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The Relationship of Qualitative and Quantitative Traits on F_5 of Azar2 and 87-Zhong291 Wheat Cultivars Crosses in Drought Stress Conditions

[1]Hami Ahmadi, [1]Abdollah Mohammadi, [2]Eslam Majidi Heravan, [3]JafarAhmadi and [4]Mahyar Rohami

[1]Young Researchers Club, Rudehen Branch, Islamic Azad University, Rudehen, Iran
[2]Agricultural Biotechnology Research Institute of Iran, Karaj, Iran
[3]Department of Agriculture Biotechnology, Imam Khomeini International University, Faculty of Engineering and Technology, Gazvin, Iran
[4]Young Researchers Club, Science and Research Branch, Islamic Azad University, Tehran, Iran

Abstract: In order to study the effect of drought stress on agronomic and morphological traits (quantitative traits) and also qualitative traits of wheat cultivars (segregation population (307 F5-plants), which are upshot of mating of Azar2 (tolerant cultivar) with 87-Zhong291 (susceptible cultivar)) and also assessment of reaction between wheat lines and cultivars to drought stress and effect of qualitative and quantitative traits on each other this study was established. For recognizing of this significant relationship on drought stress conditions experimented with using complete randomized design in 6replications was used. Farm irrigation just one time for germination of grains had done and within the growth season some agronomic and morphological characters in both vegetative and reproductive stages such as plant height (cm), days to flowering, 1000 kernels weight (KW) and etc and also evaluated some qualitative traits such as seed wrinkling after harvest, leaf twist at the hot moments of the day and etc was measured. According to an unbalanced CRD design analysis relevance of all traits, due to importance of precociousness was studied and concluded that some characters such as days to flowering were useful in plant drought tolerance and were effective on qualitative traits like seed fall and some others.

Key words: Wheat · Quantitative traits · Drought stress · Generation

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important strategic plants which have large growth areas in the world, so it's important to identify the effective traits which can increase grain yield and economize natural resources such as water [1]. The moisture is main factor of plant dispersal and crop cultivation. The most appropriate districts for wheat cultivation are in semi-arid and semi-humid areas in the northern hemisphere. Average annual rainfall in semi-arid and semi-humid districts are 254-508 mm and 508-762 mm, respectively [2-4].

Limitation in water resources is main cause to reduction the total food resources for plant and the plant obligated to decrease the vegetative growth, early finishing of vegetative stage and starting the reproductive stage. Consequently other traits such as lifetime, height, length of peduncle, length of main spike, stalk yield and even length of awn could decrease [5]. Reduction of these traits decreased photosynthesis surface and whereupon yield will abate. In addition, shortage of available moisture decreased plant cellular water and decreased swell cellular (cellular turgescence); therefore the cells haven't well growth and good shape. Reduction of cellular turgescence led to decrease plant organ's size and the plant will have smaller bulk in compare of optimize situation [5, 6]. Relation identification between qualitative and quantitative traits could be useful for breeding programs for yield increasing.

MATERIALS AND METHODS

In order to evaluate of relationship between qualitative and quantitative traits, segregation population (307 F_5-plants) was used, which were upshot of mating of

Corresponding Author: Hami Ahmadi, Young Researchers Club, Rudehen Branch, Islamic Azad University, Rudehen, Iran.

Azar 2 (tolerant cultivar) with 87-Zhong 291(susceptible cultivar), these lines in Augmented design with five check varieties (Toos, Shahriyar, Sardari and Azar 2 and 87-Zhong 291 line) which had different reaction to drought, in the complete randomized design with 6 replication were planted. Within the growth season, some agronomic and morphological characters in both vegetative and reproductive stages such as seed wrinkling after harvest, leaf twist at the hot moments of the day plant height (cm), days to flowering, 1000 kernels weight (KW), No. of grains/spike, grain yield (g), biological yield (g) and etc was measured and also some qualitative traits such as seed wrinkling after harvest, leaf twist at the hot moments of the day, leaves beneath old age at the end of the growth, similarity of tillers from height, glume hairiness, glume color and seed fall was evaluated. With using experimental error of check varieties, the lines had corrected and then the corrected lines were used in analyses and for evaluation of relationship between qualitative and quantitative traits, unbalanced complete randomized design for analysis by SAS software was used.

