ESTIMATION OF SOME GENETIC PARAMETERS IN WHEAT CROSSES AND UTILIZATION AS PRELIMINARY INDICATORS IN BREEDING PROGRAMS

By

Aya Mostafa Amin Ibrahim

B. Sc. Agric. Sci. (Agron.), Fac. Of Agric.,

Fayoum University, Egypt, (2019)

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SUMMARY

The present study is concerned with investigating the breeding potentialities of six wheat varieties, with the objective of obtaining guidelines for the efficiency of utilizing these varieties as parental types in cross breeding programs for developing superior cultivars of wheat, during the three successive growing seasons of 2020/21, 2021/22 and 2022/23 at the Experimental Farm of the Faculty of Agriculture, El-Fayoum. Univ. A total of 36 genotypes comprising 6 parents, 15 F_1's and F_2's were grown in two separate and adjacent experiments, representing two different nitrogen fertilization levels: 50 and 75 kg N/fed., representing two different environments.

The parental genotypes involved in this study of wheat i.e. Sakha 94, Sakha 95, Giza 171, Sids 14, Misr 1 and Misr 3. The obtained results can be summarized as follows:

1-Physiological traits

1- Mean squares due to wheat genotypes (G) and nitrogen levels (environments; E) were highly significant for all studied traits. Further, mean squares due to genotypes × nitrogen interactions (G × E) were highly significant for all the studied traits, indicated that parental and crosses of wheat in this study behaved differently nitrogen levels.

2- The ratio of GCA / SCA was more than the unity in individual environments and the combined data of F_1 and F_2 were detected for flag leaf area and chlorophyll b traits. Moreover, low GCA / SCCA ratio which less than the unity was detected for chlorophyll a and carotenoids traits.

3-The results obtained show that Giza 171, Sids 14 and Misr 3 varieties exhibited highly significant GCA effects in individual environments and their combined data in the two generations for most studied cases of physiological traits. Revealing that these varieties could be considered good combiners in breeding programs for the improvement of physiological traits.

4- Out of 15 crosses combinations of six hybrids *i.e*. P1 × P2, P1 × P5, P1 × P6, P2 × P3, P3 × P4 and P5 × P6 exhibited significant and /or highly significant positive SCA effects for studied of physiological traits. It is worth mention that the excellent combinations were obtained from crossing between good by good, good by low or low × low combiners.

5- The averages of physiological traits for parental genotypes; Sides 14 showed significantly higher values for flag leaf area, the variety Misr 3 for chlorophyll a, b and carotenoids traits compared to other parents tested.

2- Yield and yield components traits

1. The analysis of variance exserted significant and/or highly significant variation due to environments (E), parents (P), and genotypes (G); parents and their combinations and genotypes × environments (G × E) for yield and its components. Further, results indicating the presence of adequate genetic variability in the genetical materials. However, the interaction between nitrogen levels and genotypes (G × E) is highly significant for all traits, indicating that the performance and the ranks of different wheat genotypes are moderately or highly affected by the nitrogen levels for investigated traits.

2. The relative magnitude of additive to non-additive effects for the combined data expressed as GCA / SCA ratio were less the unity of GCA/SCA for most traits, except in some cases *i.e.* plant height and 1000-grain weight traits at the combined of F_2, grains number/spike and harvest index traits at the combined of F_1, these cases showed more ratios than the unity of GCA / SCA.

3. Two wheat varieties Sakha 94 and Sids 14 exhibited highly significant GCA effect for plant height and number of spikes/plant, two varieties: Giza 171 and Misr 3 for grains number/spike and 1000-grain weight. Misr 1 and Misr 3 for grain yield/plant and harvest index traits. This would indicate that the above parental genotypes are good combiners for the previous traits.

4. Results showed that the crosses; P1 × P2, P1× P3, P1× P4 P1× P5, P2 × P5, P2 × P6, P3 × P5, P4 × P5 and P5 × P6 had positive significance of SCA for yield and its components. These results indicated that a considerable part of the genetic variance could be attributed to the non-additive gene effects.

5. The crosses P1 × P2, P1× P3, P1× P4 P1× P5, P2 × P5, P2 × P6, P3 × P5, P4 × P5 and P5 × P6 exhibited significant positive heterosis and heterobeltiosis in individual environments and their combined analysis for yield and its components, where inbreeding depression (I.D.) effects showed highly significant values, suggesting that non-additive gene actions played a greater role than additive gene actions in the inheritance of the studied traits.

6. Results indicated that the highest values were recorded by the varieties; Sakha 94, Giza 171, Misr 1 and Misr 3 in the combined analysis. The crosses P1× P4, P1× P6 P2 × P5, P2 × P6 P3 × P4, P3 × P5 P4 × P5 and P4 × P6 recorded the highest values in the studied most cases on yield and yield components.

3- Nitrogen efficiency traits

1. The results showed that mean squares due to nitrogen fertilization levels for all traits were significant and highly significant, suggesting that these traits are influenced by different nitrogen fertilization levels.

2. Significant mean squares due to GCA and SCA abilities were detected in both environments and the combined analysis in the F_1 and F_2 generations. Therefore, it seemed that both additive and non – additive genetic effects were operative for these traits.

3. The varieties Sakha 94, Sakha 95, Giza 171, Misr 1, Misr 3 and Sides 14 exhibited highly significant and significant positive GCA effects for these traits at both nitrogen levels and the combined analysis of data in the first and second generations.

4. Results of SCA effects for nitrogen traits, six out fifteen crosses; P1× P2, P2 × P5 P2 × P6, P3 × P5, P4 × P5 and P4 × P6 exhibited slightly SCA effects.

Therefore these hybrids are considered as good F_1 and F_2 cross combinations for these traits.

4- Grain quality trait

1. Significant differences were detected between the two environments for this trait, indicating that the two levels of N differed in the environmental conditions. The results exhibited the levels of nitrogen played a significant role in the variation of this trait.

2. The two varieties Sakha 94 and Misr 1 had highly significant and /or significant GCA effects at the two environments and the combined analysis.

3. Crosses P1× P2, P2 × P3, P2 × P5, P2 × P6, P3 × P5 and P4× P6 were found to be good specific combiners which could be due to the presence of favorable gene combinations in the parents.

4. Results indicated that the crosses; P1 × P2 (22.10), followed by P2 × P3 (20.07) and P2 × P6 (13.17 %) gave the highest values and desirable heterotic effects. Also, inbreeding depression as the percentage decrease of F_1 mean performance, the instances of heterosis showed highly significant / or significant inbreeding depression amount.

5. Mean performance of grain protein content trait recorded at the combined analysis of data for wheat genotypes and were able to transmit their superiority to most of their hybrids.