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Research article

EVALUATION OF YIELD AND SOME MORPHOLOGICAL TRAITS OF WHEAT VARIETIES UNDER DROUGHT STRESS

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ABSTRACT: Since the drought is known as one of the most essential factor limiting growth and crop production, an experiment was carried out to evaluate the yield components of 15 bread wheat genotypes in a randomized complete block design with three replications in Islamic Azad University Research Farm of Ardabil in 2011-12. In this study, traits such as yield per ha, plant height, spike length, number of grains per spike and seed weight were studied. Analysis of variance indicated a significant difference among genotypes for all traits were evaluated. The overall mean yield in genotypes was 2427.1 kg ha in this study. Genotype 12 with 3125 kg ha produced the higher grain yield and genotype 9 had the lowest (1650 kg ha) than other genotypes.

Key words: wheat, drought stress, yield and yield components

INTRODUCTION

The cereals are the most important crop and supply the food of 70 percent of the people of Earth. They form the main base of nutrition and human survival. Wheat and rice provide nearly 60 percent of the energy needed to the man. And in general, more than 3.4 power and 1.2 protein needed human comes from grain [1]. As regards Iran is located in an arid and semiarid region in terms of weather, therefore, the risk of drought is threatening wheat. Hence, to achieve a sustainable self-sufficiency; drought resistant varieties should be used with high performance. In this regard, the identification and production of high yielding and resistant varieties has a special place in the country research. Drought is including the physical stress which is as the most important factor limiting growth and crop production and it is well known in many parts of the world and Iran [2]. Blum has stated that drought is multidimensional stresses that influence the plants at different levels of the organization [3]. Response to drought is complex in plants level, because it is a reflection from the combination of stress effects and relevant responses are at all low levels of organization in space and time. Siddique et al reported that drought is as the most important factors controlling the performance of products, almost "affect on all processes of plant growth [4]. Grain yield and related traits has a complex genetic control and multiple loci are related to quantitative traits responsible for it [5]. So that, Mohammadi et al (2008) for grain weight of barley, fifteen and for grain yield identified seven cases [6]. Grain yield and its sustainability in several areas where there are environmental stresses have been always used as an important criterion in the selection and presentation of data [7]. On the other hand, grain yield is a quantitative trait and is controlled by many genes. Also the heritability of this trait is low due to environmental effects and genotype-environment interaction; thus selection based on the yield may not be very effective to improve it [8]. Morphological characteristics were measured easily and with high precision and they have relatively high heritability, then selection based on this trait may be sure and rapid way for sieve plant communities and improve performance [9]. Emam et al (2007) from their studies concluded that, despite the favorable conditions until more than flowering, drought stress from flowering to grain filling has a significant effect on grain yield and can cause yield loss [10]. Therefore, in areas where there is risk of drought at the end of the growing season, using drought resistant varieties and adapted to the region which have high yield potential and little sensitivity to drought stress is advisable. Abhari et al (2006) found in their research that the grain yield sees the greatest damage in moisture stress condition [11]. And the reason is also reduction in the number of spikes per square meter, the number of grains per spike and grain weight. Grain weight is one of the key components of grain yield and it is determined by the rate and duration of grain filling.

Filling rate is controlled by many genes but filling period is influenced by the environment. Dencis et al [12] introduced the grain weight among the critical attributes in water deficit conditions [12]. Gooding et al [13] know the greatest impact of drought on the grain filling period between the first days to fourteen after pollination [13]. Lemmon [14] reported the reduction of the grain filling period due to the encounter this stage of growth with hot and dry conditions of the end of season increases the restriction accumulation of carbohydrates in the grains, grain protein and weight loss [14]. Experiments were carried out on wheat in Texas is shown for an increase of one degree Celsius the average daily temperature during grain filling stage, 3.1 days is reduced during grain filling [15]. Roustaei [16] has shown that select lines with an average size for spike length and grain weight above can be effective in increasing yield [16]. Ahmadi and Bajelan [17] was observed positive and highly significant correlation between seed weight and seed yield in moisture stress conditions and they knew that the selection for seed weight is an effective tool to improve drought resistance in early generations derived from crosses [17]. The purpose of this research was to find genotypes with desirable agronomic traits in drought stress conditions.

