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EFFECT OF DIFFERENT IRRIGATIONS ON YIELD AND ITS ASSOCIATED TRAITS IN WHEAT (*Triticum aestivum* L.)

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Abstract: Drought is a severe abiotic stress reducing yield as well as affecting its associated traits. Morphological attributes directly leading to yield has its own importance to the crop. Presently, six valuable wheat genotypes and there hybrids were exposed to three different irrigations: $T_{1,}$ contributing all normal irrigations; T_2, one irrigation escaped at tillering stage and T_3, one irrigation escaped at booting stage. The stress during tillering and booting stages affected many of the progenies and produced reduced harvest index (%), biological yield (kg ha^{-1}) and grain yield$^{-1.}$ However, few progenies TD-1 × Imdad, Sarsabz × TJ-83, Sarsabz × Khirman and Kiran-95 × Khirman were predominant and gained more, biological yield (kg ha^{-1}), harvest index (%) and grain yield kg^{-1} in different irrigations,

Introduction

Wheat (*Triticumaestivum* L.) is the major cereal crop of Pakistan grown as a mono-crop for cultivation(Khakwani et al., 2011). It is the nutritious and cheap source food of many Pakistani people (Noorka and Schwarzacher, 2013). Pakistan is one the largest growing countries of wheat occupying 10th position in the world(Shirazi et al., 2010). Most of the one third area of Pakistan is rainfed and remaining area is canal irrigated, hence sometimes severe moisture is encountered due to less rainfall effecting tillering and grain filling stages of wheat (Abdul Ghani et al 2000).Nonetheless, increase in temperature and less rainfall often reduce plant growth and crop yields (Kilic and YAĞBASANLAR, 2010). In this drought

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situationsome suitable wheat genotypes are to be needed that can adapt them in reduced moisture and improve crop yield (Shafeeq and Zafar, 2006, Shirazi et al., 2010).

Among abiotic stresses, drought stress is one of the crucial problems spreading worldwide and generating a huge loss to agriculture (Ali et al., 2013). Plants response to stress conditions is very complex and depends upon the intensity and length of stress provided to the crop (Akram, 2011, Ali et al., 2013). Different growth stages of wheat have its own importance in the development of the wheat crop. Hence, efficient utilization of water is important under moisture stress conditions (Akram, 2011). It has been observed that plants during stress maintain their metabolic activity and structure capacity to improve their potential under varied stress environments (Ali et al., 2013). From many years, conventional breeding techniques have been an efficient tool for improving crop yield (Noorka and Schwarzacher, 2013). Agronomical traits with limited water environments express variably and could be improved through selection programs (Jatoi et al., 2011). Hence, escape of water or stress avoidance depends upon the genotype (Ali et al., 2013). Keeping in view the above findings, the present research was carried out to determine the response of some important morphological traits on wheat genotypes under different stress environments.

Material and Methods

A field experiment was conducted to determine the sensitivity of wheat under different stress conditions in some important morphological traits. Six wheat genotypes were utilized for the experiment viz. Imdad, TD-1, Kiran-95, Khirman, Sarsabz and TJ-83. A split plot experiment was carried out at Latif farm of Sindh Agriculture University, Tando Jam, Hyderabad, Pakistan, for continuously two years 2011-12 and 2012-13. In the 1st year water was escaped at tillering and booting stages of wheat and the genotypes were exposed to these water irrigations. Then on the basis of morphological traits the genotypes were crossed with each other as to produce efficient combinations. Six valuable segregating populations were produced i.e.TD-1 × Imdad, Sarsabz × TD-1, TJ-83 × Khirman, Kiran-95 × Khirman, Sarsabz × TJ-83 and Sarsabz × Khirman and utilized for the 2nd generation. They were grown under different irrigations, evaluating under water stress and non-stress conditions.

T_1: All normal 5 irrigations were applied.

T_2: one water application was escaped during tillering stage.

T_3: In this stage one water irrigation was escaped during booting stage.

Few important morphological traits were studied viz.harvest index (%), biological yield (kg ha^{-1}) and grain yield $plant^{-1}$ (g)

Statistical analysis

The entire data was statistically analyzed using Analysis of variance (ANOVA) according to (Gomez and Gomez, 1984). Standard error for difference between means (SED) and Least Significant Difference (LSD) were calculated using the following formula:

$$SED = \left(2EMS / N\right)1/2LSD = SED \times t\left(0.05\right)df$$

Where EMS = error mean square n = number of replications.

