INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 8, No. 5, p. 236-241, 2016

RESEARCH PAPER OPEN ACCESS

Evaluation of five different wheat (*Triticum aestivum* L.) genotypes under drought stress conditions at haripur valley.

Ibrar Khan*, **Sami Ullah Khan, Khwaja Muhammad Khan, Ayub Khan, Ali Raza Gurmani, Sajid Ali, Shah masaoud khan, Izhar Khan, Irfan Ullah, Israr Ali, Ahmad Ali**

Department of Agricultural Sciences (Agronomy), University of Haripur

Key words: Drought, Days to maturity, Plant height, Spike length, Number of grains, 100 grain weight.

http://dx.doi.org/10.12692/ijb/8.5.236-241 Article published on May 30, 2016

Abstract

The study was conducted to investigate the "Evaluation of five different wheat genotypes under drought stress conditions at Haripur valley". The five wheat varieties were sown in pots using Completely Randomized Design (CRD) with three replications. The wheat pots were kept in two different arrangements for drought stress and control condition. The control pots plants was kept in the open climate under ordinary conditions. ANOVA revealed highly significant (*$p \leq 0.01$*) differences for the whole parameters in five different wheat genotypes. The data for eight traits were studied viz., days to 50% heading, days to maturity, number of grains per spike, plant height, 100-grain weight, number of spikelet's spike^{-1}, number of tillers and spike length. Under drought and controlled conditions maximum values of days to 50% heading, days to maturity, plant height, spike length, number of spikelet's spike^{-1}, number of grains spike^{-1}, number of tillers and 100-grain weight ranged from 71.33 to 74.66, 122.33 to 128.67, 65.73 to 68.26cm, 9.50 to 10.43, 21.26 to 22.33, 41.33 to 51.67, 4.00 to 4.00 and 2.91 to 3.52 g for drought stress and control, respectively. Similarly minimum values were observed for days to 50% heading (69 to 71.66), days to maturity (120.33 to 123.67), plant height (51.00 to55.73), spike length (8.20 to 9.26), number of spikelet's spike^{-1} (19.80 to 21.26), number of grains spike^{-1} (36.00 to 41.33), number of tillers plant^{-1} (2.00 to 3.00), 100-grain weight (2.50 to 3.24g) for drought stress and control respectively.

* **Corresponding Author:** Ibrar Khan ✉ kmk.dir@gmail.com

Introduction

Indeed wheat is one of the world's leading cereal crops Siddiqui (2008). Bread wheat (*Triticum aestivum* L. em Thell AABBD, 2n =6x=42) has remained the central theme of self-sufficiency programme in Pakistan. Wheat (*Triticum Aestivum*L.) is a cereal grain, originally from the Levant region of the near East and Ethiopian Highlands, but now cultivated worldwide. Although Pakistan was the first country in Asia to achieve self-sufficiency in wheat after the advent of the so-called Green Revolution (Siddiqui & Arian 1974; Arain & Siddiqui 1977). Studies have found tremendous variation within and between species, thus it will help to breed heat tolerance for future environment. Some of attempts to develop heat tolerant genotypes are successful (Ehlers and Hall, 1998; Camejo *et al.,* 2005).Accomplishment of self-sufficiency and food security could never be possible without enhancement of wheat production per unit area. Thus, improvement in wheat production has always been priority of every government. Considerable yield improvement in wheat is possible through the use of high yielding cultivars and advance agronomic practices. To boost the production of wheat and to make the country self-sufficient in grain production, there is dire need to enhance research on it. Wheat production can be enhanced though the development of high yielding cultivars having wide genetic base and capability of production better yield under various agro climatic conditions (Saleem, 2007). High temperatures during grain filling period of wheat adversely affect the plant growth, yield and grain quality in many regions of world. Tolerance to heat stress is complex phenomenon and controlled by multiple genes imparting a number of physiological and biochemical changes (Grag *et al.,* 2012). Due to an increasing trend of rising temperatures around the globe, wheat may be exposed to greater thermal stress in the near future. Therefore, the identification and development of suitable heat tolerant wheat varieties is an important step to resolve this threat to production and to achieve high yield, even under high temperature stress (Hossain *et al.,* 2012). Laghari *et al.,* (2012) reported that grain yield of wheat in Pakistan is low as it is severely affected by various biotic and abiotic stresses. Among the abiotic stress, heat stress (terminal high temperature) is one of the major causes of low wheat productivity. This paper focuses on the evaluation and performance of newly evolved wheat genotypes under different temperature regimes and the selection of suitable promising lines, showing early maturity coupled with high yield under high temperature-stressed environments. Keeping in view the significance of drought stress resilience in wheat for its yield change in rain-fed zones, the present study included the assessment of latest developed cultivars of wheat for drought stress resistance based on physiological and agronomic characteristics and to recommend the best screening criteria for drought tolerance in wheat.

