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Study the Genetic Variance of Genotypes of Maize (Zea mays L.)

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Article Informations

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A B S T R A C T

The experiment was conducted in the fields of the College of Agriculture and Forestry University of Mosul for the autumn season 2022-2023, and Ten genotypes were used, namely (DR-F-53, MA-F-53, H-4, DKC-F-59, IK-58, ZP-595, POL-F-6, SYM-F-53, MY-F-53 and SYN-F-54) To study the genetic stability of genotypes of maize according and the experiment was a The Randomized Complete Block Design (R.C.B.D) was used with three replicates and the traits of studied (date of tasseling , date of silking , number of ears per plant , number of grains per ear , weight of 500 grains, single plant production) . The results showed that in terms of genetic, phenotypic and environmental variations, heritability in the broad sense, and the expected genetic improvement as a percentage, it was high for all genotypes and for all traits, and this gives an opportunity for selection for these superior traits.

Introduction

Maize is considered one of the important cereal crops in the world and comes in third place after wheat and rice. The cultivated area for the maize crop in Iraq for the year 2021 for the spring and autumn seasons amounted to about (325.9) thousand dunums, and the productivity reached (374.4) thousand tons. [1] maize is traits by its high ability to genetically adapt to a wide range of conditions and produce a high yield, as well as the qualitative specifications of its grains in terms of protein, fat and starch, and this all led to the success of maize globally [2]. One of the most important reasons that indicate the decrease in the cultivated area then the total production of the Maize crop in Iraq recently is instable of it prices from one season to another as a result of the unprogrammed import, which made the majority of farmers not interested in cultivating this crop . Moreover reduction of the cultivated area, as well as the decrease in the productivity rates per unit area as a result of the deterioration of the genetically cultivated varieties and genotypes due to the lack of genetic improvement processes for them, and the adoption of modern scientific methods in their cultivation, which led to the loss of many of its productive advantages in quantity and quality , Hence, for the purpose of advancing the crop and increasing its productivity per unit area, it was necessary to constantly find and provide new genotypes that are characterized by good specifications in terms of quantity and quality, which depend on the introduction of genetic materials from different sources and testing them under different environmental conditions to select the superior ones that respond and adapt to local environmental conditions. Therefore, its genetic evaluation is of particular importance in shedding light on guiding breeding programs to achieve the genetic improvement sought by plant breeders when the genetic information available on these genotypes is not sufficient [3].The estimation of the heritability of quantitative traits is one of the most important estimates that plant breeders were interested in, as it became clear that by estimating heritability in a broad sense, the contribution of both genetic and environmental influences to the appearance of the trait can be determined, and then the value of heritability can be a criterion for determining the relationship between parents and F1 . then the value of heritability can be a criterion for determining the relationship between parents and children. The important thing to know for any quantitative trait, as it depends on its evaluation to determine the best way to breed a trait to improve it

Its estimate is also important for determining the amount of expected genetic improvement, which is the largest application of the theory of quantitative inheritance in plant breeding and improvement programs [4]. Many researchers have studied genetic, phenotypic, environmental variance , heritability , and expected genetic improvement. Among these researchers are [5]. [6], [7], [8], and [9] . The aim of this study to estimate the genetic, phenotypic, environmental variations and heritability in the broad sense and the expected genetic improvement as a percentage.

Materials and methods .

