The 2nd International Seed Science and Technology Conference of Iran
"Seed 2024"
(Medicinal Plant, Crop, Horticulture, Pasture & Forest)
seed2024.razi.ac.ir

Screening of bread wheat inbred lines (F9) derived from the crossing of "Marvdasht" × "Rasoul"

Negar Aghaei[1*], Sohbat Bahraminejad[2], Reza Amiri[3] & Reza Mohammadi[4]

[1]PhD student in genetics and plant breeding, Department of Plant Genetics and Production, Campus of Agriculture and Natural Resources, Razi University, Kermanshah, Iran.
[2]Professor, Department of Plant Genetics and Production, Campus of Agriculture and Natural Resources, Razi University, Kermanshah, Iran
[3]Assistant Professor, Crop and Horticultural Science Research Department, Lorestan Agricultural and Natural Resources Research and Education Center (AREEO), Khorramabad, Iran.
[4]Associate Professor, Dryland Agricultural Research Institute, Sararood Branch, Agricultural Research, Education and Extension (AREEO), Kermanshah, Iran.
*n.aghaei1371@gmail.com

Introduction

The importance of bread wheat as one of the most strategic grain is clear for everyone. Estimates of the International Maize and Wheat Research Center (CYMMYT) indicate that the global demand for wheat in 2050 will be 60% higher than the current demand (about 663 million tons). This is while the amount of available wheat resources will decrease by 20-30% (Keshavarznia *et al.*, 2023). The area under wheat cultivation in Iran during 2021-2022 cropping year was equal to 6.9 million hectares, from which 13.2 million tons of wheat were harvested (Anonymous, 2023). Genetic diversity is considered as one of the basic pre-requisites in crop breeding programs, because it helps in better selection and thus improvement and introduction of adaptable genotypes with high yield potential (Atsbeha *et al.*, 2024). Selection based on traits, that have a strong correlation with grain yield, can be a reliable and effective method for screening available genetic resources and indirectly improving grain yield. The current research was conducted with the aim of selecting the best bread wheat lines in terms of yield and other agronomic characteristics.

Materials and methods

The number of six inbred lines (F9 generation) obtained from the Marvdasht (M) and Rasoul (R) cross and their parents, along with Krichauff variety (KRY) and a common cultivar in the region (Torabi, T) as a control, were evaluated based on a randomized complete blocks design in four replications during 2021-2022 cropping year in the Research Farm of the Faculty of Agriculture, Razi University, Kermanshah, Iran. The spikes of ten plants were randomly selected from each plot and different traits including plant height, grain length and width, grain diameter, internal and external peduncle length, and spike length were recorded. Other investigated traits were included days to booting, days to heading, days to anthesis, days to physiological maturity, period and rate of grain filling. The grain yield (g/m2) was measured based on one square meter for each plot. Normality test was done and then, SAS software was used for analysis of variance and mean comparisons using the least significant difference (LSD) method. Pearson correlation coefficients as well as cluster analysis (Ward's method and based on Euclidean distance square) were performed on the data using SPSS software. SYSTAT software was used to draw the Pseudo-F diagram.

Results and Discussion

Variance analysis of the data showed that there is a significant difference between the lines in terms of grain yield, plant height, days to booting, days to anthesis, days to physiological maturity, grain length, spike length, grain filling period and rate (Table 1). The results of mean comparison showed that the highest grain yield was related to Rasoul and Torabi cultivars with 426.89 and 421.01 grams per square meter. Line "40" with 104.25 cm had the highest plant height and Line "29" with 173 days was identified as the earliest line in terms of phenological traits. Correlation coefficients (The related tables is not reported) showed that grain filling rate had a negative significant correlation with days to physiological maturity and grain filling period. The length of grain filling period showed a positive significant correlation with days to physiological maturity. Based on the results of cluster analysis in this research (Fig. 1), the genotypes were classified into three groups. The first group consisted of five lines with the parents Marvdasht and Rasoul. In the second group, only Torabi cultivar was located. The third group included one line along with Krichauff variety. The results of the pseudo-F diagram also confirmed this grouping (Fig. 2).

Table 1. Analysis of variance for studied traits in tested bread wheat genotypes

Sources Of Variation (S.O.V)	Degree of Freedom	GY	PH	DB	DH	DA	DM	GFP	GFR	GL	GW	GD	IPL	EPL	SL
Replicate	3	1312.45	38.46	28.75	19.82	26.56	39.75	3.89	0.55	0.06	0.22	0.24*	17.61	59.38	1.62
Treatment	9	9582.19*	365.43**	61.98**	26.70	28.43*	53.84*	17.17**	1.76*	0.78**	0.21	0.14	7.58	23.18	13.87**
Error	27	3574.22	53.68	15.35	12.13	11.12	19.54	5.39	0.75	0.23	0.20	0.07	7.58	22.60	1.31
CV%	-	17.26	9.17	2.47	2.11	1.97	2.47	18.07	29.37	7.87	14.64	10.23	33.62	16.24	11.13

GY: Grain Yield, PH: Plant Height, DB: Days to Booting, DH: Days to Heading, DA: Days to Anthesis, DM: Days to Maturity, GFP: Grain Filling Period, GFR: Grain Filling Rate, GL: Grain Length, GW: Grain Width, GD: Grain Diameter, IPL: Internal Peduncle Length, EPL: External Peduncle Length and SL: Spike Length
* and ** are significant at the 5 and 1 percent probability levels, respectively

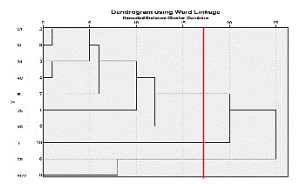

Figure 1. Dendrogram resulting from cluster analysis

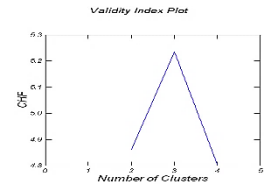

Figure 2. Pseudo-F chart to determine the number of the clusters

Conclusion

In general, according to the results obtained from this research, the lines included in the first group, which were early-matured lines, had more measured traits and high correlation with grain yield. Therefore, they could be selected and used in breeding programs to select superior genotypes in order to improve cultivars.

Keywords

Analysis of variance, Bread wheat, Correlation analysis, Grain yield, Inbred line

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