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Evaluation of Bread Wheat Genotypes in Terms of Drought Tolerance

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ABSTRACT

In order to identify drought tolerance genotypes, 6 bread wheat genotypes as subsidiary factor and irrigation treatments as main factor were grown in the form of split plot in a randomized complete block design with three replications in the research station in Islamic Azad University of Ardabil in 2011 to 2012. A significant positive correlation ($r = 0.725^{**}$) between the yield under drought stress (Ys) and normal (Yp) showed that there is correlation between the yield in both dry and irrigated conditions. Indicators STI, TOL, SSI, and MP, HARM and GMP and graph above plot were used to identify drought resistant genotypes. According to data, genotypes 4057 as resistant and genotypes Sissons were introduced as drought-sensitive.

KEYWORDS: Bread Wheat, Drought, Correlation Coefficients

INTRODUCTION

The wheat besides an important commercial crop in the world is an efficient weapon in the global political relations that its instrumental importance is increasing day by day. Despite Iran's population is about 1% of the world population, but they consume about 2.5 percent of world wheat. It is strategic commodity like energy and is considered as important indicators of agricultural (Akbari et al., 2010). Drought is one of the most important factors limiting production of crops such as wheat in the world and Iran (Mollasadeghi et al., 2011). According to the FAO, 90% of the Iran is placed in arid and semi arid areas. Also, a third of the world's arable land suffers lack of sufficient water for agriculture. The problem with climate change and population growth will be stronger in the future. Long periods of drought leading to declined a sharp in performance in the arid and semi-arid. The modification drought resistant cultivars are one of the most important solutions to deal with the drought (Rebtezke et al., 2006). Drought tolerance is a quantitative trait and there is no direct method for measuring it. This makes it difficult to identify drought resistant genotypes (Tekeda and Matsuoka, 2008). On the other hand, increased yield under water deficit need to identify drought resistant genotypes and managerial activities to maximize the available water (Fischer and Maurer., 1978). (SSI) [1] (Rosielle and Hambelen., 1981), (TOL) [2], (MP) [3] (Fernandez, 1992), (STI) [4] and (GMP) [5] (Abdomishani and Shabestari., 1988) are used to identify drought resistant genotypes. Various researchers have conducted experiments under both conditions, finally concluded that that cultivar is desirable and sustainable which answer the best in both normal and stress conditions. Stress susceptibility index (SSI), tolerance index (TOL), mean productivity index (MP) and the geometric mean (GMP) were used to select tolerant and stable genotypes (Rosielle and Hambelen., 1981; Abdomishani and Shabestari., 1988; Fernandez., 1992; Golabadi et al., 2006 and Mollasadeghi et al., 2011).

The purpose of this study was to evaluate 6 bread wheat genotypes in terms of drought tolerance in Ardabil. The results of this study can be used in breeding programs.

MATERIALS AND METHODS

In order to evaluate drought tolerance genotypes, the 6 bread wheat genotypes as subsidiary factor and irrigation treatments and lack of irrigation as main factor were grown in the form of split plot in a randomized complete block design with three replications in the research station in Islamic Azad University located in the village of Hassan Baroogh of Ardabil in 2011 to 2012. The culture was performed in the November. During the planting, watering was done for all

1 - Stress Susceptibility Index
2 - Tolerance
3- Mean of Productivity
4- Stress Tolerance Index
5 - Geometric Mean Productivity

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plants. Each plot consisted three rows and 20 cm apart from each other and had a length of three meters. The amount of seeding based on 450 seeds per square meter with regard to seed weight were determined and planted for each cultivar. Irrigation carried out two times fall and three times spring. Treatments under drought stress, irrigation was done twice after pollination. To deal with weeds during testing, any chemical fertilizers or toxic did not use and at all stages, fight weeds were performed mechanically and manually. Cultivated land was under fallow rotation. Land preparation operations included plowing after harvesting the previous crop, two times discs, two times Luler vertical and furrows. It is notable that effective rainfall was not revealed after the stress in none of the tested years.

Table 1. The genotypes evaluated in the experiment

Row	Genotype	Row	Genotype	Row	Genotype
1	Sabalan	3	Qobustan	5	**Sardari**
2	4057	4	MV 17	6	**Sissons**

The yield and biomass were measured after harvesting genotypes. To calculate the biomass, dry weight of organs on the ground (no root) was used. Indicators of stress tolerance, tolerance, and sensitivity to stress, production mean and the geometric mean were calculated using the yield in both conditions of stress (Ys) and without stress (Yp). Software MSTAT-C, SPSS – 16 and Minitab **-** 15 were used for data analysis. Mean comparison was carried out using Duncan's multiple range test.

