Selection of Parameters (Heritability, Expected Genetic Advance, Correlations and Genetic Variances) For Introduced Hybrids of Maize Zea Mays L.

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Abstract

A factorial experiment was conducted in Kirkuk governorate, in which six introduced hybrids (DK 6050, Gimbson, ZP707, ZP6263, Saganto, Glorya) were used, purchased from local markets, and four chemical herbicides (Turkish Nicosulfuron, Rimsulfuron, Atrazine 80%, Nicosulfuron Chinese), as well as a comparison treatment that was purchased from the different original to study growth traits and yield its compound, the effect of each cross, estimation of variances, coefficients of variation, heritability, expected genetic improvement, genetic, environmental and phenotypic correlations for the of herbicides. The results showed that there were significant differences between hybrids in all traits except for the number of grains per ear, index of harvest, and selling %. The highest hybrid ZP707 was in the traits of plant height, ear leaf area, number of ear per plant, ear length, number of grains per row, number of grains per row, ear weight, biological yield, harvest index and grain yield per plants, as it reached 183.03, 412.00, 1.14, 19.18, 36.97, 568.86, 221.27, 368.39, 59.85 and 205.45, respectively. The genetic correlation of grain yield plant was significant with all traits except for the number of leaves per plant, weight of 300 grains, selling %, protein %, and hectoliter, which amounted to -0.406, -0.385, -1.231, -0.466, -0.546 and -0.807 respectively. The phenotypic correlation of grain yield per plant was significant with all traits except for the number of leaves per plant, the weight of 300 grains, selling %, protein %, and hectoliter, as it amounted to -0.401, -0.332, -0.652, -0.424, -0.514 and -0.652, some of them were not significant and other Negative significant. The environmental correlation of grain yield with the plant was significant with some characteristics such as ear leaf area, number of ears per plant, number of rows per ear, ear weight, and biological yield, which amounted to 0.746, 0.555, 0.542, 0.663, and 0.509, respectively. The highest genetic and phenotypic difference coefficient for a number of grains per ear was 13.80 and 14.37, and the heritability was high in all traits except harvest index and grain yield per plant, which was medium, amounting to 40.15 and 50.35, and selling % and protein % was low, which reached 14.60 and 35.46 respectively, and highest expected genetic improvement for a number of grains per ear was 27.31.

Keyword: Maize, Hybrids, Correlation, Heritability, Expect genetic advance.

1. Introduction

The maize (Zea mays L.) is a cereal crop of great economic importance and is widely cultivated in the world and ranks third after wheat and rice in terms of global area and production [1]. It is used in the flour and starch industry and as whole seeds in food appetizers and green parts as animal feed in addition to its high production capacity and its adaptability to different environmental conditions and the possibility of planting it in more than one season [2].

The chemical control of the bush using herbicides is one of the necessary and effective applications to control the effect of the bush on crop productivity [3]. Many studies and research confirmed that although maize plants are characterized by their rapid growth and large size, they are greatly affected by the competition of the bush and do not Especially in the early stages of its growth, but in the later stages, it shades many types of bushes accompanying it due to the nature of its growth, which leads to a decrease in the bush's competition with it, especially annuals [4].

Variations are the breeder's basic material on which improvement of quantitative traits is based in terms of productivity and quality, and that the components of variance are important in estimating the coefficients of phenotypic and genetic variation, as well as the percentage of heritability in the broad sense. The correlation between these traits and the adoption of those traits that are related to the outcome in selection [5].
2. Material and Methods

The experiment was conducted in Kirkuk Governorate for the fall season 2020 (33°19'27".1 North, 44°14'13".1 East) The study included two factors first: Six hybrids introduced from local markets (DK 6050, Gimbson, ZP707, ZP6263, Saganto, Glorya) and the second: four chemical herbicides (Turkish Nicosulfuron, Rimsulfuron, Atrazine 80%, Nicosulfuron Chinese) in addition to the Control that were purchased from the commercial markets. Where the experiment was carried out as a factorial experiment using RCBD with three repetitions, and soil service operations were carried out from plowing, smoothing, and leveling, then the experimental land was divided into experimental units, numbering in one replicate (30) experimental units, another experiment unit content four lines, one and another (0.75 m) and between the hole and another (0.20 m) and 2-3 seeds were placed in the hole and then dimmed to one plant after a week of germination, triple superphosphate fertilizer P2 O5 was added as a source of phosphorous by 200 kg ha-1, all when planting, and urea fertilizer (46% nitrogen) as a nitrogen source by 200 kg ha-1, where In two once, the first at planting and the second after a month of planting, the seeds of maize hybrids were planted in the autumn season on 24/7/2020 and harvested on 11/26/2022.

