Full Length Research Article
Advancements in Life Sciences – International Quarterly Journal of Biological Sciences

ARTICLE INFO

Date Received: 13/10/2020;
Date Revised: 16/06/2022;
Date Published Online: 31/10/2022;

Authors' Affiliation:
1. Young Researchers and Elite club, Ardabil Branch, Islamic Azad University, Ardabil - Iran
2. Department of Science, Cellular and Molecular Biology, Islamic Azad University, Ardabil - Iran

***Corresponding Author:**
Majid Khayyatnezhad
Email: Khayatnezhad@gmail.com

How to Cite:
Khayyatnezhad M, Gholamin R, Keynoos H, (2022). Investigation of the Effect of End Season Drought Stress on Morphological on Durum Wheat Genotypes. Adv. Life Sci. 9(3): 284-288.

Keywords:
Drought; Stress; Durum wheat; Factor analysis

Open Access

Investigation of the Effect of End Season Drought Stress on Morphological on Durum Wheat Genotypes

Majid Khayyatnezhad[1]*, Roza Gholamin[1], Hasti Keynoos[2]

Abstract

Background: Drought stress is one of the most important factors limiting the yield of crops, especially in semi-arid regions of the world. Therefore, studying and investigating plants resistant to these conditions can be useful for the agricultural industry and the country's economy.

Methods: To evaluate this capacity overall performance grain durum wheat genotypes in drought conditions and overview a number of the developments related to yield, and a few decided on advanced genotypes, 10 genotypes of Durum wheat within side the 2017-2018 cropping year.

Results: The evaluation of variance confirmed great variations among the developments evaluated in phrases of strain and there has been no tension. Also, amongst genotypes in phrases of height, important spike length, grain weight, and there has been a great distinction in yield. Performing evaluation Factor, via evaluation, most important four additives 82.67 percentage of overall running modifications have been justified.

Conclusion: The consequences imply the significance of component coefficients traits of overall and fertile tillers, main spike length, 1000-seed weight, and yield decided on genotypes is suitable for dry conditions.

Introduction

At present, durum wheat is grown mostly in rainfed areas of the Mediterranean region under stressful and variable environmental conditions [1-3]. Developing high-yielding wheat cultivars under drought conditions in arid and semi-arid regions is an important objective of breeding programs [4-6]. The frequency and severity of extreme weather events including drought are predicted to increase due to global warming, which consequently increase the risk of food security [7-10]. Wheat, the world-widely dominant staple crop, is very sensitive to drought stress, especially those occur during the reproductive stages [11,12]. Drought leads to water loss in plant, decreases leaf stomatal conductance and photosynthesis. However, the responses of water status, stomata behavior and photosynthesis to drought largely differ between drought tolerant and sensitive cultivars [13]. Considering that performance is a polygenic adjective, and its heritability is high to achieve high yield, selection used by Performance components [14,15]. Dryness of the most important factor limiting production of crops including wheat in the world and Iran. This Topic is more important in dry and semi-arid regions of the world [16-18]. Importance of this subject is determined when we know which more than 1/4 part ground is dry and estimated that about 1/3 of the world's cultivable land under water shortage conditions are in range [16]. The development of high-yielding durum wheat genotypes is a major objective in breeding programmes and the genetic variation for the target selected trait is necessary to have suitable response to selection [19]. Further, these yield components are influenced by environmental fluctuations and some of them like grain per spike number, thousand grain weight, peduncle length, awn length, spike length, kernel number per spike, and grain weight per spike affect the durum wheat tolerance to drought stress [20-22]. According to previous investigations, number of grains per spike, thousand seed weight and number of tillers have direct and positive effects on durum wheat yield [23-25]. Yield and the adjective little are controlled by many genes. Heritability of this trait also due to the interaction of genotype and environment, so choose based on lower yield in order to improve it may not be very effective [26-29]. Especially early generations of the large number of genotypes and genotypes assessed as having repeated testing does not return if no good genetic [30-32]. Drought stress may cause a reduction in the yield-related traits, but particularly, in the number of spikes per unit area and the number of grains per spike [33], while grain weight is negatively influenced by drought stress during grain-filling period [34]. It is necessary to investigate the genetic diversity in the currently used durum wheat genotypes in order to maintain a desirable level of genetic variation for future improvement programs. [35-37] in his studies on bread wheat cultivars showed that the harvest index, kernels per year per plant and spike length were important components of performance and selection It could be the basis for improved performance to be effective [38,39]. given that a significant proportion of land under wheat cultivation in arid and semiarid regions has been the aim of this research employing statistical methods on factor analysis the resulting data, to review the structure of complex traits and determine the relative importance of traits associated with performance, to identify genotypes resistant to drought, for use in future breeding programs for high yield per unit area in dry conditions. This investigation was performed to clarify the relationship between durum wheat grain yield and its components under non-stressed and water-stressed (drought) conditions [40-42]. The aim was to provide theoretical foundations to guide durum wheat breeders who are researching the genetic association of the main agronomic traits and their influence in durum-wheat productivity. To achieve this goal, the relationship between grain yield and its components for durum wheat was studied using principal component analysis and factor analysis as multivariate statistical procedures under drought and non-stressed conditions.