RESULTS AND DISCUSSION

In this study, moisture conditions (drought and normal) showed significant differences to yield at 1% level. Also, there was no significant difference between genotypes in terms the yield. Interaction of genotype × moisture conditions was not significant (Table 2). No significant interaction shows the same response to the genotypes under moisture stress and normality. Therefore, the order of genotypes has been fixed in terms product amount in different situations. Generally, drought stress reduces 20.76 percent grain yield in the examined genotypes (Figure 1). A significant positive correlation ($r = 0.725^{**}$) between the yield under drought stress (Ys) and normal (Yp) showed that there is a correlation between the yield on both dry and irrigated conditions which indicates the yield is independent in two conditions. And two conditions must be corrected separately. High yielding genotypes in normal humidity conditions may not be successful under drought stress. These results agree with the results Fernandez who knows correlation between Yp and Ys is 0 to 0.50. But it is inconsistent with the results Karami et al, Farshadfar et al and Gol Abadi et al. The purpose of this study is not identification in terms of yield in drought stress or moisture normal conditions, but determine drought resistant and susceptible genotypes through index. The yield is depends on many conditions such as planting date, density, amount of fertilizer, irrigation, growth type, soil and weather conditions. The yield of genotypes will change with changing this situation, but to determine the resistant and susceptible genotypes through the index will not cause a problem because the basis for index calculation is the ratio of yield under drought stress and normal. So, if these conditions change the yield, this change will apply equally to both conditions and it does not change the ratio of two conditions yield. Hence the indicators are not change. The results of the correlation between the tolerance indices and grain yield under drought stress and normal stress are given in Table 3. The highest correlation is in drought stress conditions with indicators STI, MP and GMP. The results correspond to findings obtained from the researches Sadeghzadeh, Ahari, Sanjari, Radmehr and Kajbaf. Also results of correlation between grain yield in terms of moisture normal and drought tolerance indices showed the highest correlation value was related to HM, MP, STI, and GMP.

Table 2. Degree of freedom and squares mean of grain yield in the irrigated wheat

Sources of change	df	Squares mean for grain yield
Repeat	2	0.407*
Irrigation levels	1	5.476**
Error 1	2	0.28
Genotypes	5	0.157
Interaction of genotype × irrigation levels	5	0.105
Error 2	20	0.126
Changes Coefficient (%)	15.89	
* and ** significant in 5% and 1% level		

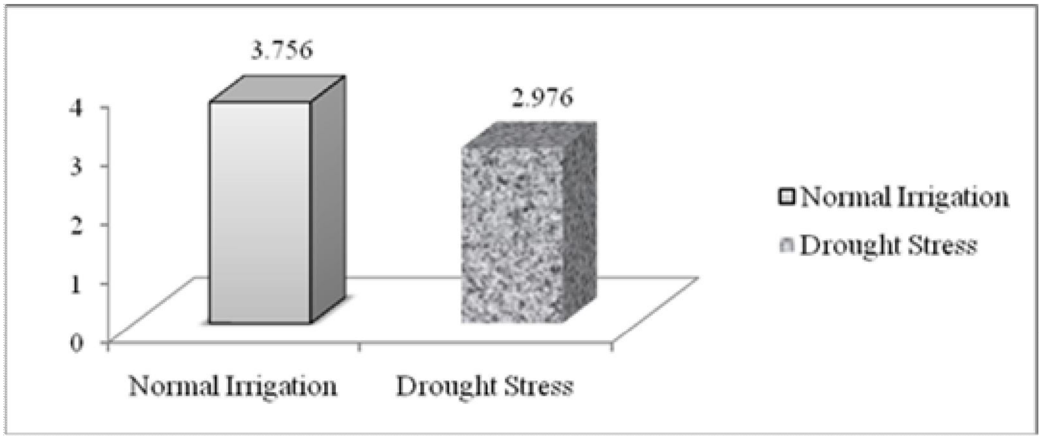

Figure 1. Average grain yield in both drought stress and normal irrigation

Table 3. Results of correlation coefficients between different parameters and grain yield under drought stress and normal irrigation

GMP	HM	MP	SSI	TOL	STI	Ys	Yp	
							1	**Yp**
						1	0.725*	**Ys**
					1	0.86**	0.800**	**STI**
				1	-0.489	-0.7**	0.100	**TOL**
			1	0.97**	-0.6*	-0.8**	-0.025	**SSI**
		1	-0.608*	-0.46	0.95**	0.90**	0.752**	**MP**
	1	0.87**	-0.091	0.105	0.81**	0.56*	0.88**	**HM**
1	0.86**	0.88**	-0.56*	-0.481	0.92**	0.92**	0.86**	**GMP**
*** and ** significant in 5% and 1% level**								

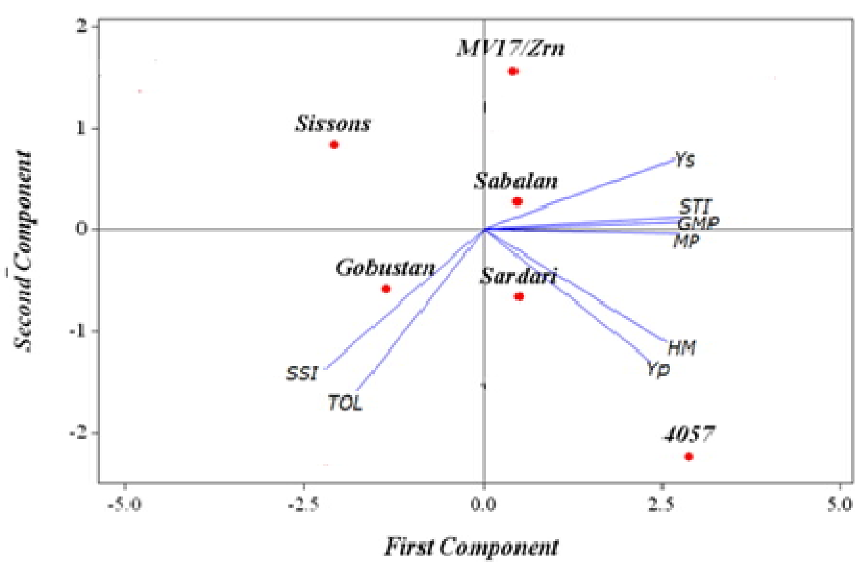

Figure 2. Biplot display of drought resistance indexes in 6 wheat genotypes

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