



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



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**ESTIMATION OF GENETIC PARAMETERS FOR
SOME AGRONOMIC TRAITS IN BREAD WHEAT
(*Triticum aestivum* L.) CROSSES UNDER
LOW NITROGEN FERTILIZATION**

By

YASSMIN TAREK MOHAMED EMAM

B.Sc. Agric. Sc., (Plant Production), Fac. Agric., Ain Shams University, 2015

**A Thesis Submitted in Partial Fulfillment
Of
the Requirements for the Degree of**

**MASTER OF SCIENCE
in
Agricultural Sciences
(Crop Breeding)**

**Department of Agronomy
Faculty of Agriculture
Ain Shams University**

2021

Approval Sheet

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ABSTRACT

Yassmin Tarek Mohamed Emam: Estimation of Genetic Parameters for Some Agronomic Traits in Bread Wheat (*Triticum aestivum* L.) Crosses Under Low Nitrogen Fertilization. Unpublished M.Sc. Thesis, Department of Agronomy, Faculty of Agriculture, Ain Shams University, 2021.

The present investigation was conducted during three successive growing seasons of 2016/17, 2017/18 and 2018/19 to evaluate 15 F₁ bread wheat crosses obtained from a half six parental diallel pattern along with their respective parents under low (40 kg N/fed) and recommended (80 kg N/fed) nitrogen fertilization levels. Mean performance, nitrogen stress tolerance indices and some genetic parameters were determined for grain yield and its contributing traits. Nitrogen levels mean squares were significant for all studied traits. Moreover, mean values for recommended nitrogen level were higher than corresponding ones under low N-level for most studied traits. Genotypes, parents and crosses mean squares were significant for all traits at both N-levels and their combined analysis. Interactions of genotypes, parents and crosses with nitrogen levels were significant for most studied traits. Number of spikes/plant had highest reduction (35.46%), while maturity date exhibited lowest one (1.34%). Results also indicated that mean productivity, geometric mean productivity and stress tolerance indices seemed to be useful for identifying most low-N tolerant genotypes. Data indicated that additive and non-additive genetic effects were involved in the inheritance of most traits. Moreover, non-additive genetic variance was predominant in inheritance of most studied traits at both N-levels and combined analysis. These results indicated the importance of testing genotypes under various environments in order to evaluate genotypes performance and to recognize favorable conditions for exploiting both types of gene action in wheat breeding programs. The best general combiners for grain yield/plant and one or more of its attributes were obtained in Sakha 93 and line 36 under N-stress conditions. The most

desirable SCA effects for grain yield/plant were found in cross $P_1 \times P_5$ under recommended N-level and cross $P_4 \times P_5$ under low N-level. Significant desirable heterosis was determined for all studied traits. Narrow sense heritability values for studied traits ranged from 3.98% for grain yield/plant to 58.96% for 100-kernel weight at recommended N environment and from 2.65% for number of spikelets/ spike to 53.85% for plant height under nitrogen stress conditions.

Key words: Bread wheat, Nitrogen stress tolerance indices, Heterosis, Combining ability, Narrow sense heritability.

ACKNOWLEDGMENT

Firstly, I wish to express my great and sincere gratitude to **ALLAH** who give me the prosperity and ability to achieve this work.

The author wishes to express her great appreciation, sincere thanks, and deepest grateful to the supervisors **Dr. Kamal Imam Mohamed Ibrahim** and **Dr. Ahmed Abd El-Sadik Mohamed Abd El-Dayem** Professors of plant breeding, Agron. Dept., Fac. Agric., Ain Shams Univ., for their valuable guidance, great help, devoted efforts and sincere concern for supervising the study and constructive guidance throughout the experimental work and the continuous encouragement during the courses and the preparation of the manuscript.

Sincere thanks and grateful appreciation are extended to **Dr. Yasser Abd El-Gawad El-Gabry** Associate Professor of plant breeding, Agron. Dept., Fac. Agric., Ain Shams Univ., for his supervision, guidance and valuable help during field experiments and preparing the manuscript.

The author would like to express her great appreciations to all staff members of Agron. Dept., Fac. Agric., Ain Shams Univ., for their encouragement and valuable help during the courses of this work and to **my family** and **my** Colleagues for their help, support and continuous encouragement.