Methods

The experiment was carried out in the fall of 2017-2018 in the field of Islamic Azad University, Ardebil branch with geographical coordinates of 48° and 30" of eastern longitude and 38° and 15: of northern latitude and height of 1350 m from sea level; some parts of this experiment was done in biotechnology laboratory of Islamic Azad University. The climate of the location was semi dry and cold, and it has a long term dry season especially in the summer. The soil of the region is loam clay type. This type of soil is poor in terms of organic materials and its amount was 0.7%. The physicochemical results of the soil samples are presented in Table 1.

The present work was carried out using 10 wheat cultivars, arranged as randomized complete block design (RCBD) under irrigated and rain fed conditions with four replications.

Stress treatments included

1. whole irrigated (100 percent used water based on the plant demand at various growing stages)
2. Limited irrigation (water supply until anthesis and after wards drought employing as water withholding until the end of growing stage).

Each genotype was planted on five rows placed 2 cm apart. Distances between irrigated and drought blocks were 2 m but were 3 m between the two irrigated or drought blocks. Upon the planting, irrigated was performed for whole blocks to moisten soil profile in the rhizosphere of all cultivars to facilitate germination. Irrigation was done as flooding at the harvest time, to prevent border effect, 50 cm of each row from both sides were eliminated to harvest and following traits were measured: plant height, total number of tillers, fertile tillers, main spike length, main spike weight, total plant dry weight, number of seeds per spike, number of seed seeds per main spike and seed weight per main spike. Also, seed yield of each block was measured.

Data were analyzed using SPSS16 for analysis of variance and Duncan's multiple range tests was employed for the mean comparisons.

Results

It was cleared that the differences between irrigated and drought, were significant for the majority of traits. Plant height, main spike length, Total plant weight, grains per main spike, Grain weight per main spike, 1000-seed weight, yield ($P<0.01$) were significant and the rest, were insignificant. Investigation of interaction effect between genotypes and irrigation status illustrated that except plant height and yield ($P<0.01$), total tillers ($P<0.05$) was significant, and the rest did not show significant difference traits. Golibagh and barakatli genotypes possessed the higher yields under rain fed than irrigation while mean yield of genotypes under irrigated significantly was more. By exerting stress, yield was decreased in the majority of genotypes but in Germi, Sarab, Sharg, 110117, Golibagh and barakatli, genotypes this trend was increasingly which caused interaction effect.

Since the correlation coefficients may complete information on the relationship between different traits and not to provide benefits according to several multivariate statistical analysis to understand the deep structure of data, factor analysis was used. Table 2 shows the especially bases in factor analysis.

