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Investigate the relationship between some quantitative traits of bread wheat with grain yield

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ABSTRACT: This study was performed on the bread wheat genotypes in a randomized complete block design with three replications at the research farm of Islamic Azad University, Ardabil in 2011. Eleven traits such as number of grains per spike, number of sterile florets, plant height, biological yield, grain yield, harvest index, peduncle weight, psychological days to maturity, seed weight, panicle length and number of tillers per plant were measured were taker and measured. The results showed that the genotypes have significantly different characteristics. Genotype correlation was used for the present a correlation coefficient and causation because of its importance in comparison with phenotypic coefficients. There was positive and significant correlation between panicle length and number of grains per spike, grain yield and grain weight. Peduncle weight, plant height and grain weight has also a significant positive correlation. Plant height, number of grains per spike and tillers per plant showed positive and significant correlation and with grain yield represent negative and significant correlation. Grain yield, harvest index and grain weight showed a positive and significant correlation and harvest index with grain weight showed a negative correlation. Traits such as harvest index, grain weight and grain number per spike and grain yield had the highest direct effect on grain yield based on the analysis of causality. According to the results and genotype correlation these traits can be used as selection criteria in enhancing and improvement of performance in the breeding programs.

Keywords**:** Bread wheat, path analysis, genotype correlation.

INTRODUCTION

Wheat is the first and most important crop supplies human food requires which have been domesticated about a hundred centuries ago. Food and economic importance of the wheat is growing due to the growing of the world population. The most important wheat consumption in the world is for human nutrition, it can also used in livestock raising, paper making and many other industries (Khodabandeh, 1994). Aside from the aspect of important commercial of wheat in the world, it is an effective weapon in politics and international relations which its instrumental significance is increasing every day. Despite, Iran's population is about 1% of the world population, but it use about 2.5% of the world's wheat. Wheat, like energy, is a strategic commodity and is considered as important indicators of agriculture (Akbari et al, 2010). Existence the drought stress in growth stages of wheat can be reduced the yield in semi-arid areas that provide the improvement of tolerant and consistent cultivars and stability of wheat in the areas (Rajram et al, 1984). Insses and Blackwell (1995) showed that the grain yield difference in wheat genotypes can be due to the difference in sensitivity of different wheat to drought in different development stages. In plant breeding, the correlation between traits has also particular importance, because the genetic and non-genetic type of relationship between two or more traits is measured. Genotypic and phenotypic correlations between different traits can help plant breeders in indirect selection of important traits through least important traits that measurement of them is easier. Genetic correlations between traits are primarily due to genes interconnection. Genetic correlations are due to the covariance of two similar genus's or conjunction of two different traits. Environment correlation is due to the fact that an environment can cause the same time variance in two traits (Singh, 1991). Coefficients analysis (path analysis) which was proposed by Wright (Wright, 1921) is the way which clarifies the relationships between the traits and their direct and indirect effects on performance. In this method, correlation coefficient separate out between the two traits which measure direct and indirect effects, Allah Gholipour (1997) were reported correlation between the components of yield such as cluster weight in plant with number of clusters, number of grains and full hundred grain weight. The purpose of this study was to identify the correlation between grain yields and yield components and also the study of direct and indirect effects of these components with grain yield and obtain information about the causal relationships between them.

MATERIALS AND METHODS

Plant materials used in this study was 20 genotypes of bread wheat (Table 1) that were evaluated and cultured as a randomized complete block design, a length of 6 meters and a width of 2.1 m and the area 2.7 square meters in three replications. Taker and measurement of the morphological traits include: Peduncle length, plant height, panicle length, number of fertile florets, internodes length, single plant weight, grain weight and grain yield per plant and harvest index that was carried out using 8 samples. Plants selection for recorded sampling was performed randomly within experimental plots in each block. Variance and covariance and genotypic and phenotypic correlations were conducted with formulas (Dewey and Lu, 1959) and tourchi and Rezaei (1997). To study of relationship between the independent variables (agronomic traits and yield components) and the dependent variable (grain yield per plant) path analysis of seed yield with related components, taking advantage of the method (Dewey and Lu, 1952) using direct effects (Causality Coefficients) and indirect effects (the product of the path a correlation coefficient) was performed using genotype correlation coefficient. Tourchi and Rezaei (2000) did not recommended the residual effects of the dependent variable changes with the independent variable. By the formula Pry = √ 1 - R2 which R2 stall the total variance and covariance of independent variables in a multiple regression model.

Table 1. Names of genotypes evaluated in this experiment

No	Name
1	Chamran
2	Sardari
3	Cross Sabalan
4	Zarrin
5	Gascogne
6	Rasad
7	Bezostaya
8	MV / 17
9	Saisons
10	Gaspard
11	Sabalan
12	Omid
13	Alamot
14	Ghods
15	Kuhdasht
16	Azar 2
17	Mahdavi
18	Falat
19	Atila 5
20	Zagros

RESULTS AND DISCUSSION

Grain yield per unit area with thousand grain (0.62^{**}), harvest index (0.59^{**}) and peduncle weight (0.52^{**}) had positive and significant correlation coefficient. So, it is expected to increase the number of fertile florets, peduncle weight, harvest index and grain yield per unit area with increasing thousand grain weights. These results are the same with findings of Nik-khah (2008) and Nourmand (1997). Grain yield had negative and significant correlation with plant height (-0.25^{**}) per unit area which correspond with the results of Allah Gholipour (1997) in rice. Peduncle weight had positive correlation with height (0.12) and with harvest index had positive genotype correlation (0.35^{*}) and with the number of days to physiological maturity had positive and significant correlation (0.48^{**}). Since the renewed transition is effective in increasing the performance, so, with increasing the height and harvest index and days to final maturity, peduncle weight increase and caused to the grain yield per unit area. These results correspond with some of findings Normand (1997) and Nik-khah (2008). By comparing the correlation coefficients in stress condition traits such as harvest index and plant height were considered in breeding programs to increase yield. Tillers per plant with harvest index and grain weight had positive and significant genotype correlation respectively (0.46**) and (0.58**). These results correspond with findings of Kouchaki and Nik-khah (2006). To evaluate the effect of each trait on the desired variable and also to transform independent variable was performed stepwise regression analysis. In this study the grain yield as the dependent variable (Y) and other traits were considered as independent variables. Separation of correlation coefficients between traits and yield to both the direct and indirect effects was performed by Dewey and Lou (1959). Number of grains per spike, harvest index and grain weight had the highest direct effects on grain yield. Harvest index had positive effects on performance through grain weight it had minimal and negative impact on grain yield through number of grains per spike. Also, the number of grains per spike had negative impact on yield through grain weight and harvest index. Grain weight had negative impact through number of grains per spike and harvest index (Table 2). According to the direct effects of the traits such as harvest index, grain weight and number of spike and also because of the high degree of the heritability of traits which indicates a substantial proportion of the genetic variance, these traits can be used as selection criteria to enhance and improving the grain yield.

Table 2. Analysis of genotypic correlation coefficients of the grain yield with yield components to direct and indirect effects

Traits	Direct effects	Indirect effects			H^2
		Harvest index	Number of grains per spike	Grain weight	
Harvest index	0.52*	-	-0.2	0.032	53
number of grains per spike	0.77*	-0.135	-	-0.15	62
grain weight	0.32**	-0.072	0.2	-	81

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