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PERFORMANCE AND STABILITY OF PROMISING BREAD WHEAT LINES

By

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B. Sc. Agric. Sc. (Agronomy), Fac. Agric., Ain Shams University, 2013
M. Sc. Agric. Sc. (Agronomy), Fac. Agric., Ain Shams University, 2018

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Approval Sheet

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ABSTRACT

Asmaa Mostafa Salem Hassan Badr: Performance and Stability of Promising Bread Wheat Lines. Unpublished Ph.D. Thesis, Department of Agronomy, Faculty of Agriculture, Ain Shams University, 2022.

The present study was conducted to evaluate 40 promising bread wheat lines compared to their 4 parents and 6 commercial cultivars for their productivity and estimating stability under eight environmental conditions. Wheat genotypes were sown on two planting dates (14 November "recommended date" and 13 December "late sowing date") under two nitrogen fertilization treatments (Biofertilizer + 40kg N/fed. and 80kg N/fed.) in two growing seasons (2018/2019 and 2019/2020) at the Experimental Farm of the Faculty of Agric., Ain Shams Univ. at Shalakan, Kalubia Governorate.

The results revealed that the mean squares of genotypes, sowing dates, and nitrogen fertilization treatments were significant for grain yield and its contributions (days to heading, flag leaf area, plant height, number of spikes/plant, spike length, number of spikelets /spike, number of kernels /spike, 1000-kernel weight and grain protein content), indicating that these characters are influenced by factors used in this investigation. Yield and yield contributes increased by planting wheat genotypes at the recommended sowing date in mid-November under optimum nitrogen levels (80 kg N/fed.). Conversely, planting under delayed sowing dates and low nitrogen conditions led to a drastic reduction in grain yield/plant and its contributes. The mean squares of environments were highly significant for all studied traits, suggesting that the environments affected differently the wheat studied traits. Environment (E) + (G x E) and pooled deviation were highly significant for all the studied traits except flag leaf area (cm^2) for pooled deviation, indicating the presence of genetic differences among genotypes for their regression on the environmental index. This study revealed that the lines number 9, 10, 11, 26, 27, 28, 29,

30, 31 and 33 gave high mean values for grain yield and its contributions and exhibited general adaptability across different environments; thus, such lines are considered to be promising genotypes and could be used in breeding programs for wheat improvement.

Keywords: *Triticum aestivum* L., Sowing date, Nitrogen fertilizer and Phenotypic stability.

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INTRODUCTION

Wheat is one of the major cereal crops, which contributed about 50% of the world grains trade and 30% of grain production in the world **(Akter and Islam 2017)**. Besides, wheat is considered as a staple food crop in more than forty countries around the world. Maximizing grain yield of wheat is one of the most important national targets in Egypt for narrowing the wide gap between production and consumption of this crop through improving wheat varieties quantitatively and qualitatively to increase the productivity of unit area to face the difficulties for expanding the wheat cultivated area horizontally. The task of the breeder is to have more information about genotypes performance under different environmental conditions to screen out genotypes planted at different intervals to enable selection of those varieties under diverse agro-ecological conditions.

Planting wheat in its optimum sowing date gave the optimum season length and achieve high grain yield as a result of suitable weather condition through different growth stages **(Ouda *et al*. 2005, Singh *et al*. 2011, Mumtaz *et al.* 2015, Uddin *et al*. 2015 and Mohamed *et al.* 2022).**

Nitrogen is one of the most important elements, which had a direct effect on plant growth and yield. In this respect, grain yield were increased with the increment of nitrogen fertilization level up to 100 kg N /fed. **(Abdel Nour and Fateh 2011, Mosslem *et al*. 2014, El-Marakby *et al*. 2015, El-Gabry and Mohamed 2019a, Abdel-Moneam *et al.* 2021 and Elmoselhy *et al.* 2022)**. Furthermore, the biochemical fertilizers had a significant effect on grain yield and its components in wheat **(Radwan *et al*. 2013)**.

Choosing the promising lines or varieties and planting them in the proper date with applying the optimum biological and mineral nitrogen fertilizers are the most important factors affecting the productivity of wheat. Moreover, use the biological materials along with beneficial

microbes (biofertilizers) to release nutrients to crops is another way for increasing sustainable production in an eco-friendly and pollution-free environment. Also, microbes biofertilizers harvest atmosphere nitrogen and converts into ammonical form which is available to the plants.