The data of traits study were collected and analyzed statistically and genetically, where the genetic variances and phenotypes were estimated by mean of the squares for the genotypes, analysis of the covariance between traits and the analysis of each of the traits under study, genetic, phenotypes, and environmental correlation coefficients were estimated (rG), environmental (rE) and phenotypic (rP) between traits according to equations genetic correlation, phenotypic correlation and environmental correlation. The values of heritability were expressed according to the limits mentioned by [6], which are less than (30%) low, (30-60%) medium, more than (60%) high, While the values of the coefficients of variation were expressed according to [7], represented by less than (10%) low, (10-20%) medium, more than (20%) high. The limits of the expected genetic improvement were adopted according to [8], which are less than (10%) low, (10-30%) medium, and more than (30%) high, as according to the equations: \[
\sigma_G^2 = \frac{(Mse - Mse)}{3}, \quad \sigma_E^2 = \frac{Mse}{\text{d.f}}, \quad \sigma_P^2 = \sigma_G^2 + \sigma_E^2, \quad r_G = \frac{\sigma_{G/E}}{\sqrt{\sigma_G^2 \cdot \sigma_E^2}}, \quad \Delta G = h^2 b.sicp.
\]

\[\Delta G\% = \left(\frac{\Delta G}{\bar{y}}\right) \times 100\]. The averages were tested according to Duncan's multiple tests under a significant level of 0.05, the averages that carry similar letters of the alphabet do not differ from each other significant [9]. Computer programs were used, including (SAS, EXCEL, Opstat)

3. Result and Dissection

Table (1) shows the analysis of variance for the hybrids as an average of the herbicides used. It is noted that the hybrids were significant for all the studied traits except for the number of ears per plant, harvest index, and percentage of selling. This difference may be due to the difference of the hybrids in their genetic nature [6-14], and, they found significant differences between the camels for most of the studied traits.

Table 1. Analysis of variance of Hybrids according to Herbicides for studied traits.