MATERIALS AND METHODS

The research was administered in the field of Islamic Azad University of Ardabil in 2011-12. Genotypes used in this study (Table 1) were evaluated based on randomized complete block design with three replications. Tillage operations including plowing, disk, Luler and furrows in the plowing land. Ammonium phosphate fertilizer from phosphorus source was consumed in the basic form and nitrogen fertilizer from urea source was used twice base and top-dress according to the analysis of laboratory, Research of Soil and Water. Each of the lines was cultured at 2 rows and 3 m length in the form manual and uniform. Seed rate were determined based on 450 seeds per square meter and seed weight. In order to prevent smut, the seeds were disinfected with the Vltava's fungicide before planting. Also fighting broadleaf weeds and narrow leaves was performed with Granstar and tapik poison. After arriving product, seed weight, spike length, seed weight and number of seeds per spike, plant height of each genotypes was measured in 10 randomly plants from experimental plot. The grain yield per plot was recorded after weighing the marginal effects. Data after normality test was performed in the form randomized complete block design and analysis of variance and Duncan's multiple range tests at the 5% level. Computer software SAS 9.2 and SPSS was used for data analysis.

Table 1- genotypes studied in the experiments

No	Name	No	Name
1	Saisonez	9	Alvand
2	Sardari	10	Kohdasht
3	Azar2	11	Cascogine
4	Zagros	12	Bezostaya
5	chamran	13	Cross Sabalan
6	Finkan	14	MV-17
7	Navid	15	Shiraz
8	Zarin		

RESULTS AND DISCUSSION

There were significant difference among genotypes in terms all traits based on the results of variance analysis in traits assessed (Table 2). This was due to the high genetic diversity among the studied genotypes in terms of characters were examined. The range of seed weight among the genotypes studied was variable from 42 g (genotype 12) to 29.8 g (genotype 2). Genotypes 5 and 12 accounted for the highest seed weight and were in the class a. Genotype 2 with an average of 29.8 was located in the group e (Figure 1). Plant height range between genotypes studied was variable from 99.2 cm (genotype 3) to 75.3 cm (genotype 2). Genotypes 3 accounted for the greatest plant height and were in the class a. And genotypes 2 and 9 are also included in the group e had the shortest plant height among the 15 genotypes (Figure 2). Genotype 9 and 15 had the maximum length of the spike and were placed in class a (Figure 3). The range of number of grain per spike among genotypes was variable from 29 (genotype 10) to 22 g (genotype 9). Genotype 10 had the highest number of grains per spike between genotypes (Figure 4). Statistical analysis of data related to grain yield showed there was significant difference among genotypes in terms grain yield at 1% level. Significant differences between genotypes and varieties for yield indicating broad diversity between varieties and genotypes.

There is a variation to develop high yielding varieties in the breeding programs. The overall mean of grain yield in the genotypes was 2427.1 kg ha in this experiment. Genotype 12 with 3125 kg ha produced the highest grain yield and genotype 9 had the lowest (1650 kg ha) than other genotypes (Figure 5).

Table 2 - Analysis of variance for traits in 15 wheat genotypes

MS					DF	Coefficient of Variation
Thousand grain weight	Number of grains per spike	Spike length	Plant heigth	Yield ha		
0.525^{ns}	0.068^{ns}	3.14^{ns}	6.07^{ns}	52952.4^{ns}	2	Repeat
10.465**	22.047**	2.558**	128.924*	228351.**8	14	Genotype
0.258	5.03	0.865	8.883	28114.15	28	Error
16.23	6.513	9.97	4.554	5.584	CV	

ns is the absence of significant differences

*And **, respectively, as significantly different at the 5 and 1 percent level.