Results and Discussion

Many plant species have the ability to tolerate the stress environments whether it is abiotic or biotic stress. Presently, in our experiment different genotypes explored variably at different irrigations.The pooled ANOVA depicted that six F_2 segregating populations and their parental wheat varieties for the traits grain yield $plant^{-1}$ (g) and harvest index (%) were significantly different at $P \leq 0.05$; while biological yield (kg ha^{-1}) was highly significant at $P \leq 0.01$ level of probability (Table 1). Genotypes × treatment interactions (G × E) also seem to be highly significant ($P \leq 0.01$) (Table 1). Previous studies also reveal significant differences between genotypes and treatments observed in different characters (Sial et al., 2010). The mean performance varied with different irrigations treatments in the population. Among the six progenies Sarsabz xTD-1, TJ-83 × Khirman, Sarsabz × TJ-83 hybrids contributed maximum performance in harvest index (%), biological yield (kg ha^{-1}) and grain yield $plant^{-1}$during normal irrigations (Fig 1-3). In T_2 the progeny TD-1 × Imdad, TJ-83 × Khirman, Sarsabz × TJ-83 and Sarsabz × Khirman revealed high performance during stress at tillering stage for biological yield (kg ha^{-1})(Fig 2). However, Sarsabz × TJ-83 showed higher grain yield plant $^{-1}$in this stress stage (Fig 3). Some of the progenies were affected by reduced yield, emphasizing that they might have provoked difficulties in stress conditions (Chen et al., 2012). TD-1 × Imdad and Kiran-95 × Khirman also contributed maximum harvest index (%) during T_2 (Fig 1). During escape of irrigation at booting stage most of the genotypes/hybrids revealed decreased harvest index (%), biological yield (kg ha^{-1}) and grain $yield^{-1}$ (Fig 1-3). However, in T_3, the progenies TD-1 × Imdad, Sarsabz × TD-1 and Kiran-95 × Khirman attributed maximum grain yield $plant^{-1}$ (Fig 3). For the trait biological weight (kg ha^{-1}) the cross Sarsabz × TJ-83 increased in T_3 (Fig 2). Also two progenies Sarsabz × TJ-83 and Kiran-95 × Khirman performed better for the trait harvest index (%) (Fig 1). Previous studies report that harvest index (%) is the most significant trait for screening drought resistance in genotypes under stress environment (Khakwani et al., 2011).

Previous studies declare that some stages of wheat can cope under moisture stress, where others might be susceptible and enhance low yield (Akram, 2011). It is suggested from our results that the progenies TD-1 × Imdad, Sarsabz × TJ-83, Sarsabz × Khirmanand Kiran-95 × Khirman gained more, biological yield (kg ha^{-1}), harvest index (%) and grain yield kg^{-1}in different irrigations, thus emphasizing that they can be used at stress conditions.

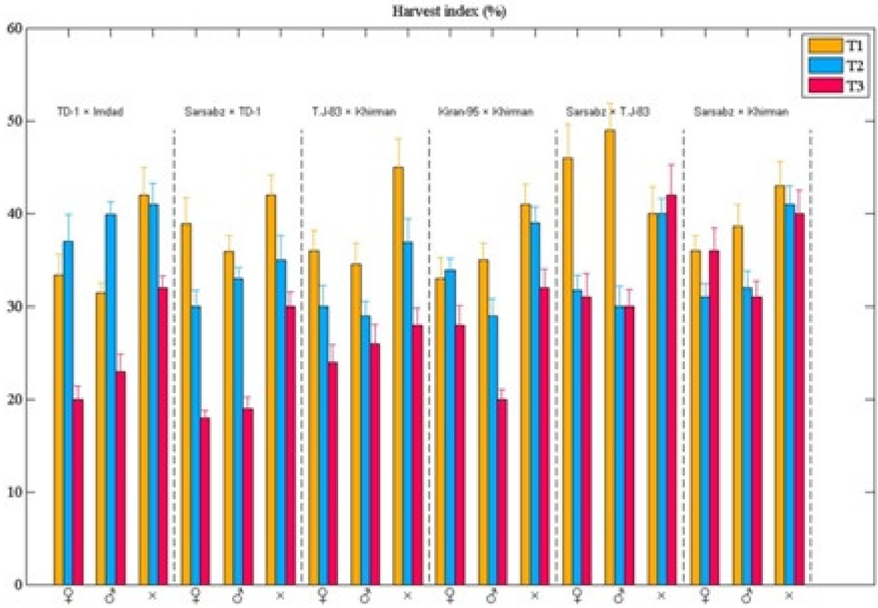
Table 1. Pooled Analysis of variance (ANOVA) of some agronomical traits of wheat *(Triticumaestivum L.) under normal and water stress conditions*