RESULTS

The summary of descriptive statistics for quantitative traits have shown (Table 1), maximum StDev is relevant to biological yield trait and the Days to flowering trait with 21 days different between the most resistance and the most sensitive genotypes. Due to cross between two different variety (Azar2 (wintery) and 87-Zhong 291 (spring)) the outcome lines have shown wide range of swing and because of genetic welter. The line's number 38 have maximum 1000 kernels weight with 71.5g. The reduced yields associated with some line wheat's could be due to the short seed filling periods and delays in heading. Worland *et al.* [7] found that earliness alleles could reduce spikelet numbers and produce larger grain, thereupon increase yield. Earliness in flowering and long seed filling period were also important factors to achieve high yields in varieties.

Other quantitative traits, plant height (cm), biological and grain yield (g) and number of grains per spike are mainly different within 307 lines (Table 1). Mean descriptive statistics for qualitative traits have shown in Table 2, shannon index for seed fall trait is more than one and it is different with other shannon index traits. This index was calculated by bottom formula:

$$H' = -\sum_{i=1}^{s} pi \ln pi$$

In this formula p_i is the abundance percentage of each trait. This segregated generation variety showed that with using of this population, the relationship of qualitative and quantitative traits can be displayed better. Table 3 shows the effects of qualitative and quantitative traits on each other based on an unbalanced CRD design. Significant relationships between yield and days to flowering and some agro-morphological traits were detected in the 307 lines (Table 3). No significant

Table 1: Mean, Minimum, Maximum, Range and StDev of Segregated lines in the experiment

Quantitative Traits	Mean.	Min.	Max.	Range	StDev
Plant height (cm)	94.69	65.94	119.09	53.15	10.30
Days to flowering (g)	186.40	170.20	191.20	21.00	2.90
Biological yield (g)	35.42	15.74	94.20	78.46	10.88
No. of grains/spike	40.19	21.22	71.48	50.26	9.17
1000 K W (g)	36.89	23.04	71.50	48.46	6.98
Grain yield (g)	16.41	6.85	42.78	35.93	4.79

Table 2: Mode (M.), Range (R.), Minimum, Maximum and Shannon Index (Sh.I.) of Segregated lines

Qualitative Traits	M.	R.	Min.	Max.	Sh.I.
Glume colour	1	1	0	1	0.5901
Seed fall	0	3	0	3	1.0457
Glume hairiness	0	3	0	3	0.4489
Leaf twist at the hot moments	3	3	0	3	0.7968
Similarity of tillers	0	3	0	3	0.3368
Seed wrinkle	0	3	0	3	0.6642
Leaves oldage	1	3	0	3	0.7642

Table 3: Analysis of variance for compare of Qualitative and Quantitative traits on each other in segregating wheat's

	Qualitative Traits					
Quantitative Traits	Biological yield (gr)	No. of grains/spike	Day to flowering	1000 KW (gr)	Grain yield (gr)	Plant height (cm)
Similarity of tillers	0.46 ns	0.14 ns	1.21 ns	1.78 ns	0.74 ns	0.05 ns
Seed fall	0.83 ns	0.55 ns	16.17**	2.57 ns	0.38 ns	0.01 ns
Seed wrinkle	1.79 ns	0.7 ns	1.21 ns	6.82**	4.78**	0.14 ns
Leaf twist at the hot moments	0.97 ns	1.76 ns	2.9 ns	0.6ns	2.83 ns	0.09 ns
Leaves old age	0.15 ns	0.34 ns	1.51 ns	0.96 ns	0.41 ns	0.01 ns
Glume hairiness	3.14*	0.62 ns	7.43**	2.3 ns	3.75*	0.13 ns
Glume colour	0.96 ns	1.34 ns	23.18**	0.06 ns	0.14 ns	0.10 ns

ns: non-significant, *significant at 5%, **1% respectively

Table 4: Mean comparisons of Qualitative and Quantitative traits effects on each other in segregated lines