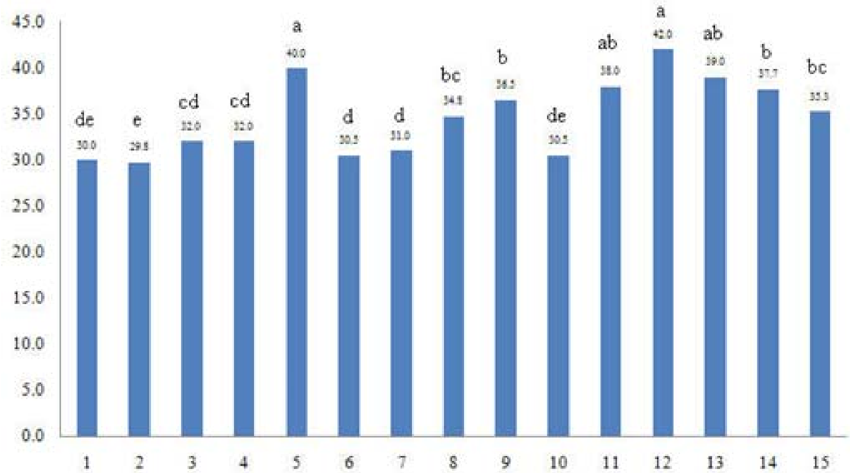

Figure 1 - Mean comparison of examined genotypes in terms of grain weight
***Dissimilar letters mean significant difference at the 5% level by Duncan's multiple range test**

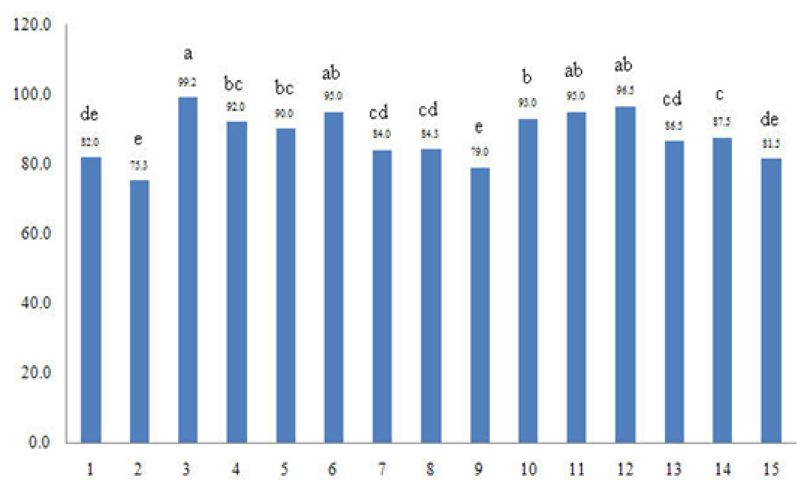

Figure 2 - Mean comparison of examined genotypes in terms of plant height
***Dissimilar letters mean significant difference at the 5% level by Duncan's multiple range test**

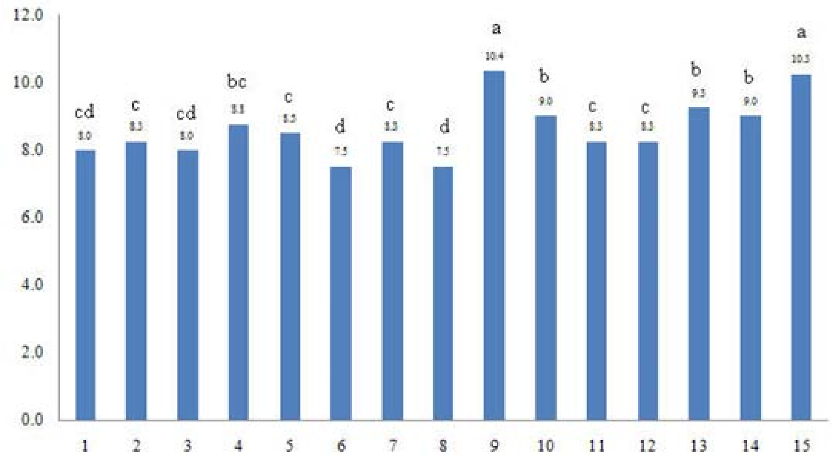

Figure 3 - Mean comparison of examined genotypes in terms of spike length
*Dissimilar letters mean significant difference at the 5% level by Duncan's multiple range test

