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Factor Analysis for Performance and Other Characteristics in Durum Wheat under Drought Stress and Without Stress

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Abstract: 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 can be used. In order to assess this potential performance grain durum wheat genotypes under drought conditions and review some of the traits associated with yield and some selected superior genotypes, 30 genotypes of durum wheat with a test originated in Iran and Azerbaijan in 1387-88 crop year, Agricultural Research Stations, Azad University of Ardebil was performed. The analysis of variance showed significant differences between the traits evaluated in terms of stress and there was no tension. Also among genotypes in terms of height, main spike length, grain weight and there was a significant difference in yield. Performing analysis Factor, through analysis, principal 5 components 82/58 percent of total operating changes were justified. The results indicated that the importance of factor coefficients characteristics of fertile tillers, grain weight original lavender, seed weight and harvest index selected genotypes is desirable for dry conditions.

Key words: Drought · Durum wheat · Factor analysis

INTRODUCTION

Tetraploid durum wheat (*T. durum*) or hard wheat mainly used for flour to produce Semolina, especially pasta, pasta and grits is cultivation. Although the cultivation of tetraploid wheat is low but their resistance to disease and environmental stress than wheat is more hexaploid [1]. Considering that performance is a polygenic adjective and its heritability is high to achieve high yield, selection used by performance components [1]. 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 [2]. 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 [2]. 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 [3]. Especially early generations of the large number of genotypes and genotypes assessed as having repeated testing does not return if no good genetic [4]. Morphological traits simply are measured with great precision and quality relatively high heritability for plant communities and improve screener performance [5]. Decay correlation coefficients between different traits with grain yield to decisions about the relative importance of these attributes and their values as selection criteria helps [6]. According to several reports, between grain yield in wheat and grain weight, fertile tillers or spikes per plant, spikelet's per spike and spike has a significant correlation [7, 8]. Solidarity, especially in plant height and heading time, different results (depending on variety and planting systems used) is seen [9]. Renold *et al.* [10] with different grain Simit review concluded that a whole wheat linear relationship between stress and the yield is. Gupta *et al.* [11] reported that the generation of 40 advanced lines of wheat with 11 controls were evaluated. Factor analysis, 15 traits associated with yield and grain quality to address five main characteristics of spike, grain characteristics and quality protein and reduced tillering [11]. Dawari and Luthra [12] on bread

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wheat stated that cultivars showed that the harvest index, kernels per ear per plant and spike length were important components of performance and selection. It could be the basis for improved performance to be effective 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.

MATERIALS AND METHODS

Twenty two durum wheat cultivars (*Triticum durum* Desf.) in Iran and Azerbaijan republic region were chosen for the study based on their reputed differences in yield performance under irrigated and non-irrigated conditions (Table 1).

Experiments were conducted at the experimental field of Islamic Azad University of Ardabil, in Ardabil province (Northwest of Iran) during 2008/09 growing season. Seeds were hand drilled and each genotype was sown in five rows of 1.5 m, with row to row distance of 0.2 0 m. The experiment was laid out in randomized complete block design (RCBD) with two replications. Two levels of stress treatments including:

- Full irrigation (100 percent water based on plant needs wheat cultivars at different growth stages).
- Limited irrigation (Supply plant water needs until pollination stage and then format water until the end of wheat growth and development).

Every line in 5 rows and 20 cm intervals and 150 cm in width were planted. Immediately after planting the field was irrigated to soil moisture profiles in root development and saturated and identical for all treatments in addition to the germination easily is done. Irrigation was done with leaking method. After harvest to evaluate the factors affecting the performance traits, plant height, total tiller numbers, fertile tillers, number of internodes, peduncle length, length of main spike, spike original weight, awn length, total dry weight, number of seeds per main spike and main spike grain weight were measured.