| Source of variation | d.f | Tassling | No. of leaves | plant height | ear leaf area | ear weight | 300 grain weight | Biological yield index | Harvest index | ear length | ear diameter |
|---------------------|-----|----------|---------------|--------------|--------------|------------|-----------------|------------------------|--------------|------------|-------------|
| Replicate           | 2   | 1.81     | 1.04          | 520.94       | 1997.47      | 0.001      | 2.88            | 0.06                   |              |            |             |
| Hybrids             | 5   | 18.93**  | 1.26**        | 79.24**      | 1750.95**    | 0.009      | 2.71**          | 0.08**                 |              |            |             |
| Error               | 10  | 0.084    | 0.029         | 3.732        | 89.20        | 0.0005     | 0.043           | 0.003                  |              |            |             |
| Source of variation | d.f | No. of rows | No. of grain | No. of grain | ear weight | 300 grain weight | Biological yield index | Harvest index | ear length | ear diameter |
| Replicate           | 2   | 1.785    | 49.43         | 21050.43     | 1699.86     | 234.62     | 10629.75        | 42.51                   |              |            |             |
| Hybrids             | 5   | 6.59**   | 17.24**       | 14286.11**   | 975.63**    | 178.94**   | 2601.59**       | 24.70                   |              |            |             |
| Error               | 10  | 0.051    | 0.72          | 388.82       | 21.25       | 5.86       | 863.57          | 16.32                   |              |            |             |
| Source of variation | d.f | selling % | Protein %     | Hectoliter weight | Oil % | grain yield per plant | |
| Replicate           | 2   | 11.03    | 2.39          | 3.99         | 0.21       | 1208.29     |              |            |             |
| Hybrids             | 5   | 17.31    | 1.84**        | 0.47**       | 0.03**     | 1048.09**   |              |            |             |
| Error               | 10  | 6.53     | 0.04          | 0.03         | 0.009      | 33.55       |              |            |             |
Table 2 shows the average values of the hybrids depending on the average of the herbicides used, it is noted that in the tassling trait, the hybrid DK 6050 superior the hybrid DK 6050 by giving the lowest number of days amounted to 53.53, while hybrid ZP707 gave the most number of days tassling reached 59.00, a number of leaves, the hybrid Glorya, which gave 14.04 leaves, did not differ significantly from the ZP6263 and Saganto hybrids, and the lowest hybrid was DK 6050, which gave 12.44 leaves, and the rest of hybrids took values between two averages, plant height, the hybrid ZP707 superior with an average of 183.03, in contrast to the hybrid Zp6263, which gave the lowest height of 168.14. The ear leaf area, hybrids ZP707 and Gimbson, which amounted to 412.00 and 408.98 respectively, outperformed, while the lowest hybrids were in the area of the hybrid ear leaf DK 6050, which averaged 354.20, number of ears, the hybrid ZP707 outperformed the rest of the hybrids, with an average of 1.14, ear length, the hybrid ZP707 was the lengths, which gave an average of 19.18, in contrast to the hybrid Zp6263, which gave an average of 16.47, and the rest crosses were taken with a difference between the highest and lowest value. The diameter of the ear, the Gimbson hybrid was superior to an average of 5.16, in contrast to the hybrid Glorya, which gave the lowest ear diameter of 4.71, number of rows per ear, the hybrid Gimbson outperformed it, as it reached 16.93, in contrast to the hybrid Glorya, which gave the lowest number of rows, which amounted to 12.91, a number of grains per row, the hybrid ZP707 was significantly outperformed by an average of 36.97, compared to the hybrid DK 6050 with an average of 29.91, and the rest crosses were taken with a difference between highest and the lowest value, number of grains per ear, the Gimbson hybrid outperformed with an average of 592.61, which did not differ significantly from the ZP707 hybrid, unlike other hybrids, ear weight was significantly superior to the hybrid ZP707 with an average of 221.27, which did not differ significantly from the Gimbson hybrid, in contrast to the Saganto hybrid, which took the lowest average of 175.96. With the weight of 300 grains, the hybrid Glorya outperformed it, giving it an average of 119.04, in contrast to the hybrid Glorya, which gave the lowest ear diameter of 4.71, number of rows per ear, the hybrid Gimbson outperformed it, giving it an average of 19.18, in contrast to the hybrid ZP707, which took the lowest average of 175.96, in contrast to the hybrid ZP707, which took the lowest average of 175.96, oil %, the Saganto hybrid surpassed it with an average of 96.40, biological yield, the hybrid ZP707 was significantly superior with an average of 349.83 ab, compared to the hybrid DK 6050, which gave 345.08 b, in contrast to the hybrid Glorya, which gave 346.70 b, harvest index, the hybrid ZP707 was significantly superior with an average of 53.53, in contrast to the Saganto hybrid, which took the lowest average of 53.53.

Table 2. Mean of Hybrids according to mean herbicides for all traits.

| Traits                  | DK 6050 | Gimbson | ZP707 | ZP6263 | Saganto | Glorya |
|-------------------------|---------|---------|-------|--------|---------|--------|
| Tassling                | 53.53 d | 55.20 c | 59.00 a | 52.20 e | 57.53 b | 54.86 c |
| No. of leaves           | 12.44 c | 13.42 b | 12.74 c | 13.88 a | 13.72 ab | 14.04 a |
| Plant height            | 174.44 c| 178.47 b| 183.03 a| 168.14 d| 178.85 b| 179.24 b|
| Ear leaf area           | 354.20 c| 408.98 a| 412.00 a| 363.16 bc| 377.68 b| 396.66 a|
| No. of ear per plant    | 1.00 b  | 1.00 b  | 1.14 a  | 1.00 b  | 1.01 b  | 1.00 b  |
| Ear length              | 17.32 c | 17.27 c | 19.18 a | 16.47 d | 16.79 d | 17.74 b |
| Ear diameter            | 4.79 cd | 5.16 a  | 4.99 b  | 4.82 c  | 4.80 cd | 4.71 d  |
| No. of rows per ear     | 15.26 b | 16.93 a | 15.33 b | 13.57 c | 13.79 c | 12.91 d |
| No. of grain per row    | 29.91 d | 35.07 b | 36.97 a | 33.59 bc| 32.34 c | 33.47 bc|
| No. of grain per ear    | 459.08 b| 592.61 a| 568.86 a| 456.87 b| 446.70 b| 433.55 b|
| Ear weight              | 182.243 cd| 214.16 a| 221.27 a| 188.00 bc| 175.96 d| 194.39 b|
| 300 grain weight        | 111.39 b| 96.40 c | 111.58 b| 114.65 ab| 113.60 b| 119.04 a|
| Biological yield        | 304.57 b| 349.83 ab| 368.39 a| 310.68 b| 295.49 b| 305.41 b|
| Harvest index           | 54.05 a | 52.68 a | 59.85 a | 52.97 a | 52.41 a | 56.09 a |
| Selling %               | 88.54 a | 85.03 ab| 81.56 a | 87.05 a | 86.79 a | 86.35 a |
| Protein %               | 5.23 c  | 5.42 c  | 5.59 c  | 6.71 b  | 6.54 b  | 7.12 a  |
| Hectoliter weight       | 75.14 a | 74.54 bc| 74.39 c | 74.80 b | 74.60 bc| 75.43 a |
| Oil %                   | 3.18 b  | 3.24 b  | 3.12 b  | 3.38 a  | 3.41 a  | 3.30 ab  |
| Grain yield per plant   | 161.54 cd| 183.29 b| 205.45 a| 163.55 cd| 154.71 d| 167.19 c|