	Qualitative Traits								
	Day to flowering			1000 K W (gr)			Biological yield (gr)		
Quantitative Traits	0	1	3	0	1	3	0	1	3
Similarity of tillers	189.29a	186.99a	186.95a	37.18a	34.96a	37.34a	35.15a	36.80a	36.52a
Seed fall	187.33a	185.68b	185.36c	36.51ab	38.23a	35.93b	35.66a	36.11a	33.96a
Seed wrinkle	186.49a	186.36a	185.20a	37.51a	36.16a	30.58b	35.98a	34.58a	30.62a
Leaf twist at the hot moments	185.54b	186.45ab	186.69a	37.83a	36.84a	36.57a	34.47a	36.45a	34.80a
Leaves old age	187.89a	186.23a	186.59a	33.30a	36.94a	37.03a	35.57a	35.69a	34.99a
Glume hairiness	186.59a	185.65a	182.16b	37.03a	34.61a	37.93a	34.81b	39.43a	38.26ab
Glume colour	185.16b	186.88a	---	37.05a	36.83a	---	34.44a	35.80a	---
	Qualitative Traits								
	Grain yield (gr)			Plant height (cm)			No. of grains/spike		
Quantitative Traits	0	1	3	0	1	3	0	1	3
Similarity of tillers	16.26a	17.21a	16.88a	95.42a	92.01b	88.03b	35.15a	40.86a	40.58a
Seed fall	16.30a	16.77a	16.18a	95.50a	94.40a	93.29a	35.66a	40.25a	41.23a
Seed wrinkle	16.87a	15.54b	13.47b	96.46a	89.76b	92.18ab	35.98a	41.18a	41.19a
Leaf twist at the hot moments	15.75b	17.18a	15.93b	93.81a	94.16a	95.51a	34.47a	41.14a	39.07a
Leaves old age	17.65a	16.51a	16.18a	92.05a	95.30a	93.90a	35.57a	40.54a	39.71a
Glume hairiness	16.17b	18.36a	14.89b	95.63a	90.04b	79.03c	34.81b	40.61a	44.50a
Glume colour	16.24a	16.47a	---	91.98b	95.72a	---	34.44a	39.82a	---

The means of traits which have a same letter, haven't significant discrepancy at 1% level of Duncan's test

differences were found between number of grains in spike and plant height (cm). Between days to flowering and seed loss significant relation was observed (Table 3) which indicates the importance of precociousness in drought stress conditions. this relation were found before, whatever plants haven't enough time to become completely mature, they will compulsively die and then seed loss will increase, certainly this situation depend on variety [5, 6].

Relations of traits within different levels of qualitative traits had evaluated which achieved the more significant relations between Days to flowering and seed loss as a qualitative trait. Among of others traits (qualitative and quantitative) likewise observed relations which can be so helpful (Table 4).

DISCUSSION

Qualitative and quantitative response among the 307 F_5-plants segregated wheat studied. These differences indicated that the relations of these traits on grain yield and other important traits depended on the genotype and the environment of plant growth [8-12].

Due to importance of quantitative traits and especially yield, it's significant which qualitative traits can be use and help us to increase grain yield (Table 3), with assiduity to some important qualitative traits and control them some better results will obtain.

With changing of different levels of qualitative traits number of grains in spike have not significant relation (Table 3), this could be due to the different varieties

analysis have interaction between the genes which control the qualitative and quantitative traits. The traits affecting grain yield most positively, mainly in low water varieties, were long filling period and earliness (Table 3).

Several authors have related yield stability under drought and measured some qualitative characters [8]. Our results are in agreement with this statement since earliness of flowering is also an essential mechanism under drought conditions and can also help to improve some qualitative traits [13]. Consequently, some wheat lines analyzed in the present work could be a reservoir of widely adapted germplasm for sustainable low input production. It was also shown that core subsets of germplasm collections constitute a helpful tool to preselected genotypes for breeding programs.

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