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INTRODUCTION

Bread wheat (*Triticum aestivum* L.) is one of the most important crops in Egypt. In 2018/19 season, local cultivated area of wheat was 3.15 million feddans with an annual grain production of 8.77 million metric tons and an average productivity of 18.53 ardabs/ feddan (**USDS, 2019**). The local production covers less than half of the local consumption. Increasing wheat productivity is a nation target in Egypt to reduce the gap between wheat production and consumption. The production of wheat can be increased by increasing the agricultural area or by increasing yield productivity per unit area. Currently, it is difficult to increase the agricultural area of wheat due to competition with other winter crops as well as restricted reclaimed lands and water shortage. Therefore, the alternative strategic solution is to use high yielding cultivars characterized by tolerance against environmental stresses, especially soil nitrogen deficit, which affect the production of wheat. Applying nitrogen fertilization is the most important cultural practices to maximize wheat productivity through improving vegetative growth and enhancing kernel set. The needs of new wheat genotypes response to high doses of nitrogen fertilizer is important to express full yield potential. To decrease the cultivation costs, the breeders should develop new wheat genotypes with high tolerance to nitrogen deficiency to avoid the effect of nitrogen to the land and atmosphere pollution and other components of the ecosystem (**Bouwman et al. 2002**). In breeding programs, breeders use yield performance in both recommended and stressful environments as a key indicator for screening the most tolerant genotypes. During the past four decades, several yield-based indices have been suggested for evaluating stress tolerance in crops.

Nowadays, many efforts are done through genetic improvement to maximize the productivity of wheat. To establish an effective breeding program, enough information about the components of genetic variance and their interactions with nitrogen application must be known by the breeder. Diallel analysis is an attempt to divide the total variation into

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genetic and environmental variations and to subdivide genetic variation into its additive and non-additive genetic components. These estimates can then be used to draw conclusions about the genetic systems controlling grain yield and other important characters as well as the best breeding strategy to be used to improve them. Several researchers found that additive type of gene action was important in the inheritance of grain yield (**Motawea 2017**), plant height (**Nathan and Moubarak 2016**) and number of spikes/plant (**Kamaluddin *et al.* 2007**). On the other hand, other investigators mentioned that non-additive genetic effects played important role in inheritance of grain yield (**Farooq *et al.* 2019**) and spike length (**El-Hosary *et al.* 2012**). Heterosis refers to superiority of F₁ hybrid over the mid- or better parents. It is expressed by allelic and non-allelic interactions of genes in either homozygote or heterozygote conditions under influence of particular environment. Heterosis has been observed for wheat, but level of heterosis is widely different among F₁ crosses. Knowledge of heritability of a trait guides plant breeder to predict behavior of successive generations and response to selection.

Therefore, the present investigation aimed to evaluate mean performance of 15 F₁ crosses and their respective parents for fifteen studied traits at two N-levels and to determine fifteen nitrogen stress tolerance indices for grain yield as well as to estimate some genetic parameters and their interactions with different nitrogen fertilization levels and identify promising parents and crosses at low- and recommended nitrogen levels.

REVIEW OF LITERATURE

The review of literature related to the agronomic characteristics and genetic parameters in bread wheat under different nitrogen fertilization levels will be divided to the following main headings:

1. Effect of nitrogen fertilization treatments on grain yield and its contributors in wheat.
2. Nitrogen stress tolerance indices.
3. Studies of genetic parameters under different levels of nitrogen fertilization.

1. Effect of nitrogen fertilization treatments on grain yield and its contributors in wheat

Munir *et al.* (2000) studied the effect of three nitrogen fertilization rates (72, 80 and 88 kg N/fed) on number of spikes/m², number of kernels/spike, grain weight/spike, 1000-grain weight, grain yield/fed, protein percentage and straw yield/fed of the wheat cultivars; Gemmeiza 5, Gemmeiza 7 and Gemmeiza 9 in two seasons. The results indicated that increasing nitrogen rates significantly increased mean values of all studied traits in both seasons, except protein percentage in the first season. Nitrogen rate at 88 kg N/fed gave highest mean values of grain and straw yields/ fed and protein percentage in both seasons as compared to other nitrogen rates.

Ismail (2000) assessed nine bread wheat genotypes and their non-reciprocal F₁'s at three levels of nitrogen (50, 75 and 100 kg N/fed). His results showed significant differences among genotypes and between nitrogen levels for all studied traits. The genotypes x nitrogen interactions were highly significant for plant height and grain yield/plant. Meantime, increasing nitrogen fertilization levels up to 100 kg N/fed significantly increased plant height and grain yield/plant.