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Effect of End Season Drought Stress on Yield and its Components in Synthetic Wheat

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Abstract: In order to study the reaction of 12 synthetic wheat genotypes to end season drought stress and selecting the tolerant genotypes, an experiment was carried out under two conditions (stress and normal) in randomized complete block design with two replications in Research Center of Islamic Azad University of Ardabil. Results of analysis of variance showed that the genotypes were significant of plant height and yield at 0.01 percentage level. The interaction between genotypes and drought for plant height and main spike length was significant. Mean comparison for yield showed that the highest yield related by S_8 and S_1 genotypes respectively with 4.64 and 4.62 ton h^{-1} and the lowest yield related by S_2 genotypes respectively 3.36 ton h^{-1}. Being a product of genotypes S_8 and S_1 the average high was related traits. Correlation and path analysis for yield shoed that the most direct effect for yield related by plant height that through seed weight in main spike the most indirect effect on yield was applied.

Key words: Path analysis · Correlation · Synthetic wheat · Drought stress

INTRODUCTION

Wheat production in Mediterranean region is often limited by sub-optimal moisture conditions. Visible syndromes of plant exposure to drought in the vegetative phase are leaf wilting, a decrease in plant height, number and area of leaves and delay in accuracy of buds and flowers [1]. Drought tolerance consists of ability of crop to growth and production under water deficit conditions. A long term drought stress effects on plant metabolic reactions associates with, plant growth stage, water storage capacity of soil and physiological aspects of plant. Drought tolerance in crop plants is different from wild plants. In case crop plant encounters severe water deficit, it dies or seriously loses yield while in wild plants their surviving under this conditions but no yield loss, is taken into consideration. However, because of water deficit in most arid regions, crop plants resistance against drought, has always been of great importance and has taken into account as one of the breeding factors [1]. Achieving a genetic increase in yield under these environments has been recognized to be a difficult challenge for plant breeders while progress in yield grain has been much higher in favorable environments [2].

The most promising approach to increase agricultural productivity and to satisfy human needs in the future is the genetic improvement of crops, which requires a continuous allocation of new sources of genetic variation [3]. Hexaploid wheat (*Triticum aestivum*) has no hexaploid wild relatives, but synthetic hexaploid wheat is considered a promising source of exotic alleles for introgression into wheat [4-7]. Synthetic hexaploid wheat can be produced from interspecific crosses of tetraploid *T. turgidum* spp. and diploid T. tauschii. Synthetics derived from cultivated durum (*T. turgidum* spp. durum) have been used in QTL studies [8]. Zaeifizadeh *et al*. [9] studied the relationship between genotype and environmental conditions (dry and normal) on the amount of chlorophyll content and the amount of super oxide dismutase reported that drought-resistant cultivars increase super oxide dismutase stress increases but in susceptible cultivars decreased chlorophyll super oxide dismutase. Khayatnezhad *et al.* [1] in study of genetic diversity and path analysis for yield in durum wheat genotypes reported the most direct effect of harvest index for performance won which means that to achieve high performance of this attribute can be used, but the maximum direct effect of this trait through total tillers was applied in phenotypic correlation the maximum direct effect was related to harvest index.

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Table 1: Name and pedigreeof genotypes

Code	Pedigree
S_1	CMH81.794/4/CHEN/AEGILOPS SQUARROSA
S_2	(TAUS)//FCT/3/STAR/6/CMH79A.955/4/AGA/3/4*SN64…
S_3	Mv17/casgogen//108
S_4	CMH79A.955/CMH74A.487//CMH81A.744/3/STAR//KAUZ/STAR/6/CMH79A.955/4/AGA/3/4*SN64
S_5	Casgogen/604 zea
S_6	CMH79A.955/CMH74A.487//CMH81A.744/3/ELVIRA/6/CMH79A.955/4/AGA/3/4*SN64/...
S_7	N-85-17/TEG/GANFRENCH/6/CMH79A.955/4/AGA/3/4*SN64/CNO67//INIA66/5/NAC
S_8	CMH79A.955/CMH74A.487//CMH81A.744/3/ELVIRA/6/CMH79A.955/4/AGA/3/4*SN64/...
S_9	CMH80.638/CMH75A.411//CMH80.638/3/ELVIRA/6/CMH79A.955/4/AGA/3/4*SN64/CN067//...
S_{10}	CMH76.1084/2*CMH72A.429//ELVIRA/6/CMH79A.955/4/AGA/3/4*SN64/CNO67//…
S_{11}	VEE/CMH77A.917//VEE/3/CMH82A.1294/CMH84.3621/4/LERKE
S_{12}	VEE/CMH77A.917//VEE/3/ELVIRA/6/CMH79A.955/4/AGA/3/4*SN64/CN067//INIA66/5/NAC

The maximum direct negative effect on performance was related to the fertile tillers. The purpose of this study, investigation genetic diversity in synthetic hexaploid wheat cultivar, effective traits on yield, study traits correlation with together and also was selection the best genotypes. The purpose of this experiment, measuring Agricultural potential of synthetic wheat genotypes and identifying characteristics consistent with dry conditions and low water and increase the yield of the reaction characteristics are moisture conditions.