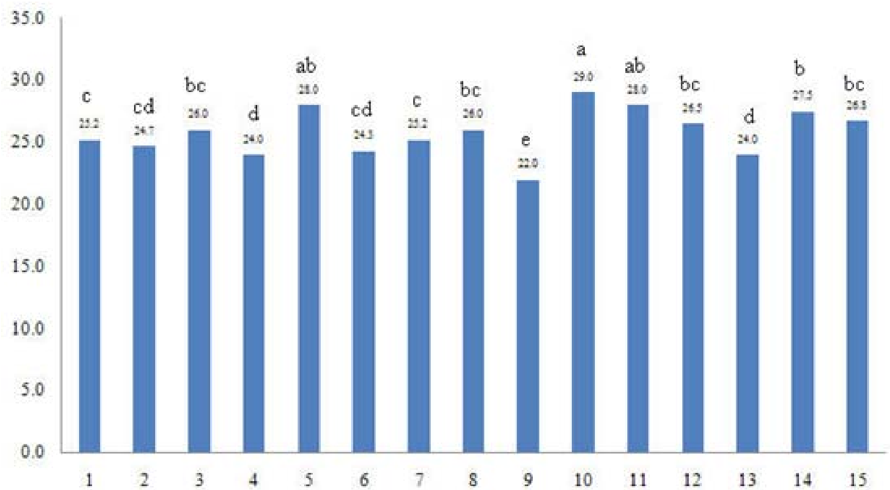

Figure 4 - Mean comparison of examined genotypes in terms of number of grain per spike
*Dissimilar letters mean significant difference at the 5% level by Duncan's multiple range test

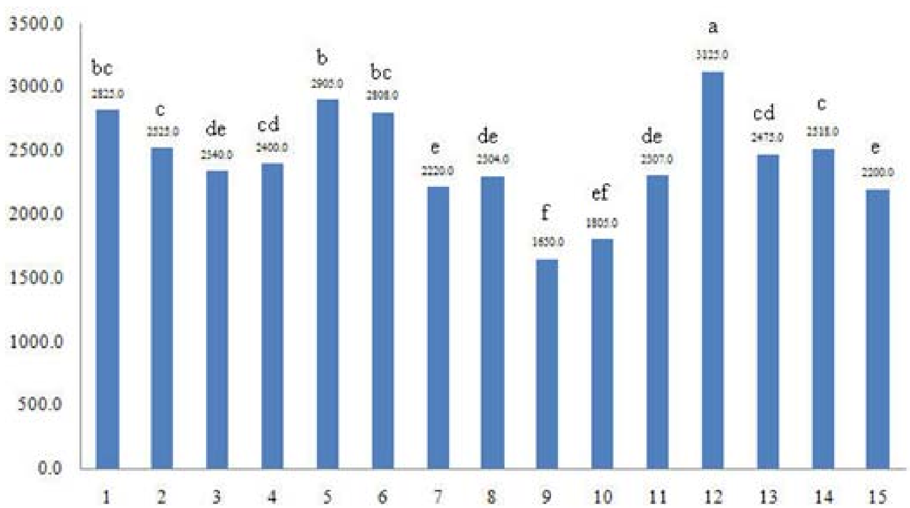

Figure 5 - Mean comparison of examined genotypes in terms of grain yield
*Dissimilar letters mean significant difference at the 5% level by Duncan's multiple range test

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