Table (3) showed the genetic correlation coefficients between the studied traits, and there was a significant genetic correlation for a tassling with plant height, ear leaf area, number of ear per plant, ear length, biological yield, harvest index, the number of grains per row and grain yield per plant, while with the rest of traits it did not significant and others were negative. Number of leaves trait, the genetic correlation was significant with the protein% and oil %, while with the rest of the traits it did not
significant limits and some were negative, plant height, the correlation was significant with ear leaf area, the number of ear per plant, ear length, and harvest index, number of grains per row, ear weight, biological yield, and grain yield per plant, the of ear leaf area, it was significant with ear length, ear diameter, number of grains per row and ear, ear weight, biological yield, harvest index, grain yield per plant, and number of leaves per plant, number of ear per plant, the genetic correlation was significant with ear length, number of grains per row, the weight of ear, the biological yield and harvest index, and the grain yield per plant, number of grains per ear, and rest of traits did not other significant were negative, ear length, the genetic correlation was significant with a number of grains per row, ear weight, biological yield, harvest index, and grain yield per plant, the number of grains per ear, and with rest traits, it did not significant, and other was significant negative. Ear diameter, the genetic correlation was significant with a number of grains per ear, biological yield, ear weight and grain yield per plant, and rest traits did not significant, and other was significant negative, a number of rows per ear, the correlation was significant with the number of grains per ear, biological yield, ear weight and grain yield per plant, while with rest traits did not significant, and some of the others were significant negative, the number of grains per row, it was significant with a number of grains per ear, biological yield, harvest index, and grain yield per plant, while with rest of traits did not significant, and with other was negative, the number of grains per ear weight was significant with biological yield, harvest index, grain yield per plant while with rest of traits were negative.

The number of ear per plant, correlation was significant with protein % and biological yield, the biological yield genetic correlation was significant with harvest index and grain yield per plant, harvest index correlation was significant with grain yield per plant, the selling % of yield was significant with hectoliter and oil %, the protein % was significant with oil %, and rest did not significant between the traits and other were negative. This result agree with [15-17], they found a desirable and significant genetic correlation of yield traits with most of the studied traits. We conclude from the previous results the yield of grains increased from the traits with which they are positively and highly significant, as the plant breeder can choose for two traits together because the genetic correlation between two traits represents their educational values between the two traits, as the selection for one of them means the selection for the other trait.

Table (4) shows the phenotypic correlation coefficients between the studied traits, and there was a significant phenotypic correlation of flowering trait with plant height, ear leaf area, number of ear per plant, ear length, number of grains per row, and grain yield per plant, the rest of traits did not significant or were negative significant, number of leaves trait, the phenotypic correlation was significant with the protein % and oil %, the rest of traits it did not significant or other was negative significant, plant height, the correlation was significant with the area of ear leaf, number of ear per plant, ear length, number of grains per row, ear weight and grain yield per plant, the ear leaf area, it was significant with ear length, number of grains per row, number of grains per ear, ear weight, biological yield, the yield of grains per plant, number of ear per plant, ear diameter and with the rest traits, some not significant and some are negative significant.