Methods and materials

Study side and experimental design

The recent research study was conducted at Agriculture farm University of Haripur, to study the "Evaluation of wheat genotypes under drought stress conditions at Haripur valley". The genotypes were sown in pots and recreated thrice utilizing Completely Randomized Design (CRD). Two different arrangements of plants were kept up for drought stress and control. One arrangement of plants was exchanged to rain asylum burrow at the pre-anthesis development stage. The control set plants were kept in the open climate under ordinary conditions. The control set plants were inundated as and when needed.

Uses of Fertilizer

The pots were supplied with the nitrogen @ 1.5 kg Nitrogen pot^{-1} as for each near usual for best -yielding wheat expansion, K_2O @ 0.5 and 1.5 kg Nitrogen pot^{-1}, and P2O5 and individually.

Observations Recorded

Data was recorded on the following parameters such as days to heading, days to maturity, plant height, spike length, number of tillers, Number of spikelet per spike, Number of grains per spike, 100 grain weight.

Data analysis

Averages were calculated for recorded data in each replication. Data was analysed by using statistical software Statistix 8.1.

Results and discussion

Analysis of variances

The Statistical analysis showed highly significant variation for the observed parameters such as days to heading, days to maturity, plant height, spike length, number of tillers, Number of spikelet per spike, Number of grains per spike and 100 grain weight.

Days to heading in control ranged from 71.66 to 74.66 days, while in the drought, it ranged from 69 to 71.33 days. Various studies revealed that drought stress decreased the number of days to heading (Kilic and Yagbasanlar. 2010).

Table 1. Different wheat genotypes under control condition.

NO	Varieties	Days H	Maturity	PH	Spike Lenght	No T	Skipe^{-1}	G Spike	100 GW
11	Hashim	1.66 AB	127.33 AB	60.90 D	9.46 ABC	3.00 ABC	22.26 A	46.33 B	3.35 BC
22	Pasban-90	1.66 AB	125.67 BC	55.73 E	10.43 A	4.00 A	21.26 AB	51.66 A	3.52 A
33	Rohtas	74.66 A	128.67 A	59.20 D	10.40 AB	3.00 ABC	22.33 A	47.00 B	3.40 AB
44	PSK-2008	73.00 AB	123.67 CD	63.70 C	9.26 CD	3.00 ABC	21.50 AB	50.66 A	3.27 BC
55	Tatara	74.66 A	125.67 BC	68.26 A	9.36 ABC	3.00 ABC	21.33 AB	41.00 C	3.24 C
LSD		4.5265	2.4289	2.0322	1.0703	1.1678	1.1560	2.5992	0.1465

Days to heading, days to maturity, plant height, spike length, number of tillers, Number of spikelet per spike, Number of grains per spike, 100 grain weight.

