Furat	880	1855	1367.5	475.3	347.577	0.746	0.714
$Tmoz_2$	1800	1505	1652.5	43512.5	208.6	0.873	1.013
Total	9680						
Grand mean							1423.57

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