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

RESULTS

The results of analyses of variance for grain yield and other related traits in both stress and non-stress environments are given in Table 2. There was a significant difference among stress conditions for grain yield and other traits, except as total number of tillers and fertile tillers remaining traits were significant at 0.01 percent probability level. The genotypes showed significant differences in grain yield and other traits. Total number of tillers, total plant weight and seed numbers per main spike were non-significant, fertile tillers and harvest index at 0.05 percent level and other traits were significant in 0.01 percent level. Thus, indirect selection for a drought-prone environment based on the results of optimum conditions will not be efficient. These results are in agreement with thoseobtained by Sio-Se Mardeh *et al.* [13] and Bruckner and Frohberg [14].

Table 1: Origin and taxonomy of durum wheat landraces tested

No	Name	Landraces	Origin	No	Name	Landraces	Origin
1	Hordeiforme	Miyane	Iran	12	leucumelan	Naxcivan	Azerbijan
2	Africanum	Sanandaj	Iran	13	albiprovinciale	Qu	Azerbijan
3	leucurum	kermanshah	Iran	14	murceinse	Naxcivan	Azerbijan
4	melanopus	Ahar	Iran	15	leucurum	Lerik	Azerbijan
5	hordeiforme	Maragheh	Iran	16	leucumelan	Naxcivan	Azerbijan
6	leucurum	Sarab	Iran	17	apulicum	11010	Iran
7	leucurum	Tabriz	Iran	18	melanopus	hasanbaruq	Azerbijan
8	melanopus	Cheiltoxm	Azerbijan	19	hordeiforme	Langan	Azerbijan
9	hordeiforme	shamxi	Azerbijan	20	apulicum	Ardabi	Iran
10	apulicum	xanlar	Azerbijan	21	boeuffi	Ardabi	Iran
11	boeuffi	shaxi	Azerbijan	22	aboscurum	Ardabi	Iran

Table 2: Results of Analysis of variance for studied traits

		MS					
S.O.V	df	Plant height	Total tillers	Fertile tillers	Peduncle length	Main spike length	Main spike weight
Rep	1	739.96**	2.13	0.031	649.80**	1.77*	0.012
Condition	1	7040.78**	0.13	1.65	2465.03**	10.09**	3.64**
Genotype	21	713.54**	3.041	4.15*	179.01**	1.71**	0.406**
CxG	21	278.74**	3.78*	2.906	150.54**	0.36	0.07
Error	43	113.36	2.205	2.46	37.63	0.61	0.15

		MS					
S.O.V	df	Total plant weight	Grains per main spike	Grain weight per main spike	1000 grain weight	Yield	Harvest index
Rep	1	77.4	1.11	0.013	50.16	15.72	64.96
Condition	1	747.17**	120.11**	4.11**	217.54**	1216.901**	647.09**
Genotype	21	71.84	15.44	0.23**	32.41**	1516.86**	45.35*
CxG	21	58.17	12.72	0.05	23.13	953.4*	46.48*
Error	43	64.36	17.16	0.07	18.63	474.41	27.84

** And * Significant at the 0.01 and 0.05 levels, respectively

Table 2: The minimum, maximum, mean, standard deviation and percentage changes in phenotypic traits in genotypes

Traits	Mean	Minimum	Maximum	Standard deviation	Percentage of phenotypic changes
Plant height	118/01	81/07	155/45	3/04	2/57
Total tillers	6/77	4/17	10/87	0/25	3/69
Fertile tillers	5/27	3/78	8/34	0/2	3/79
Main spike length	6/18	5/15	7/41	0/13	2/10
Main spike weight	2/35	1/68	4/35	0/09	3/82
Total plant weight	18/77	10/13	28/66	0/72	3/83
grains per main spike	26/16	21/91	33/55	0/51	1/94
Grain weight per main spike	1/56	1/07	2/25	0/05	3/20
1000 grain weight	55	47/25	59	0/62	1/12
Yield	88/63	60/73	126/6	2/73	3/08

Table 3: Special roots in factor analysis by considering all the traits and eliminating performance

	Without yield		With yield	
Operating	Cumulative percentage variance	Percent variance	Cumulative percentage variance	Percent variance
1	28/73	28/73	26/75	26/79
2	52/18	23/44	48/54	21/75
3	66/05	13/87	61/40	12/85
4	75/71	9/66	73/68	12/28
5	85/08	9/36	82/58	8/89

The minimum and maximum, average, standard deviation and coefficient of variation of phenotypic traits are presented in Table 2. Of all traits, a large variation between wheat cultivars studied further was found. The highest percentage of phenotypic changes related to the main spike weight and total weight the plant.