The days to 50% heading is considered effective in various bread wheat and durum varieties (Moayedi *et al.* 2010) but this may not be necessary that early heading plants gave higher yield (Ooro *et al.* 2009) those in which heading days become increased may also give high yield. Under control, days to maturity ranged from 123.67 to 128.67 days with a mean of 126 days while under drought condition it ranged from 120.33 to 122.33 days with a mean of 120 days. Earlier research studies on drought stress in wheat revealed that the days to maturity decreased in different wheat varieties (Kilic and Yagbasanlar. 2010), and in common bean cultivars (Rosales-Serna *et al.* 2004). The variation among the wheat genotypes for days to maturity might be due to their different genetic makeup (Ahmad *et al.* 2006). Plant height ranged from 68.26 to 55.73 cm in the case of control condition with average plant height of 61.55 cm. While under drought condition it ranged from 65.73 to 51.00 cm with an average height of 57.32 cm. In another study it was revealed that plant height was considerably caused by various water actions in unusual wheat selections (Zarea-Fizabady and Ghodsi. 2004, Saleem. 2003). Significant variation was observed in different durum wheat genotypes for plant height and this can be useful for broadening the genetic base of local varieties (Arzani. 2002). Under control situation spike length ranged from 9.26 to 10.43 cm with a mean of 9.78 cm while under drought condition it ranged from 8.20 to 9.50 cm with a mean of 8.83 cm. In an experiment of bread wheat it was revealed that there was significant reduction in ear spike length under water stress condition (Saleem. 2003 Mirbahar *et al.* 2009 Kiliç and Yagbasanlar. 2010) which supported these results. Similarly, significant variation was found in spike length in different species of wheat (Baalbaki *et al.* 2006). Number of tillers under controlled condition ranged from 4.00 to 3.00 with an average of 3.20 while in drought condition it ranged from 4.00 to 2.00 with an average of 2.93. High tillering has been viewed as unwanted luxury under water deficit condition, due to depletion of water (hurd, 1971: Blum, 1985) the low number of fertile tillers under water stress condition is one of the main causes of reduced yield (Peltonen-Sainio, 1991; Cabeza *et al.*1993; Cone *et al.*1995) Some scientist have examed the genotypes with a limited tillering capacity as an advantage in the arid regions with low rainfall (Innes *et al.* 1981). Number of spikelet per spike in the control condition ranged from 21.26 to 22.33 with an average of 21.37, while in drought condition it ranged from 19.80 to 21.26 with an average of 20.43. it has been examine to be decreased by other workers, (Kalinin,1988; Iqbal *et al.*1999) similarly result views has been extended for spikelet's per spike remaining stable (Iqbal *et al.* 1999) or exhibiting decrease due to water stress (Shalaby *et al.* 1988). Number of grains per spike in the control condition ranged from 41.00 to 51.67 with an average of 47.33, while in drought condition it ranged from 36.00 to 41.33. According to Nouri G.A and Hassan pauoh. (2009) a major decrease and variation in grains per spike was obtained in drought stress situation in various wheat varieties. Previous other studies also showed that number of grains per spike reduced significantly below water stress. (Kazmi *et al.* 2003 Kilic and Yagbasanlar, 2010).

Table 2. Different wheat genotypes under Drought conditions.

NO	Varieties	Days H	Maturity	Plant H	Spike length	NO T	Spikelet S	G Spike	100GW
1	Hashim	69.00(3.71%) B	120.33 (5.49%) E	55.60(8.70%) E	8.50(10.14%) CD	2.33 (22.23%) BC	21.26(4.49%) AB	36.00(22.29%) D	2.67 (20.29%) E
2	Pasban-90	69.00(3.71%) B	120.67(3.97%) E	53.26(4.43%) F	9.50 (8.91%0 ABC	4.00 (0%) A	19.86 (6.58%) C	37.66 (27.10%) D	2.60 (26.13%) EF
3	Rohtas	70.66(5.35%) AB	120.33 (6.48%) E	51.00(13.85%) G	9.33 (10.28%) BC	3.00 (0%) ABC	20.56 (7.92%) BC	41.33 (12.06%) C	2.50 (26.47%) F
4	SK-2008	71.33(2.28%)AB	120.67 (2.42%)E	61.03(4.19%) D	8.20 (11.40%) D	3.33 (-11%)AB	19.80 (7.90%) C	40.33 (20.39%) C	2.91 (11.00%) D
5	Tatara	71.33(4.46%) AB	122.33 (2.65%) DE	65.73(3.70%) B	8.63 (7.79%)CD	2.00 (33.33%)C	20.70 (2.95%) BC	36.33 (11.39%) D	2.72 (16.04%) E
LSD	4.5265								

Days to heading, days to maturity, plant height, spike length, number of tillers, Number of spikelet per spike, Number of grains per spike, 100 grain weight.