The number of ear per plant, correlation was significant with ear weight, number of grains per row, ear weight, biological yield, yield of grains per plant, number of grains per ear, the rest traits did not significant, and other was negative significant, ear length correlation was significant with number of grains per row, number of grains per ear, ear weight, biological yield, harvest index, and grain yield per plant, ear diameter the correlation was significant with number of grains per ear, ear weight, biological yield and grain yield per plant, the rest traits did not significant other were negative significant, number of rows per ear correlation was significant with number of grains per ear, ear weight, biological yield and yield of grains per plant, the traits rest did not significant and the others were negative significant, number of grains per row, it was significant with number of grains per ear, ear weight, biological yield, and grain yield per plant and the traits rest did not significant and other traits were negative significant.

The number of grains per ear was significant with ear weight, biological yield, and grain yield per plant and the rest of the traits did not significant, while the other characters were negative significant, ear weight the correlation was significant with biological yield and grain yield per plant, and with the traits, rest did not significant, and other was negative significant, the trait of the weight of 300 grains, the correlation was significant with protein % and hectoliter, while biological yield was significant with a yield of grains per plant, and the rest did not reach the significant limits between the traits and the other ones were negative. This result agrees with [15-18], they found a desirable and significant phenotypic correlation of yield traits with most of the studied traits.

The phenotypes appearance of a trait is nothing but the interaction of genotypes or genetic genes with environmental factors, and that the phenotypic correlation between two traits is nothing but a correlation between the effects of gene and environmental factors, as the efficiency of selection depends on the nature of the relationship between the selected traits. An increase in a specific trait may be followed by an increase or decrease in the rest of the other traits, that is, the relationship may be direct or inverse, depending on the genetic behavior of the genes of those traits.
### Table 3. Genetic correlation coefficients of hybrids as mean herbicides for traits studied.

|          | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 1        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 2        | 0.216 | NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3        | 0.906+ | NS | 0.231+ | NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4        | 0.667-0.103+0.805+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 5        | 0.777-0.462+0.615+0.566+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 6        | 0.680-0.496-0.790-0.677-0.892+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 7        | 0.300NS+0.300+0.628+0.382NS+0.293NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 8        | 0.182NS+0.257NS+0.352NS+0.245NS+0.263NS+0.906+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 9        | 0.544+0.999+0.471+0.887+0.731-0.625+0.640+0.258NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 10       | 0.423NS+0.399NS+0.430NS+0.715+0.561+0.521+0.991+0.863+0.712+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 11       | 0.427NS+0.245+0.530+0.853+0.679+0.748+0.790+0.589+0.884+0.888+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 12       | 0.061NS+0.283NS+0.147NS+0.395NS+0.009NS+0.030NS | 0.969+0.943+0.270NS+0.823+0.823-0.513 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 13       | 0.406NS+0.728NS+0.865NS+0.351NS+0.327NS-0.570+0.360NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 14       | 0.557+0.925+0.850+0.896+1.005+0.811+0.976+1.097+1.140+0.662+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 15       | 1.187+0.879+1.646+1.626+0.076NS+0.021NS+1.226+1.657+1.127+0.406NS+1.855+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 16       | 0.331NS+0.030NS+0.807NS+0.422NS+0.142NS+1.142+0.904+1.072+0.225NS+1.163+2.398+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 17       | 0.171NS+0.754+0.854+0.921+0.045NS+0.698+0.424NS+0.716+0.754+0.012NS+0.360NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 18       | 0.557+0.857+0.214NS+0.754+0.560+0.634+0.759+0.481+0.560+0.759+0.163NS+0.809NS+0.434NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 19       | 0.344NS+0.978+0.487+0.352NS+0.698+0.946+0.402NS+0.684+0.263NS+0.639+0.728+0.396NS | 0.799+1.572+0.816+0.908+0.105NS |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 20       | 0.585+0.406NS+0.585+0.777+0.865+0.868+0.692+0.540+0.881+0.853+0.967+0.385NS+1.146+1.272+1.231+0.466NS+0.546+0.807+ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

(1) Tassling 50%, (2) No. of leaves, (3) plant height, (4) ear leaf area, (5) No. of ear per plant, (6) ear length, (7) ear diameter, (8) No. of rows per ear, (9) No. of grain per row, (10) No. of grain per ear, (11) ear weight, (12) 300 grain weight, (13) Biological yield, (14) Harvest index, (15) selling %, (16) Protein %, (17) Hectoliter weight, (18) Oil %, (19) grain yield per plant.
### Table 4. Phenotypic correlation coefficients of hybrids as mean herbicides for traits studied.