MATERIALS AND METHODS

In order to study the effect of drought stress on yield and yield components of 12 synthetic wheat (Table 1), an experiment based on complete randomized block was carried out in 2008-2009 cropping year at Research Center of Islamic Azad University of Ardabil branch.

Stress Treatments Included:

- Whole irrigated (100 percent used water based on the plant demand at various growing stages).
- Limited irrigation (water supply until a thesis and after wards drought employing as water withholding until the end of growing stage).

Nylon covers were used for control of under stress treatments.

After Sampling Traits As: Plant height, main spike length, number of seeds per main spike, number of seeds per Spikelet, own length, harvest index and yield were measured.

Traits measured based instruction of randomized complete blocks design in variance analysis and treatments mean ere compared by LCD method. Also, in order to analyze experiment data, we used software PATH2, SPSSI6, Excel. Causality analysis had been performed about yield on the basis of residual traits from multivariable regression by stepwise.

RESULTS AND DISCUSSION

Analysis of Variance: Results of analysis of variance (Table 2), showed that effect of conditions was significant for plant height, plant weight, seeds in spittle, seeds per main spike, harvest index and yield at 0.01 percentage level. The effect of genotype was significant at 0.01 percentage level for plant height, plant weight, seeds in spittle, own length, seeds per main spike and yield. Also the interaction between genotypes and drought conditions was significant for plant height, plant weight, seeds per spittle, own length and seeds per main spike at 0.01 percentage level.

Path Analysis: Results of path analysis (Table 3) showed that the most direct effect was for plant height. So in these genotypes selection based on plant height of the major factors considered for selection. This means that the plant height is more a product of genotypes can be achieved. On the other hand, the field observations of how the leaves of these genotypes was standing Khayatnezhad *et al*., [1] reported similar results.

The results are quite consistent with the results of Mohammadi *et al*., [12], respectively. During his trial to evaluate the drought stress on wheat and traits that were apparent, with the correlation coefficient in the stress

Table 2: Results of analysis of variance for studied traits

		MS								
SOV	df	Main spike weight	Seeds weight per main spike	Plant height	Plant weight	Seeds per spittle	Own length	Seeds per main spike	Harvest index	Yield
Condition	1	1.87	23.49	3176.88**	588.9**	2.72**	0.28	872.10**	1198.69**	28.13**
C×Rep	2	21.27	11.52	30.28	21.91	0.002	0.33	17.85	1141.92**	7.08**
Genotype	11	29.67	9.41	61.72**	97.87**	0.47**	0.72**	216.32**	53.57	3.40**
G×C	11	23.38	8.60	96.65**	28.66**	0.40**	1.005**	294.42**	140.34	1.31
Error	22	22.53	8.59	9.3	25.08	0.77	0.16	55.66	117.18	0.72

** Significant at the 0.01 level

Table 3: Partitioning of correlation coefficient analysis direct and indirect effects for mean yield

		Indirect effect through				
Trait name	Direct effect	Plant height	Main spike length	Seed weight per main spike	Harvest index	Correlation
Plant height	0.241	-	-0.21	0.56	0.124	0.501
Main spike length	-0.38	0.18	-	0.076	0.042	0.27
Seed weight per main spike	0.29	0.64	-0.1	-	0.039	0.38
Harvest index	0.28	0.15	-0.06	0.041	-	0.46

process concluded that traits such as height and elongation of the peduncle to provide source material for this transport phenomenon. The plant tolerates drought and photosynthesis level can be effective. It seems directly related to yield and plant height of more light penetration into the canopy and carried by all the leaves during photosynthesis and thus produces and most of the seeds are photosynthesis. Sadeghzadeh and Ahari [13] reported a positive correlation between grain yields per plant and there is a significant altitude. More indirect effect on plant height, harvest index has been applied. The choice of this method is also important Khayatnezhad *et al*., [1] reported similar results.

The second trait directly affecting the function of plant height and harvest index and grain weight was lavender. In other words, these two characteristics of high performance were selected as the main characters.

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