In the experiment 10 genotypes of maize was obtaind from Dr. Mohammed Al-Falahi University of Duhok ((DR-F-53, MA-F-53, H-4, DKC-F-59, IK-58, ZP-595, POL-F-6, SYM-F-53, MY-F-53 and SYN-F-54) and the experiment was a The Randomized Complete Block Design (R.C.B.D) was used with three replicates . The experimental land was prepared by conducting two perpendicular ploughs with the dump plough, then the smoothing and leveling process was carried out and the area of the experimental unit consists of two lines the length of the line is 2 meters and the distance between one line and another 0.75 and three seeds were placed in each hole and was reduced to one seed and triple superphosphate fertilizer was added in the form of phosphorus pentoxide as a source of phosphorus and by 200 kg / ha all when planting Urea fertilizer (46% nitrogen) was used as a source of nitrogen by 400 kg / ha, and was added in two batches, the first when planting and the second after a month of planting according to the recommendations of the Ministry of Agriculture, the experiment was irrigated according to the need of the crop The maize stalk borer insect was controlled using the pesticide Malathion (50%) sprayed on all parts of the plant and twice, the first after 25 days of planting and the second after two weeks The crop was served according to [10]. The traits studied were date of tasseling , date of silking , the number of ears per plant, the number of grain per ear , the weight of 500 grains, and the single plant yield. **Statistical analysis**

The data obtained for the studied traits were analyzed according to the randomized complete block design [11] using Excel and SAS computer programs, and comparisons were made between the averages using Duncan's method.

Phenotypic,Genotypic and Environmental Variance

The value of genetic, environmental and phenotypic variation was estimated according to the method explained [12] as follows :

$$\sigma_E^2 = Mse \qquad \sigma_P^2 = \frac{Msg - Mse}{r} \qquad \sigma_G^2 =$$

$\sigma G2 + \sigma E2$

Whereas :-

Msg = mean squares of genotypes

Mse = Error

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

Heritability has been estimated in the broad sense in the manner shown by [13] and as follows

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

$H^2_{B.S}$ represents heritability in the broad sense, it represents genetic variation, and it represents the phenotypic variation of the trait. The ranges that [14] clarified

depended on the values of heritability in the broad sense, as it comes less than 40% and low, from 40-60% medium, more than 60% high, and the amount of expected genetic improvement is G.A. From the following equation:

As:

G.A is the expected genetic improvement and K is the intensity of selection, which is equal to 2.06 when selecting 5% of the plants Then H_2b.S heritability in the broad sense and σp of the phenotypic standard deviation of the trait were estimated. Then the expected genetic improvement (G.A%) was estimated as a percentage of the average trait ($\bar{X}$) in the manner explained by [15].

$$G.A\ \% = \frac{G.A}{\bar{X}} \times 100\ .$$

The ranges proposed by [16] were adopted for the limits of expected genetic improvement, which are less than (10%) low and between (10-30%) medium and more than (30%) high.

Results and discussion

The results in table (1) indicates that the genotypes were all significant and for all traits, the date of tasseling , date of silking, the number of ears, the number of grains per ear, the weight of 500 grains, and single plant production this is agree with [8] and [9].

The results of Table No. (2) indicate the superiority of the genotype (MY-F-53) in the traits of the date of tasseling, date of silking, and the weight of 500 grains. This is consistent with [17], [18] . And the genotype (MA-F-53) excelled in the traits of the number of ears and its value was (2.677), and this agrees with [19], [18]. The genotype (DKC-F-59) was superior in the trait of the number of grains per ear, and its value was (695.593 grains), and the genotype (DR-F-53) was superior in the trait of single plant production and its value was (293.971 g). This is agree with [20], [19]. It is clear from the above that the genotype is superior (MY-F-53), and it is recommended to use the genotype in future breeding programs.

genotype (DR-F-53) was superior in the trait of single plant production and its value was (293.971 g). This is agree with [20], [19]. It is clear from the above that the genotype is superior (MY-F-53), and it is recommended to use the genotype in future breeding programs.

Table (3) shows that the components of genetic, phenotypic and environmental variance were significant for all studied traits, and this is agree with [5], [21] and [22]. This discrepancy between the combinations gives an opportunity for selection for these superior traits.

The results in table (4) indicate that the values of heritability in the broad sense were high for all the studied traits, and this is consistent with what was mentioned by [23], [6] .

References

[1] Central Bureau of Statistics, (2021).Ministry of Planning and Development Cooperation, Directorate of Agricultural Statistics, Iraq.