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 3 to the analysis Operating shows. Note that in terms of entering or not yield the factor analysis of differences of opinion

among experts there [15], so in order to compare the two views presented in two modes, factor analysis For existing data was conducted, Damania and Jackson [16] 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 [17,18]. Data in Table 3, based on Eigen values greater than one in both factor analysis with regard to five factors was performed. The total factor 82/58 percent (performance) and 85 / 08 percent (no function) changes in the received data.

First factor the highest volume (26/79 percent) of changes in the data was a positive and large coefficients for weight symbols, total plant weight and tiller numbers were we can as a factor in plant weight and performance considered. The second factor (21/75 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. Damania and Jackson [16] indicated that in the third factor as spike features were introduced. These coefficients indicated 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. Spike components (length, spikelet number, number of fertile florets and grain number) have more impact on performance. If there are moisture and appropriate and accessible food, genotypes that have high spike length, number of spikelet's and fertile florets and spike them is greater, will yield a large (1.) feet tall as well as selecting varieties resistant to lodging and plant height (75 to 100 centimeters) in dry conditions can be useful for the following reasons [15]:

- More photosynthetic material can be stored in the stem.
- Mechanized harvesting, especially in the drought conditions that cause extreme short leg is easily possible.
- Is a straw in the soil can remain in storage at the field level during the descending sky fall and winter to keep moisture to be effective and save.

The third factor having (12/85 percent) of the changes has positive and large coefficients for the total number of tillers and fertile tillers. Having the fourth factor (12.28 percent) of the changes has positive and large coefficients for height and yield. Damania and Jackson [16] reported that in the third factor.

Table 4: Factor Analysis of water considering all the traits

	Operating				
Traits	1	2	3	4	5
Plant height	0/475	-0/29	-0/64	0/36	-0/24
Total tillers	0/536	-0/62	0/35	-0/27	0/17
Fertile tillers	0/622	-0/64	0/29	-0/098	-0/011
Main spike length	0/071	0/38	-0/63	-0/16	0/48
Main spike weight	0/44	0/66	-0/10	-0/14	0/041
Total plant weight	0/88	-0/16	-0/13	0/042	0/19
Original number of seeds lavender	0/28	0/63	0/077	-0/58	-0/063
Main lavender seed weight	0/53	0/68	0/16	0/074	-0/016
1000-Grain weight	0/45	0/55	0/15	0/50	-0/10
Yield	0/23	0/14	0/26	0/78	-0/020
Harvest index	-0/35	0/28	0/65	0/090	0/43

Table 5: Operating simple correlation coefficients with grain yield

Operating	Yield
1	0/23
2	0/14
3	0/26
4	0/78**
5	-0/027

Evaluation of advanced bread wheat genotypes has shown that more figures with a height of early access and enjoy high performance [9]. Having the fifth factor (8 / 89 percent) of the change has large and positive coefficients for the length lavender harvest index was the original. Rostaei *et al*. [9] indicated that the relationship between grain yield quantitative traits through factor analysis in wheat expressed changes from entering or failure in performance analysis results were not significant impact on factor was achieved. Bramel *et al.* [17] showed that, while race (quoting 3) by performing factor analysis with and without grain yield reported in the second case (remove the grain) the number of operating changes are less justified. With reference to Table 3 the factor coefficients related traits in the analysis, regardless of operating performance shows we can get results largely inconsistent with the results and when the factor analysis without yield higher percentage was calculated to justify the changes. So, it looks like their selection based on performance efficiency can be less so based on genotype factor values in factor analysis, regardless of performance will be possible desirable genotypes in terms of selected indicators intended to be selective. In this case, simple correlation coefficients calculated with the yield factor, which is reflected in Table 5 indicate that a significant correlation between the fourth factor (0 / 78 **) with the performance show (Table 5).

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