Source of variation	Mean of squares			
	df	**Harvest Index (%)**	**Biological Yield (Kg/ha)**	**Grain yield/plant (g)**
Replications	2	10.534	456734	0.18
Treatments water (T)	2	25.711*	2668746**	0.07*
Error	4	24.066	269051	0.06
Varieties (V)	11	172.762*	3825399**	0.12*
Treatments x Varieties(TxV)	22	14.574	582191**	0.085*
Error	44	13.712	28880	0.081

**** =** Significant at P≤ 0.01, ***=** Significant at P≤ 0.05.

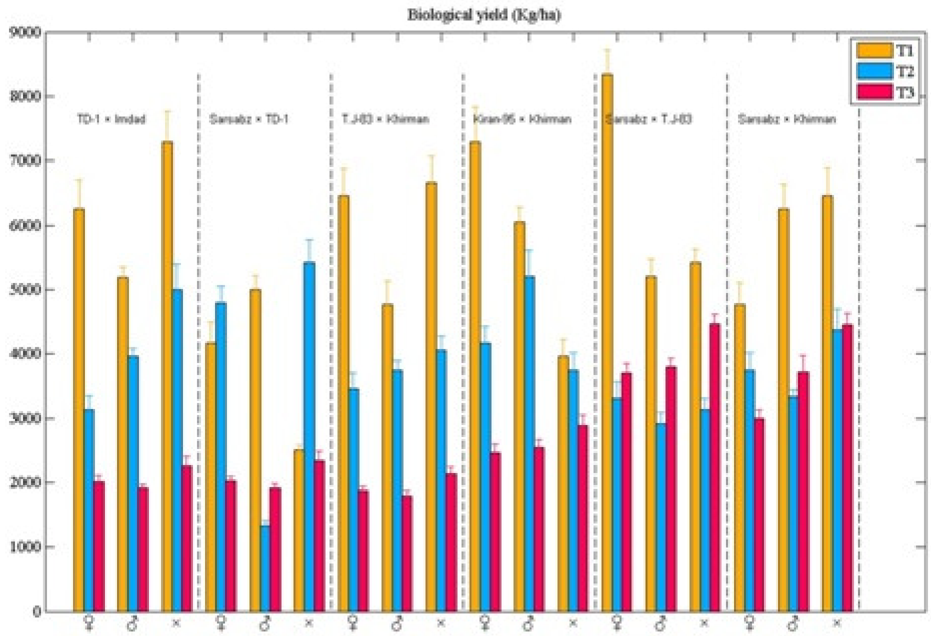
The T represents the water treatments applied, V is for genotypes/varieties used and T x V is the interaction between treatment of water and genotypes

Fig 1. Mean performance of six F_2 progenies and their respective parental lines of wheat for the trait harvest index (%) at different irrigations.



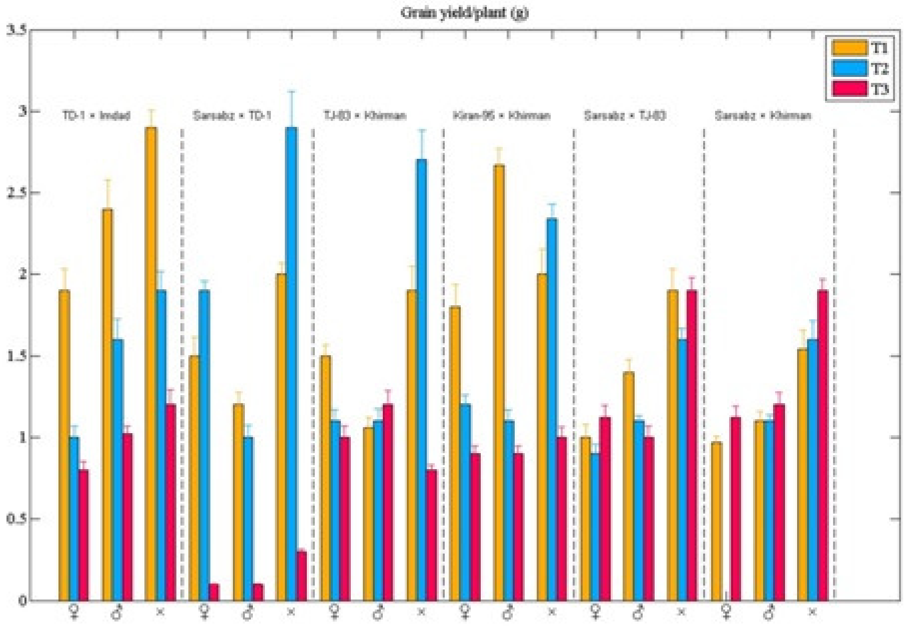
T1: normal irrigation, T2: escape of irrigation at tillering stage and T3: escape of irrigation at booting stage