|   | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 13    | 14    | 15    | 16    | 17    | 18    |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 0.221 | -     | -     | 0.855 | 0.203 | -     | 0.626 | 0.064 | 0.731 | **    | 0.732 | **    | 0.667 | **    | 0.269 | **    | 0.180 | 0.327 | 0.398 |
| 2 | 0.358 | 0.448 | 0.332 | 0.601 | 0.748 | 0.265 | 0.627 | 0.347 | 0.541 | 0.231 | 0.253 | 0.538 | 0.494 | 0.265 | 0.398 | 0.362 | 0.562 | 0.771 |
| 3 | 0.148 | -     | -     | -     | 0.064 | -     | 0.200 | -     | 0.103 | -     | -     | 0.332 | -     | -     | 0.332 | -     | 0.064 | -     | -     |
| 4 | 0.586 | 0.103 | 0.290 | 0.311 | 0.601 | 0.331 | 0.264 | 0.075 | 0.153 | 0.290 | 0.148 | 0.541 | 0.253 | 0.538 | 0.253 | 0.332 | 0.362 | 0.562 |
| 5 | 0.290 | 0.311 | 0.276 | 0.258 | 0.920 | 0.362 | 0.562 | 0.253 | 0.332 | 0.327 | 0.448 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 |
| 6 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 |
| 7 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 | 0.455 |

(1) Tassling 50%, (2) No. of leaves, (3) Plant height, (4) ear leaf area, (5) No. of ear per plant, (6) ear length, (7) ear diameter, (8) No. of rows per ear, (9) No. of grain per row, (10) No. of grain per ear, (11) ear weight, (12) 300 grain weight, (13) Biological yield, (14) Harvest index, (15) selling %, (16) Protein %, (17) Hectoliter weight, (18) Oil %, (19) grain yield per plant.
Table (5) showed the environmental correlation coefficients between the studied traits, and it was found that the environmental correlation was significant for the flowering trait with number of ear per plant, ear weight, protein %, and the traits rest did not significant, while others were negative significant, number of leaves. The environmental correlation was not significant with some traits, while others were negative significant, plant height, the correlation was significant with number of grains per row, number of grains per ear, number of ear per plant, number of rows per ear, ear weight, protein %, and it was not significant with some traits, and it was significant and negative with the others, the ear leaf area, it was significant with number of rows per ear, number of grains per ear, ear weight and grain yield per plant, while with the rest of the traits it did not reach the significant limits, and the other was negative, the number of ears per plant the environmental correlation was significant with the ear weight, biological yield and grain yield per plant, ear length, some of them were negative and some were not significant, ear diameter, it was significant with weight of 300 grains and selling %, and it was not significant with the rest. The number of rows per ear, the environmental correlation was significant with a number of grains per row, number of ear grains, weight ear and grain yield per plant not significant with the rest of the traits, the number of grains per row was significant with a number of grains per ear, ear weight, biological yield, protein %, and not significant or negative with other characteristics, number of grains per ear the correlation was significant with biological yield and protein %, and not significant or significant negative with the other traits, ear weight, there was a significant correlation with biological yield and protein % with the grain yield per plant, the trait weight 300 grains, it was significant with selling % and not significant with the other traits. The biological yield the environmental correlation was significant with the protein %and grain yield per plant, insignificant with some and negative with the other, the harvest index trait the environmental correlation was significant with the selling % and not significant with the other traits, the selling % was negative or not significant with the other traits, the traits of hectoliter, oil % and grain yield per plant were not significant with the rest. This result agrees with [16] and [17]. The positive environmental correlation between two traits means the environmental factors affect two traits together, and that the environmental conditions that are appropriate for a particular trait will mean their suitability to the other trait, and that an increase in one of the traits due to a particular environmental factor will lead to an increase in the other trait.

Table (6) shows the genetic parameters, and it shows that the highest genetic and phenotypic variance in the characteristic of ear leaf area, which amounted to 553.91 and 643.06, respectively, and the lowest genetic and phenotypic variance for the characteristic weight, which amounted to 0.214 and 0.262, respectively this result agrees with [16].