[2] Lee, H, .and Z.H. Zhang.(2016). Maize (*Zea mays* L.) Hi-II Transformation via Agrobacterium-Mediated T-DNA Transfer. Current Protocols in *Plant Biology* 1:121-137.

[3] Al-Kamr, Majed Khalif (1999). Horticultural plant breeding. *Dar Al-Khaleej* Library - Amman – Jordan

[4] Allard, R.W. (1960). Principles of Plant Breeding. John willey and Sons. Inc. New York , USA.

[5] Al-Badrany, Qusay Amer Yousef (2020) Study of Federal Potential, Genetic Action and Hybrid Vigor in Single Crosses of Maize (*Zea mays L.),* Master Thesis. Department of ring crops, College of Agriculture and Forestry, University of Mosul, Iraq.

[6] Amiri , Ahmed Muhammad Jassim (2021). Detection of non-allelic overlaps by analyzing the average generations of worker crosses in maize at different locations. PhD thesis, College of Agricultural Engineering, University of Baghdad .

[7] Hussein, Shaimaa Yahya Hussein (2022). Evaluation of the genetic behavior of strains of maize and their individual hybrids at different levels of nitrogen fertilization. PhD thesis. College of Agriculture and Forestry - University of Mosul.

[8] Amegbor, I.K., Van-Biljon, A. Shargie, N., Tarekegne, A.,and Labuschagne, M.T.(2022). Heritability and associations among grain yield and quality traits in quality protein Maize (QPM) and Non-QPMHybrids. Plants, 11(713), 1-17.

[9] Rasheed,Weam Yahya (2023) Genetic behavior of genotypes of maize (Zea mays L.) at different plant densities. Ph D thesis. University of Al Mosul . College of Agriculture and Forestry.

[10] Al-Younis, Abdul Hamid Ahmed Mahfouz Abdul Qadir and Zaki Abdul Yas (1987). Grain crops . Dar Al-Kutub for Printing and Publishing. University of Mosul. Iraq.

[11] Al-Rawi, Khasha'a Mahmoud and Abdul-Aziz Muhammad Khalaf Allah (2000). Design and analysis of agricultural experiments. Mosul University - Ministry of Higher Education and Scientific Research - Dar Al-Kutub for Printing and Publishing / Iraq.

[12] Walter , A.B (1975) Manual of quantitative genetic (3rd edition) Washington state Univ. press . U.S.A .

[13] Hanson ,C.H,H.F. Roubunson and Comestok .(1956) . Biometerical Studies of yeild in segar gating population of Koven Lespedeza . Agron . J . 48:268-272.

[14] Ali, Abdo Al-Kamel Abdullah (1999) Hybrid Vigor and Genetic Action in Maize (Zea mays L.), PhD thesis. Field crops department. College of Agriculture and Forestry, University of Mosul. P:45.

[15] Kempthorne, O. (1969). An introduction to Genetic Statistics. Iowa State University Press, Ames.

[16] Agarwal, V. & Ahmad, Z. (1982). Heritability and genetic advance intricate. Indian Journal Agriculture Research, 16, 19-23.

[17] Saeed, Haitham Abdel Sattar, Aziz Hamed Majeed, and Aziz Saadoun Shalal. (2023) Hybrid strength and the ability to combine yield components in some single crosses of Maize (Zea mays L.). Syrian Journal of Agricultural Research, Volume (10), Issue (1), 2023.

[18] Marina F e Silva, Gabriel M Macie, Rafael R Finzi, Joicy Vitoria M Peixoto, Wender S Rezende, Renata Castoldi . 2020 . Selection indexes for agronomic and chemical traits in segregating sweet corn populations . segregating sweet corn populations. Horticultura Brasileira 38: 71-77.

[19] Younis, Salem Abdullah and Al-Hassan, Abbas Mahdi (2018) The effect of planting dates on the growth characteristics and yield of silage and grain of Maize (Zea mays L.), Al-Rafidain Agriculture Journal, 46 (1).