-		MS			
S.O.V	df	Total plant weight	grains per main spike	Grain weight per main spike	1000 grain weight
Rep	1	-	-	-	-
Condition	1	**	**	**	**
Genotype	21	-	-	**	**
C*G	21	-	-	-	-
Error	43	61.25	14.25	0.06	17.52

Table 3: Results of analysis of variance

Component	Initial Eigenvalues	
	% of Variance	Cumulative %
1	41.26	41.26
2	17.95	59.57
3	12.01	72.16
4	9.89	82.67

Table 4: Especially bases in factor analysis

Discussion

Note that in terms of entering or not yield the factor analysis of differences of opinion among experts there , so in order to compare the two views presented in two modes, factor analysis for existing data was conducted. [31,41-43] as examples in the factor analysis did not yield the intervention. While most researchers entering the performance together with the other characters in the factor analysis were emphasized . As seen in Table 3, the total four factors' 82.67 percent of the data changes were justified. First factor the highest volume (41.26 percent) of changes in the data. The second factor (17.95 percent) of changes in the data fills large and positive coefficients for grain weight per main lavender, seed number and weight of the original lavender lavender was the original as we can factor in the spike characteristics Rate Nanm said. [43] in the third factor as spike features were introduced. These coefficients indicate that the genotypes have high levels of second factor regardless of other characteristics has a long and fertile spike with more grain number and grain weight would be greater.

Soil type	Soil texture			Absorbent Potassium (ppm)	Absorbent Phosphorus (ppm)	Total nitrogen (percent)	Organic carbon (percent)	Neutral-reacting material (percent)	Total acidity (PH)	Electrical conductivity (ds / m)	Saturation	Depth (cm)
	Sand	Silt	Clay									
Clay loam	31	41	28	460	4. 8	0. 103	0. 97	4. 8	7. 8	2. 6	48	0-30
Clay	40	36	24	290	2	0. 056	0. 47	7	8. 2	2. 4	45	30-60

Table 1: Results obtained from analyzing the sample soils

		MS					
S.O.V	df	Plant height	Total tillers	Fertile tillers	yield	Main spike length	Main spike weight
Rep	1	**	**	**	-	**	0.012
Condition	1	**	-	-	**	**	**
Genotype	21	**	-	*	**	**	**
C*G	21	**	*	-	**	-	-
Error	*43*	117.29	2.37	2.16	458.24	0.70	0.14

Table 2: Results of Analysis of variance for studied traits

Spike components (length, spikelet number, number of fertile florets and grain number) have more impact on performance.

The third factor in having (12.01 percent) of the changes has positive and large coefficients for the 1000-grain weight and yield. Having the fourth factor (9.89 percent) of the changes has positive and large coefficients for main spike lenght. [43] reported in the third factor. Evaluation of advanced bread wheat genotypes has shown that more figures with a height of Early access and enjoy high performance [44]. [44] the relationship between grain yields quantitative traits through factor analysis in wheat expressed changes from entering or failure in performance analysis results where not significant impact on factor was achieved [17,18,32]. in general the result of such inference is that the traits related to grain yield and spike characteristics can index important for the evaluation and improvement of wheat varieties to be. So we can use these traits for increasing yield. This test is recommended on most varieties and wider levels also done.

Competing Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

The authors declare that they were responsible for all activities related to data collection, analysis and writing of the article. All authors read and approved the final version.