Fig 2. Mean performance of six F_2 progenies and their respective parental lines of wheat for the trait biological yield kg ha^{-1}at different irrigations.



T1: normal irrigation, T2: escape of irrigation at tillering stage and T3: escape of irrigation at booting stage.

Fig 3. Mean performance of six F_2 progenies and their respective parental lines of wheat for the trait grain yield plant^{-1} (g) at different irrigations



T1: normal irrigation, T2: escape of irrigation at tillering stage and T3: escape of

References

[1] Akram, M. (2011). Growth and yield components of wheat under water stress of different growth stages. Bangladesh Journal of Agricultural Research 36: 455-468.

[2] Abdul Ghani, Abid Nisar Ahmed &Muhammad Sarwar(2000).Interactive effect of nitrogen and water stress on nitrogen content and grain yield of two wheat (*Triticum aestivum L.).Pak.J.Agri. Se;' Vo!'37(3-4).*

[3] Ali, A., N. Ali, N. Ullah, F. Ullah, M. Adnan and Z. Ahmed (2013). Research article effect of drought stress on the physiology and yield of the pakistani wheat germplasms.

[4] Chen, X., D. Min, T. A. Yasir and Y.-G. Hu (2012). Evaluation of 14 morphological, yield-related and physiological traits as indicators of drought tolerance in chinese winter bread wheat revealed by analysis of the membership function value of drought tolerance (mfvd). Field Crop Res 137: 195-201.

[5] Gomez, K. A. and A. A. Gomez (1984). Statistical procedures for agricultural research, John Wiley & Sons.

[6] Jatoi, W., M. Baloch, M. Kumbhar, N. Khan and M. Kerio (2011). Effect of water stress on physiological and yield parameters at anthesis stage in elite spring wheat cultivars. Sarhad J.

Agric 27: 59-65.

[7] Khakwani, A. A., M. Dennett and M. Munir (2011). Drought tolerance screening of wheat varieties by inducing water stress conditions. Songklanakarin J Sci Technol 33: 135-142.

[8] Kilic, H. and T. YAĞBASANLAR (2010). The effect of drought stress on grain yield, yield components and some quality traits of durum wheat (triticum turgidum ssp. Durum) cultivars. Notulae Botanicae Horti Agrobotanici Cluj-Napoca 38: 164-170.

[9] Noorka, I. R. and T. Schwarzacher (2013). Water a response factor to screen suitable genotypes to fight and traverse periodic onslaughts of water scarcity in spring wheat (triticum aestivum l.). Intl. J. Water Resources & Arid Environ 3: 37-44.

[10] Shafeeq, S. and Y. Zafar (2006). Genetic variability of different wheat (triticum aestivum l.) genotypes/cultivars under induced water stress. Pakistan Journal of Botany (Pakistan).

[11] Shirazi, M., J. Gyamfi, T. Ram, H. Bachiri, B. Rasyid, A. Rehman, M. Khan, S. Mujtaba, M. Ali and A. Shreen (2010). Selection of some suitable drought tolerant wheat genotypes using carbon isotopes discrimination (cid) technique. Pakistan J Bot 42: 3639-3644.

[12] Sial, M. A., M. U. Dahot, S. Mangrio, M. Arain, K. A. Laghari and A. A. Simair (2010). Screening of wheat genotypes for water stress tolerance. Pak. J. Biotech.