[20] Al-Baaj, Razzaq Abdulrab Jaafar and Hassoun, Kazem Mohammed (2017). Effect of planting date and intensity on yield and components of three hybrids in maize. Al-Furat Agricultural Journal 9(4):210-223.

[21] Luji, Mohamed Abdullah Idan (2021) Evaluating the performance of several synthetic cultivars of maize and estimating some of their genetic features by varying several levels of humic acid. Master Thesis. College of Agriculture - University of Tikrit.

[22] Alou, Saja Abbas Abdel-Jabbar (2022) Estimation of some genetic parameters of genotypes of Maize (Zea mays L.) at different planting dates.

[23] Latheeth, H. R. and A. M. Kazem. (2016). Study of epistasis gene action using triple test cross procedure in maize.Karbla J.agric.sci. 12 (4) : 192 - 201.

Table 1. Analysis of variance table

s.o.v	d.f	Date of Tasseling	Date of Silking	Number of ears per plant	number of grains per ear	Wight of 500 Seeds (gm)	Single plant yield (gm)
Replicate	2	0.151	0.196	0.040	39.562	0.321	0.0452
Genotypes	9	** 25.245	** 28.039	** 0.178	** 20320.006	** 337.416	** 6088.913
Error	18	0.115	0.131	0.0061	38.586	0.325	0.368

Table 2. Averages of traits in maize

Genotype	Date of tasseling	Date of silking	Number of ears per plant	Number of grains per ear	Weight of 500 seed (gm)	Single plant yield (gm)
DR-F-53	49.777 a	57.039 d	2.5390 a	652.518 a	142.918 c	293.971 a
MA-F-53	47.89 f	54.4780 e	2.677 a	629.796 a	129.93 f	256.301 c
H-4	53.452 b	59.133 b	2.116 cd	599.914 c	126.607 g	199.574 e
DKC-F-59	48.1423 f	53.072 f	2.311 b	659.593 a	131.770 e	194.411 f
IK-58	49.283 de	54.411 e	2.178 b c	506.297 f	136.365 d	169.494 h
ZP-595	55.312 a	58.219 c	2.594 a	551.093 e	131.450 e	202.800 d
POL-F-6	51.342 c	57.031 d	2.544 b	561.982 d	142.998 c	263.805 b
SYM-F-53	51.251 c	60.491 a	2.033 d	594.991 c	127.160 g	166.793 i
MY-F-53	45.239 g	50.288 g	2.022 d	621.666 b	159.249 a	256.862 c
SYN-F-54	48.923 e	57.086 d	2.266 b	384.870 g	148.756 b	181.652 g
Average	50.061	56.124	2.328	576.272	137.720	218.566

Table 3. Phenotypic,Genotypic and Environmental Variance

Variance / Traits	Genotypic	Phenotypic	Environmental
Date of tasseling	8.377 ± 3.588	8.492 ± 2.311	0.115 ± 0.036
Date of silking	9.303 ± 3.985	9.434 ± 2.568	0.131 ± 0.041
Number of ears per plant	0.058 ± 0.025	0.064 ± 0.017	0.006 ± 0.002
Number of grains per ear	6760.473 ± 2888.163	6799.059 ± 1850.470	38.586 ± 12.202
Weight of 500 seed (gm)	112.364 ± 47.958	112.689 ± 30.670	0.325 ± 0.103
Single of plant yield (gm)	2029.515 ± 865.440	2029.883 ± 552.464	0.368 ± 0.116

Table 4. Heritability broad sense and genetic advance and expected genetic advance

Traits	broad sense heritability	Expected genetic advance	expected genetic advance as mean
Date of tasseling	0.986	5.922	11.829
Date of silking	0.986	6.239	11.117
Number of ears per plant	0.904	0.470	20.175
Number of grains per ear	0.994	168.896	29.308
Weight of 500 seed(gm)	0.997	21.805	15.833
Single of plant yield (gm)	0.999	92.795	42.456