References

1. Nouri A, Etminan A, Teixeira da Silva JA, Mohammadi R. Assessment of yield, yield-related traits and drought tolerance of durum wheat genotypes (Triticum turjidum var. durum Desf.). Australian Journal of Crop Science, (2011); 5(1): 8.
2. Abdolhakim I. Technique Selection of Corporation by considering the Environmental Restraints. Water and Environmental Sustainability, (2022); 2(1): 18-22.
3. Baruah S. Assessing Heavy Metal Bioaccumulation in Freshwater Fish at the Gingee River in Puducherry, India. Water and Environmental Sustainability, (2021); 1(4): 1-4.
4. Leilah A, Al-Khateeb S. Statistical analysis of wheat yield under drought conditions. Journal of Arid environments, (2005); 61(3): 483-496.
5. Ebah E, Okpokwasili G. Solid trash molasses bio-degradation in Aranthangi sugar industry, Tamilnadu with utilization of Aspergillus niger. Water and Environmental Sustainability, (2022); 2(3): 1-5.
6. M R, Seyyed sayyah A, Minaei A. Nitrification Prohibition in Soil under Pastureland in Western Australia. Water and Environmental Sustainability, (2022); 2(2).
7. Wang X, Vignjevic M, Jiang D, Jacobsen S, Wollenweber B. Improved tolerance to drought stress after anthesis due to priming before anthesis in wheat (Triticum aestivum L.) var. Vinjett. Journal of experimental botany, (2014); 65(22): 6441-6456.
8. Abdi MM. Evaluation of spring bread wheat lines/varieties in international observation nurseries and yield trials in moderat region of Iran. Bioscience Research, (2021); 18(3): 2127-2134.
9. Alizadeh M. Enhanced Imazethapyr Activity on Jimsonweed using natural Additives. Bioscience Research, (2021); 18(4): 3080-3086.
10. Karasakal A. Composted organic manure replacement probability using chemical fertilizer in organic Safflower farming. Bioscience Research, (2021); 18(4): 3115-3124.
11. Karasakal A, Talib N. Cadmium Ions Removal Analysis from Wastewater utilizing Salvadora persica Stem's Activated Carbon. Water and Environmental Sustainability, (2022); 2(2): 1-5.
12. Abdolhakim I. Dietary utilization of vitamin A evaluation by pre-school students in Southern Ethiopia- a cross-Sectional analysis. Water and Environmental Sustainability, (2022); 3(2): 10-15.
13. Munns R, James RA, Sirault XR, Furbank RT, Jones HG. New phenotyping methods for screening wheat and barley for beneficial responses to water deficit. Journal of experimental botany, (2010); 61(13): 3499-3507.
14. Mobar S, Bhatnagar P. Evaluation of Atmosphere Air Quality in Hyderabad Urban, India. Water and Environmental Sustainability, (2022); 2(2): 30-33.
15. Mohammed K, Achebe O. Employing spider webs for environmental investigation of suspended trace metals in residential and industrial areas. Water and Environmental Sustainability, (2021); 1(4): 22-26.
16. Kirigwi F, Van Ginkel M, Trethowan R, Sears R, Rajaram S, et al. Evaluation of selection strategies for wheat adaptation across water regimes. Euphytica, (2004); 135(3): 361-371.
17. Xu Y-P et al. Optimal structure design of a PV/FC HRES using amended Water Strider Algorithm. Energy Reports, (2021); 72057-2067.
18. Zhang et al. Optimal model evaluation of the proton-exchange membrane fuel cells based on deep learning and modified African Vulture Optimization Algorithm. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, (2022); 44(1): 287-305.
19. Mir RR, Zaman-Allah M, Sreenivasulu N, Trethowan R, Varshney RK. Integrated genomics, physiology and breeding approaches for improving drought tolerance in crops. Theoretical and Applied Genetics, (2012); 125(4): 625-645.
20. Blum A (2011) Plant water relations, plant stress and plant production. Plant breeding for water-limited environments: Springer. pp. 11-52.
21. Niya N. Investigation about Water Quality at Madurai, Tamilnadu, India. Water and Environmental Sustainability, (2022); 2(2): 6-9.
22. Radmanesh M. Investigation of the Endurable Expressway Landscapes Eco-Controlling System. Water and Environmental Sustainability, (2022); 2(1): 14-17.
23. Mohammadi M, Karimizadeh R, Shefazadeh MK, Sadeghzadeh B. Statistical analysis of durum wheat yield under semi-warm dryland condition. Australian Journal of Crop Science, (2011); 5(10): 1292.
24. Zarei L, Cheghamirza K, Farshadfar E. Evaluation of grain yield and some agronomic characters in durum wheat ('Triticum turgidum'L.) Under rainfed conditions. Australian Journal of Crop Science, (2013); 7(5): 609.
25. Alizadeh M. Maize residue management effect on nitrogen fertilizer and canola grain yield. Bioscience Research, (2021); 18(4): 3098-3104.
26. Richards R. Defining selection criteria to improve yield under drought. Plant growth regulation, (1996); 20(2): 157-166.
27. Karasakal A. The Technology of Biogas production by current urban solid waste landfills. Bioscience Research, (2021); 18(3): 2117-2126.
28. Mohammadzadeh S. The presence of Nickel Sulphate in soil influences the synthesis of flavonoids and phenols in garlic (Allium sativum L.), changing its allelopathic potential. Bioscience Research, (2021); 18(4): 3125-3131.
29. Radmanesh M. Impacts of salinity, Pseudomonas and salicylic acid on seed bean physiological properties and yield (Phaseolus vulgaris). Bioscience Research, (2021); 18(4): 3023-3030.
30. Keim D, Kronstad W. Drought Response of Winter Wheat Cultivars Grown under Field Stress Conditions 1. Crop Science, (1981); 21(1): 11-15.