From the foregoing, the values of genetic and phenotypic variances were median in all traits, and this means gives a great opportunity for plant breeders to increase the efficiency of process of breeding, improvement and selection for superior traits and to select the best ones directly due to their less influence on environmental factors. The highest genetic difference coefficient was average in the number of rows per ear, the number of grains per ear, biological yield, and hectoliter, as it reached 10.09, 13.80, 10.65, and 12.69, respectively, and all other traits were low. The biological yield, harvest index, and hectoliter were 10.20, 14.37, 11.16, 11.78, and 13.17, respectively. This result agrees with [19] and [16] they found the value of genetic, phenotypic was median.

We note the results of the values of phenotypic and genetic variation coefficients were different, and this is mainly due to the different values of both phenotypic and genetic variation, and these values were between the low and the medium for all traits. We note from the estimates of phenotypic and genetic variation coefficients that they were identical for most traits, and this allows plant breeders to rely heavily on the phenotypic form of selection for superior genotype, as the expression of gene is clear on the performance of the genotypes. The heritability, which was high in all traits except for harvest index, and grain yield per plant, was median which reached 40.15, and 50.35, respectively, and it was low in portion % and selling %, which was lower which reached 35.46 and 14.60. This result agrees with [16], they found all traits was high value.

The heritability was high for most of the traits and this is due to low value of environmental variance compared to genetic variance and that high heritability values indicate that this trait is affected little by environmental conditions and makes the selection for this trait easy and unlike in medium and low traits.

The expected genetic improvement as a percentage, was low with all traits, while the median ear leaf area, ear length, number of rows per ear, number of grains per row, number of grains per row, ear weight, the weight of 300 grains, biological yield, and specific weight, which were 11.67, 10.86, 20.54, 13.54 and 27. 31, 18.14, 13.41, 20.93, and 25.19, respectively. This result agrees with [16], they found most traits was median.

We conclude from this that the values of response to selection (expected genetic improvement) were low to medium for most traits, including the traits of the yield and its components, improve these traits.
Table 5. Environmental correlation coefficients of hybrids as mean herbicides for traits studied.

|   | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | -  | -  | -  | -  | 0.474* | 0.354 NS | 0.061 NS | 0.242 NS | 0.298 NS | 0.248 NS | 0.573 - | 0.576* | 0.535* | 0.457 NS | 0.320 NS | 0.380 NS | 0.172 NS | 0.350 NS |
| 2 | -  | -  | -  | -  | 0.363 NS | 0.101 NS | 0.158 NS | 0.308 NS | 0.139 NS | 0.487* | -  | -  | -  | -  | -  | -  | -  | -  |
| 3 | -  | -  | -  | -  | 0.076 NS | 0.085 NS | 0.575 NS | 0.727* | 0.387 NS | 0.311 NS | 0.447 NS | 0.377 NS | 0.429 NS | 0.616 NS | 0.231 NS | 0.231 NS | 0.281 NS | 0.629** |
| 4 | -  | -  | -  | -  | 100.399 NS | 0.150 NS | 0.668 NS | 0.604 NS | 0.454 NS | 0.144 NS | 0.236 NS | 0.874 NS | 0.885 NS | 0.586 NS | 0.395 NS | 0.496 NS | 0.743 NS | 0.650 NS |
| 5 | -  | -  | -  | -  | 0.066 NS | 0.097 NS | 0.730 NS | 0.491 NS | 0.762 NS | 0.174 NS | 0.516 NS | 0.661 NS | 0.001 NS | 0.346 NS | 0.312 NS | 0.121 NS | 0.375 NS | 0.730 NS |
| 6 | -  | -  | -  | -  | 0.078 NS | 0.455 NS | 0.179 NS | 0.625 NS | 0.043 NS | 0.178 NS | 0.376 NS | 0.520 NS | 0.538 NS | 0.526 NS | 0.206 NS | -  | -  | -  |
| 7 | -  | -  | -  | -  | 0.419 NS | 0.401 NS | 0.490 NS | 0.401 NS | 0.714** | 0.375 NS | 0.421 NS | 0.490 NS | 0.401 NS | 0.714 NS | 0.375 NS | 0.421 NS | 0.490 NS | 0.401 NS |
| 8 | -  | -  | -  | -  | 0.008 NS | 0.420 NS | 0.344 NS | 0.014 NS | 0.450 NS | 0.812 NS | 0.701 NS | 0.565 NS | 0.325 NS | 0.733 NS | 0.851 NS | 0.680 NS | 0.375 NS | 0.421 NS |
| 9 | -  | -  | -  | -  | 0.024 NS | 0.399 NS | 0.121 NS | 0.150 NS | 0.074 NS | 0.005 NS | 0.038 NS | 0.195 NS | 0.127 NS | 0.259 NS | 0.036 NS | 0.103 NS | 0.112 NS | 0.375 NS |
| 10| -  | -  | -  | -  | 0.119 NS | 0.038 NS | 0.484 NS | 0.497 NS | 0.208 NS | 0.234 NS | 0.823 NS | 0.561 NS | 0.471 NS | 0.544 NS | 0.374 NS | 0.434 NS | 0.419 NS | 0.279 NS |
| 11| -  | -  | -  | -  | 0.350 NS | 0.380 NS | 0.746 NS | 0.555 NS | 0.054 NS | 0.374 NS | 0.542 NS | 0.044 NS | 0.382 NS | 0.663 NS | 0.196 NS | 0.509 NS | 0.213 NS | 0.194 NS |
| 12| -  | -  | -  | -  | 0.375 NS | 0.421 NS | 0.490 NS | 0.401 NS | 0.714 NS | 0.375 NS | 0.421 NS | 0.490 NS | 0.401 NS | 0.714 NS | 0.375 NS | 0.421 NS | 0.490 NS | 0.401 NS |