So the result described that number of grains per spike, including grain weight per spike in drought situation have vital direct effect on yield (Dencic *et al.* 2000). Under control condition, 100 grain weight ranged from 3.24 to 3.52 g with a mean of 3.35 g while under drought condition it ranged from 2.50 to 2.91 with a mean of 2.68 g. Grain yield of wheat depends upon its yield components. Changes in any one of these can decrease the overall yield. Water scarcity reduces every component in spring wheat (Ashraf, 1986) and in durum wheat (Giunta *et al.* 1993). on the basis of various learning method that 100 kernel weight was importantly affected by water stress treatment in various wheat species (Zarea-Fizabady and Ghodsi, 2004).

Conclusion

Keeping in view the better performance of Pasban-90 PSK 2008 and Tatara for measured physiological and yield characteristic under pre-anthesis water stress in soil pot condition, it is suggested that these varieties can be used in the wheat crop breeding material for the development of new drought resist wheat varieties.

Refrences

Ahmad M, Akram Z, Munir M, Rauf M. 2006. Physio-morphic response of wheat genotypes under rainfed conditions. Pakistan Journal of Botany **38,** 1697-1702.

Arzani A. 2002. Grain yield performance of durum wheat germplasm under Iranian dry land and irrigated field conditions. SABRAO Journal of Breeding and Genetics **34,** 9-18.

Ashraf MY. 1986. Yield and yield components of wheat (Triticum aestivum) genotypes grown under soil water deficit condition. Acta. Agronomy. Humg. **46,** 45-51.

Baalbaki R, Hassan NH, Zurayk R. 2006. Aegilops species from semiarid areas of Lebanon Variation in quantitative attributes under water stress. Crop Science **46,** 799.

Blum A, Shpiler L, Golan G, Meyer J, Sinmena B. 1991. Mass selection of wheat for grain filling without transient photosynthesis. Euphytica **54,** 111-

116.

Cabeza C, Kin A, Ledent FJ. 1993. Effect of water shortage on main shoot development and tillering of common and spelt wheat. Journal of Agronomy and Crop Science **170,** 243-250. http://dx.doi.org/10.1111/j.1439037X.1993.tb01082.x

Camejo D, Jimenez A, Alarcon JJ, Torres W, Gomez JM, Sevilla F. 2006. Changes in photosynthetic parameters and antioxidant activities following heat-shock treatment in tomato plants. Functional Plant Biology **33,** 177-187. http://dx.doi.org/10.1071/FP05067

Cone AE, Slafer GA, Halloran GM. 1995. Effects of moisture stress on leaf appearance, tillering and other aspects in Triticum tanschii. Euphytica **86,** 55-64.

Dencic S, Kastori R, Kobiljski B, Duggan B. 2000. Evaluation of grain yield and its components in wheat cultivars and landraces under near optimal and drought conditions. Euphytica **113,** 43-52.

Ehlers JD, Hall AE. 1998. Heat tolerance of contrasting cowpea lines in short and long days. Field Crops Research.**55,**11–21. http://dx.doi.org/10.1016/S0378-4290(97)00055-5

Ghodsi M. 2004. Ecophysiological aspects of water deficit on growth and development of wheat cultivars. PhD Thesis, University of Tehran.

Gogorcena Y, Iturbe-Ormaetxe I, Escuredo PR, Becana M. 1993. Antioxidant defenses against activated oxygen in pea nodules subjected to water stress. Journal of Plant Physiology **108,** 753-758.

Hossain A, Teixeira da Silva JA, Lozovskaya MV, Zvolinsky VP. 2012. The effect of high temperature stress on the phenology, growth and yield of five wheat (Triticum aestivum *l.*) genotypes. Asian Australasian Journal of Plant Science and Biotechnology **6,** 14–23.

Hurd EA. 1971. Can we breed for drought resistance? In Drought injury and Resistance in Crops. (Larson,K.L.ed) Crop Science of Society **2,** 77-88.

Innes P, Blackwell RD, Austin RB, Ford MA. 1981. The effects of selection for number of ears on the yield and water economy of winter wheat. The Journal of Agricultural Science **96,** 523-532. http://dx.doi.org/10.1017/S0021859600036844

Iqbal M, Ahmad K, Ahmad I, Sadiq M, Ashraf MY. 1999. Yield and yield components of durum wheat. (triticum durum Desf) as influenced by water at various growth stages Pakistan Journal Of Biological Sciences **2,** 1438-1440. http://dx.doi.org/10.3923/pjbs.1999.1438.1440

Kalinin NI. 1988. Parameters of spring wheat cultivar in relation to drought type. Nauchno-Isledovatel' skogo Instituta Rastenievodstva Imeni N.I Vavilova. **177,** 15-17.

