RESEARCH PAPER

Study on yield and some agronomic traits of promising genotypes and lines of bread wheat through principal component analysis

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Abstract

In order to study 57 promising genotypes and lines of bread wheat based on yield and some agronomic traits, we conducted an experiment in the station of Agriculture Research and Natural Resources in Ardabil in random blocks design with three replication a year in 2013. The results showed that the number of selected components is appropriate and these components could justify the trait changes ideally. The result from principal component analysis showed that generally 4 components with specific values justify over than 64% changes. First component with the special value of 1.6 justifies more than 40% and the second component with special value of 0.98 justifies more than 24% of changes. Since traits of day to flowering and seed yield had the highest positive coefficient in forming the first component, so the selection based on this component had the genotypes of 13, 49, 34 and 33 respectively which had the highest value in first component, these genotypes were late flowering and high yielded. In contrast, in forming the second component, the highest positive coefficient was related to plant height, so based on this component the genotypes including 53, 52, and 2 were high-feet. In general these 4 components measured a particular trait against other traits.

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Introduction

The phenomenon of population growing in developing countries and variety of food and its high consumption in developed countries made an unprecedented increase in global demand for food (Naseh, 2011). Wheat is the first cereal and the main crop in the world and is the most widely cultivated crop in the world. The main crop species of wheat are: bread wheat (*Triticum aestivum* L) and Durum wheat (*Triticum turgidum* L.). Wheat, as the most important crop, is mainly used as bread which its quality is important in terms of flavor, taste, long-term maintenance and waste reduction (Bushuk and Scanlon, 1998). Wheat products in Iranian food pattern is really important, so that it supplies 40 to 45% calorie and about 50% required protein for each person (Iran-Nejad and Shahbaziyan, 2005).

Principal component analysis is an effective statistical method in the reduction of data volume and data results show a high correlation between the original variables (Moqaddam *et al*, 1995 and copper, 1983). This method was efficiently applied for understanding the relationship and structure of yield components and morphological traits of crops (Sorkhiullah Loo *et al*, 1993 and Bramol *et al*, 1984). Gupta *et al* (1999) measured 17 traits of 40 lines of advanced generations of wheat with11 control group in random block design. Factors analysis reduced 15 traits related with yield and seed quality into 5 major factors, spike characteristics, seed properties and protein quality and tiller. Also another report measuring 7 agronomic and physiologic characteristics in 4 groups of Durum wheat we got two major components which generally justified 64% changes (Pecetti and Annicchiarico, 1998).

Roostaei *et al* (1997). Who performed an experiment on 650 native lines in draught stress, showed that in factors analysis, 5 factors are included in the model and has justified 65.57% changes. They called the first factor affecting yield components, second factor affecting seed weight third factor affecting yield and harvest index, fourth factor affecting length of the awn and number of day to be mature and fifth factor affecting seed number in spike and stem diameter. Leilah and AL-khateebs (2005) found three hidden factors when studying factors affecting on wheat grain in draught stress which justified 74.4% of total diversity. The first factor includes spike quantity per square meter, weight of 100 seeds, seed number per spike and biologic yield witch explained 26.6% of data variation. Second factor includes plant height, spike length and seed number per spike which explained 25.9% variation. Third factor included spike diameter and harvest index which has 19.8% changes. Tousi Mojarad *et al* (2005) conducted an experiment in crop year of 2003-2004 control 245 genotypes from Mexicowith to evaluate the potential of seed yield of bread wheat genotypes in draught stress and study the relation of quantity traits with seed yield and select the best genotypes to use in breeding program in the futureand reported that there is a notable variation between studied genotypes in total traits especially seed yield. By factors analysis based on extracting latent roots through principal components analysis, 5 factors generally justified67.703% data change. The results from reviewing factor coefficient show the importance of peduncle length, peduncle extrusion length, height and earliness traits (day number to spike heading and number of days to maturity) in choosing desired genotypes for draught stress. A research on 36 bread wheat winter genotypes for morphologic traits reported that according to principal components analysis, number of 5 components justified 97% change (Khodadadi *et al*, 2011). Naqdipoor *et al* (2012) performed an experiment 17 advanced lines of durum wheat to study factors analysis for yield and other traits of durum wheat and reported that 4 independent factors justified 67.93% change.

This study aims at applying statistical components analysis method at resulted data to study complex structure of traits and determine relative importance of studied traits in relative with yield, to use it in breeding programs in the future to raise yield promotion per area unit.

Materials and Methods

Place of doing experiments

We received 65 seed varieties and promising lines of bread wheat from research center for Agriculture and Natural resources of Ardabil in crop year of 2012-2013 in random block designs with three replications and planted in station of Agriculture Research and Natural Resources of Ardabil.

Method of computations

The plant was done in second half of Mehr and each plot consisted of 5 rows with 3 meters plant, the space of plant rows was 20 m and the planting density of 300 plants was square meter. Since 8 genotypes didn't grow due to damage of storage pests, 8 genotypes were removed and the experiment was performed with 57 genotypes. Phonological traits, dry to flowering and day to maturity during growing period were recorded with regards to 50% flowering plants and physiologic maturity. Plant height also measured for 5 plants which were selected randomly. After plants matured, two lateral bush rows were considered as margins, and seed yield was obtained from 3 middle rows and the area of half a square meter.

Statistical analysis

We used SPSS software in this research for components analysis.

Results and discussion

Due to complex relationship of traits witheach other, final judgment cannot be made solely on the basis of simple correlation coefficients and Using multivariate statistical analysis methods are needed to understand the relationship between characters. Principal component analysis is one of effective statistical methods in redacting data volume and the results from data show a high correlation between the original variables this analysis was performed on measured traits. As shown is Table 1 components analysis was performed based on particular values more than 1 and considering 4 components. The results from principal components analysis showed that the first component with particular values justify more than 64% change. First and second components with 1.6Eigen value and 0.98 Eigen value, respectively, justify more than 40% and 24% changes. Since in forming first component the traits of day to flowering and seed yield had the highest positive coefficient, so this selection had the highest value in first component based on genotypes of 13, 49, 34 and the genotypes were late flowering and high yield. In contrast, in forming second component, the highest positive coefficient was related to plant height, so based on this component, 53, 52 and 2 were genotypes with high-feet (Table 1).

Table 1. Eigen values, the coefficients and the variance of the principal components obtained from principal components analysis.

Traits	1	2	3	4
Days to flowering	0.627	0.089	0.008	-0.774
Days to maturity	0.481	-0.427	0.682	0.348
Plant height	0.340	0.856	0.105	0.375
Yield	0.510	-0.277	-0.724	0.374
Total	1.6172	0.9834	0.805	0.595
% of Variance	0.404	0.246	0.201	0.149
Cumulative %	0.404	0.65	0.581	1
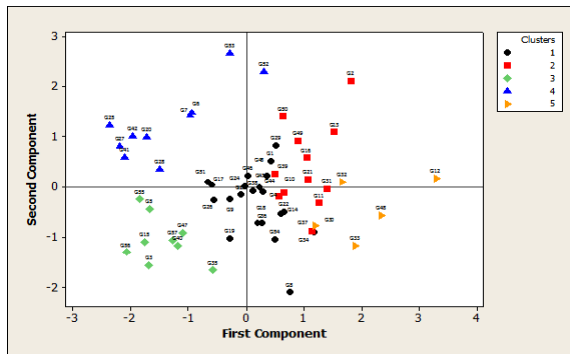
Fig. 1. Distribution of genotypes based on the first two components obtained from principal components analysis.

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