(1) Tassling 50%, (2) No. of leaves, (3) plant height, (4) ear leaf area, (5) No. of ear per plant, (6) ear length, (7) ear diameter, (8) No. of rows per ear, (9) No. of grain per row, (10) No. of grain per ear, (11) ear weight, (12) 300 grain weight, (13) Biological yield, (14) Harvest index, (15) selling %, (16) Protein %, (17) Hectoliter weight, (18) Oil %, (19) grain yield per plant.
Table 6. Genetic parameter for hybrids according to mean herbicide for all traits.

| Traits                        | σ²G  | C.V.G | σ²P  | C.V.P | h², Bs % | AG  | AG %  |
|-------------------------------|------|------|------|------|---------|-----|-------|
| Tasseling 50%                 | 6.285| 4.526| 6.368| 4.556| 98.667  | 5.129| 9.260 |
| No. of leaves                 | 0.412| 4.800| 0.441| 4.966| 93.408  | 1.278| 9.556 |
| plant height                  | 25.171| 2.834| 28.906| 3.037| 87.085  | 9.645| 5.448 |
| ear leaf area                 | 553.919| 6.106| 643.061| 6.579| 86.129  | 44.995| 11.673 |
| No. of per plant ear          | 28.980| 5.263| 34.676| 5.757| 83.588  | 0.102| 9.913 |
| ear length                    | 25.864| 5.403| 27.133| 5.534| 95.312  | 1.898| 10.866 |
| ear diameter                  | 15.052| 3.360| 16.755| 3.545| 89.824  | 0.320| 6.560 |
| No. of rows per ear           | 121.750| 10.091| 124.614| 10.209| 97.693  | 3.007| 20.546 |
| No. of grain per row          | 40.812| 6.993| 46.159| 7.437| 88.393  | 4.545| 13.543 |
| No. of grain per ear          | 180.241| 13.807| 195.376| 14.375| 92.256  | 134.670| 27.319 |
| ear weight                    | 69.560| 9.100| 74.206| 9.399| 93.737  | 35.573| 18.149 |
| 300 grain weight              | 33.254| 6.836| 36.634| 7.175| 90.779  | 14.908| 13.417 |
| Biological yield              | 48.726| 10.653| 121.346| 11.169| 90.974  | 36.133| 20.931 |
| Harvest index                 | 7.220| 7.466| 49.442| 11.782| 40.151  | 31.418| 9.745 |
| selling %                     | 3.251| 3.056| 9.168| 7.997| 14.605  | 1.316| 2.406 |
| Protein %                     | 152.982| 2.207| 164.746| 3.706| 35.467  | 2.325| 2.707 |
| Hectoliter weight             | 0.214| 12.693| 0.262| 13.172| 92.855  | 1.538| 25.196 |
| Oil %                         | 6.083| 0.512| 12.083| 0.567| 81.457  | 0.712| 0.951 |
| grain yield per plant         | 1.351| 3.005| 1.485| 4.235| 50.358  | 0.144| 4.393 |

Conclusion

The hybrid zp707 is considered the best among the studied hybrids for its superiority in most traits, the correlation of grain yield with most of the traits was significant and desirable, so the different traits can be improved through the correlation value, High coefficients of variation, heritability and expected genetic improvement allow for low inverse selection.

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