Genotype × environment interaction is extremely important in the evaluation of varieties in plant breeding programs because it reduces the progress from selection under diverse environments **(Sime and Tesfaye 2021)**. If genotypes significantly interact with seasons, sowing dates or fertilization treatments or all of them, then selection of superior genotypes becomes more complex. Crop breeders have been striving to develop genotypes with superior grain yield and yield components over a wide range of different environmental conditions to select stable genotypes unaffected by environmental changes.

The major objectives of this investigation are; studying performance of 40 promising bread wheat lines compared with their parent (4 varieties) and 6 commercial cultivars at eight different environments (two seasons, two sowing dates and two N-fertilization treatments), estimating phenotypic stability of genotypes for different studied traits and determining the best and stable lines, which can be used as useful genetic sources in wheat breading programs.

REVIEW OF LITERATURE

The review of literature connected with this study will be presented under the following main topics:

A- Effect of sowing date.

B- Effect of N fertilization treatments.

C- Genotype x environment interaction and stability of wheat genotypes.

A- Effect of sowing date.

Tahir *et al.* (2009) studied the effect of three sowing dates December 1, 15 and 30 on three wheat cultivars. Both sowing dates and varieties significantly affected the number of fertile tillers, plant height, number of spikelets / spikes, 1000-grain weight and grain yield. In case of sowing dates, maximum grain yield was obtained when crop was sown on 1st December and minimum grain yield in case of late sowing 30th December.

Hamam and Khaled (2009) evaluated twelve wheat genotypes under two dates: 14 November (favorable) and 26 December (heat stress) during three winter seasons. Flag leaf area, days to heading, plant height, spike length, 1000-kernel weight and grain yield were significantly influenced by years, sowing dates, genotypes and their interaction. The temperatures were decreased up to 2.50 to 6.39 º C at sowing late date than at the favorable sowing date. However, a wide variation was found in response of wheat genotypes to heat tolerance. The results indicated that the 1000-kernel weight and grain yield traits are stable under heat stress. Some wheat genotypes conferred productive and adaptive advantages where they expressed high yield and yield stability when compared to other genotypes. This study indicated that higher 1000-kernel weight and days to heading are the two important traits which could be considered as potential selection criteria for yield under heat stress.

REVIEW OF LITERATURE

Four sowing dates (1st and 15th Nov., 1st and 15th Dec.) and six wheat genotypes were studied by **Khokhar *et al.* (2010)**. Because of better plant growth, growth period, Nov.15th planted wheat had maximum grain yield of 5904 kg ha^{-1}, followed by Nov. 1st and Dec.1st which gave 5302 and 4948 kg ha^{-1}, respectively. Wheat planted on Dec.15th gave minimum grain yield of 4756 kg/ha. Results from the study revealed that maximum grain yield could be achieved with wheat planted in first fortnight of November and any delay in wheat planting might reduce grain yield.

Twelve bread wheat genotypes (*Triticum aestivum* L) were evaluated by **Tawfelis *et al.* (2011)** under three sowing dates i.e. 25th November, 10 th and 25 th December. Delaying sowing date reduced plant height and flag leaf area in 10th and 25th December planting dates by 3.85 and 10.33% and 14.45 and 23.59%, respectively as compared to the recommended sowing date.

Singh *et al*. (2011) evaluated 10 diverse genotypes, their 45 F_1s and F_2s for identification of high temperature stress effect. The experiment was conducted under normal (20th November) and late sown (20th December) condition. The results obtained from the analysis of variance studies showed highly significant differences among all the characters and genotypes in all the sowing environments indicating the influence of sowing condition on genotypes and traits. Further, it was observed that all the characters responded to high temperature stress in different way in different genotypes. The mean of parents, F_1s and F_2s for different characters decreased under late sown in comparison to normal sown. It was revealed that days to heading, plant height, number of spikelets/spike and spike length were less affected by late sown condition, while grain yield per plant, flag leaf area and grain yield per spike highly suffered under late sown. Most of the traits were adversely affected under late sown conditions.