Kazmi RH, Khan MQ, Abbasi MK. 2003. Effect of water stress on the performance of wheat grown under controlled conditions at Rawalakot, Azad Jammu and Kashmir. Sarhad Journal of Agriculture **19,** 61-68.

Kiliç H, Yagbasanlar T. 2010. The effect of drought stress on grain yield, yield components and some quality traits of durum wheat (Triticum turgidum ssp. durum) cultivars. Not. Bot. Hort. Agro.bot. Cluj. **38,** 164-170.

Laghari KA, Sial MA, Arain MA, Dahot MU, Mangrio MS, Pirzada AJ. 2010. Comparative performance of wheat advance lines for yield and its associated traits. World Applied Sciences Journal 8 (Special Issue of Biotechnology and Genetic Engineering): 34-37: ISSN 1818-4952.

Moayedi AA, Boyce AN, Barakbah SS. 2010. The performance of durum and bread wheat genotypes associated with yield and yield component under different water deficit conditions. Australian Journal of Basic and Applied Sciences **4,** 106-113.

Mostajeran A, Rahimi-Eichi V. 2009. Effects of Drought Stress on Growth and Yield of Rice (*Oryza sativa* L.) Cultivars and accumulation of proline and soluble sugars in sheath and blades of their different ages leave. American-Eurasian Journal of Agriculture & Environmental Sciences **5,** 264-272.

Naroui RR, Kadir MA, Ehawa Z, Jaafar Cgement D. 2012. Physiological and biochemical relationship under drought stress in wheat (Triticum aestivum). African Journal Of Biotechnology **11,** 1574-1578.
http://dx.doi.org/10.5897/AJB11.1109

Ooro PA, Bor PK, Amadi DOK. 2009. Evaluation of wheat genotypes for improved drought tolerance through increased seedling vigour. African Crop Science Conference Proceedings 9, 49-53. Record Number = 20133232444.

Peltonen-Sainio P. 1991.Effect of moderate and severe drought stress on the pre-anthesis development and yield formation of Oats. Journal of Agricultural Science in Finland **63,** 379-389.
http://aims.fao.org/serials/c_177cfaec

Rosales S, Kohashi-Shibata RJ, Acosta-Gallegos JA, Trejo-Lopez C, Ortiz ereceres J, Kelly JD. 2004. Biomass distribution, maturity acceleration and yield in drought-stressed common bean cultivars. Field Crops Research **85,**203-211.
http://dx.doi.org/10.1016/S0378-4290(03)00161-8

Saleem M. 2003. Response of durum and bread wheat genotypes to drought stress: biomass and yield components. Asian Journal of Plant Sciences. **2,** 290-293.

Shalaby EM, Rahim HMA, Mosaad MG, Masoud MM. 1988. Effect of watering regime on morpho-physiological traits and harvest index and its components of wheat. Assiut University. Journal of Agriculture sciences **19,** 195-207.

Siddiqui KA. 1977. Synthetic amphiploids in breeding-genetic and evolutionary studies in wheat. In: Genetic Diversity in Plants. Eds. A. Muhammad,R.Aksel, R.C. von Borstel. pp. 97-102. Plenum Press, New York.

Siddiqui KA, Arain AG. 1974. Performance and selection for yield of wheat mutants derived from different cultivars. Euphytica **23,** 585-590.

Siddiqui KA. 2008. Coping with wheat in Pakistan in the wake of green biotechnology, nano biotechnology and food sovereingnty. 11 th International Wheat Genetics Symposium, Brisbane, Australia.:
www.iwgs.info) (E:iwgs@fcconventions.com.au).

Zarea FA, Ghodsi M. 2004. Evaluation of yield and yield components of facultative and winter bread wheat genotypes (*Triticum aestivum* L.) under different irrigation regimes in Khorasam province in Iran. Pakistan Journal of Agronomy **3,** 184-187.
http://aims.fao.org/serials/c_9ecc0948.