31. Li A et al. Developing the non-dimensional framework for water distribution formulation to evaluate sprinkler irrigation*. Irrigation and Drainage, (2021); 70(4): 659-667.
32. Sun Q et al. Investigation of phosphoric acid fuel cell, linear Fresnel solar reflector and Organic Rankine Cycle polygeneration energy system in different climatic conditions. Process Safety and Environmental Protection, (2021); 147993-1008.
33. Abayomi Y, Awokola C, Lawal Z. Comparative evaluation of water deficit tolerance capacity of extra-early and early maize genotypes under controlled conditions. Journal of Agricultural Science, (2012); 4(6): 54.
34. Chmielewski F-M, Köhn W. Impact of weather on yield components of winter rye over 30 years. Agricultural and Forest Meteorology, (2000); 102(4): 253-261.
35. Dawari N, Luthra O. Character association studies under high and low environments in wheat (Triticum aestivum L.). Indian Journal of Agricultural Research, (1991); 2568-72.
36. Sahana K, Prem Kumar S, Istalingamurthy. The Modified Biosand Filters for Water Treatment. Water and Environmental Sustainability, (2022); 2(1): 1-8.
37. Tamia S. An investigation into value of Eutrophication in Hosur Lakes. Water and Environmental Sustainability, (2021); 4(1).
38. Amin B, Sunjai H, Aysu A. Nickel one of the critical factors and a poisonous. Water and Environmental Sustainability, (2022); 2(3): 6-9.
39. Lin H. Performance of ecosystem water utilization in Inner Mongolia temperate pasturage. Water and Environmental Sustainability, (2022); 2(3): 24-26.
40. Abdolhakim I. Technique Selection of Corporation by considering the Environmental Restraints Water and Environmental Sustainability, (2022); 2(1): 18-22.
41. Duan F et al. Model parameters identification of the PEMFCs using an improved design of Crow Search Algorithm. International Journal of Hydrogen Energy, (2022); 47(79): 33839-33849.
42. Guo H et al. Parameter extraction of the SOFC mathematical model based on fractional order version of dragonfly algorithm. International Journal of Hydrogen Energy, (2022); 47(57): 24059-24068.
43. Damania A, Jackson M. An application of factors analysis to morphological data of wheat and barley landraces from the Bheri river valley, Nepal. Barley and Wheat Newsletter, (1986).
44. Roostaie M, Sadegh-Zadeh D, Arshad Y. Evaluate the relationship traits affecting wheat grain yield using factor analysis in rainfed conditions. Agriculture Science, (2003);