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Determination of the Best Traits Effective on Seed and Protein Yield in Iranian Durum Wheat (*Triticum durum* L.) Genotypes

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ABSTRACT

The randomized complete block design with three replications was used in this research during 2013-2014 farming season. Relationship among measured traits were assessed by Pearson's correlation coefficient and factor analysis. Correlation analysis showed the significant reltaion of grain and protein yield with all the traits except correlation of seed filling duration and peduncle length with seed yield as well as spike yield and peduncle length with protein yield. Factor analysis based on principal component analysis method and varimax rotation indicated that four important factors accounted for about 96.5 percent of the total variation among traits studied. The first factor assigned 47.1 percent of total variation between traits and was significantly related with traits seed yield, biological yield, protein yield and protein percentage. This factor was regarded as quantitative and qualitative yield improvement factor. Other factors accounted for 19.2, 16.9 and 13.3 percent of variation between traits so were entitled as spike yield, seed filling ability and photosynthesis reservoir enhancement factors, respectively. In conclusion, results revealed effect of seed filling rate, biological yield, no.seed/spike, spike yield and protein percentage on seed and protein yield. Hence, these traits are recommended as indirect selection criteria for genetic improvement of seed yield especially in early generations.

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INTRODUCTION

Correlation coefficient analyses helps researchers to distinguish significant relationship between traits. On the other hand, factor analysis has been found to give more specific information on the of each of the component characters upon seed yield. Factor analysis is a multivariate analysis method that aims to explain the correlation between a large set of variables in terms of a small number of underlying independent factors.

Leilah and Al-Khateeb [8] studied durum wheat genotypes under drought stress condition using different multivariate techniques. In this study revealed that three factors accounted for 74.4% of total variation exist between traits. First factor related with number of spikes/plant, 100-seed weight, spike yield and biological yield. Therefore, this factor was regarded as a yield factor. Second factor was strongly associated with plant height, spike length and number of seed/spike. This factor entitled as a biomass factor. Third factor has significant loading factor for spike diameter and harvest index. This factor regarded as a harvest index factor.

Mohamed [9] determined two factors for explain relation of traits in durum wheat genotypes. These factors accounted for 80.8% of variation between traits and entitled as seed yield and spike density, respectively.

In determining the potential of genetically different lines and cultivars, breeders have to observe many different characters that influence yield. Accurate evaluation of these characters is made more difficult by the genotype by environment interaction [15].

Harvest index and biological yield introduced as the most important traits to improve seed yield [10]. In small-grained cereals increase in harvest index may causes yield improvement, without increase in plant water use [10,12]. Indirect selection in early generations through traits correlated with seed yield is one of the most important strategies in plant breeding.

Success of a breeding programme depends on numerous factors. Selection of a right variety for a particular region is an important one. Yield component concept in breeding has got much importance in improving yield potentiality [4]. Initiating a breeding programme based on the yield components requires the knowledge of

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relationship between the yield and its component characters. In this connection, determination of correlation coefficients between the characters has a considerable importance in selecting breeding materials [1,2].

This study was conducted to find out relationship between yield, its component characters and some morphological attributes of durum wheat cultivars. Increasingly, the relationship of different traits was further analyzed using correlation and factor analysis based on quartimax rotation.

MATERIALS AND METHODS

Durum wheat lines (Eighteen lines) along with Dena and Sepahan as checks (totally twenty durum wheat genotypes) were planted at the middle of November 2013 at the Research field of Jehad-Agriculture Institute of Isfahan, Isfahan, Iran. Each plots comprise six rows with 2m long and 0.2m apart. In spring 2014 the trial was irrigated every 8 days. Amount of precipitation was 152 mm.

Sixtheen traits viz; seed yield (Kg/ha), spike weight (g), spike harvest index (%), plant harvest index (%), number of seed/spike, biological yield (Kg/ha), number of spikelet/spike, spike yield (g), 1000-seed weight (g), spike length (cm), plant height (cm), peduncle length (cm), seed filling duration, seed filling rate (Kg/ha/day), protein percentage (%) and protein yield (Kg/ha) were measured on 25 normal plants randomly selected from each plot after border effect eliminating.

Relationships between traits investigated using pearson's correlation coefficients. Then it is assumed that each of the variables measured depends upon the underlying factors but is also subject to random errors. The principal factor analysis method explained by Harman [6] was followed in the extraction of the factor loadings. Factors having eigen value higher than 1 selected for performing loading factors matrix.

The varimax rotation method (an orthogonal rotation) was used in order to make each factor uniquely defined as a distinct cluster of intercorrelated variables [11]. The factor loadings of the rotated matrix, the percentage variability explained by each factor and the communalities for each variable were determined. In order to better interpretation, loadings higher than 0.5 were considered as significant coefficients [6,14,15].

The array of communality, the amount of the variance of a variable accounted by the common factors together, was estimated by the highest correlation coefficient in each array as suggested by Seiler and Stafford [13]. The number of factors was estimated using the maximum likelihood method of Rao [11]. Correlation and Factor analysis were performed using SPSS16 software for all the traits of durum wheat cultivars.

RESULTS AND DISCUSSION

Factor analysis indicated that only 4 first factors, which account for 96.5% of the total variance are important (Table 1). Factor one, which accounted for about 47.1% of the variation, was strongly associated with seed yield, biological yield, protein yield and protein percentage (Table 3). This factor was regarded as a quantitative and qualitative yield enhancement factor since it included several traits, which are components of seed and protein yield [3]. All variables had positive loadings in factor one. The sign of the loading indicates the direction of the relationship between the factor and the variable. Factor two, which accounted for about 19.2% of the variation was named a spike yield improvement factor because it consisted of no.seed/spike, spike yield and no.spikelet/spike which are associated with spike yield.

Table 1: Eigen value, percent of variance and cumulative variance of extracted factors (n=20).

Factors	Eigen value	Variance (%)	Cumulative variance (%)
1	4.02	47.1	47.1
2	3.19	19.2	66.3
3	3.01	16.9	83.2
4	2.24	13.3	96.5

Factor three, accounted for 16.9% of the variation. In this factor, loading factors related to seed filling duration and seed filling rate were positive and higher than 0.5. Because of that this factor entitled as seed filling ability factor. Factor four was named photosynthetic reservoir factor since loadings for traits plant height and peduncle length were higher than 0.5 and positive (Table 2). This factor accounted for 13.3% of the total variation among the traits studied.

Furthermore, this is determined the traits number of seed/spike, spike yield and no.spikelet/spike are the best to increase spike yield. Similar results have been mentioned in many researches [7,9,10].

On the other hands, biological yield and spike yield are suggested as the best indirect selection criteria for genetic improvement of yield in early generations. This result is inconsistent with reports given by Richards [12], Quarrie *et al*. [10] and Dogan [4] for breeding seed yield in durum and durum wheat.

In order to genetic improvement of seed filling ability, selection via traits seed filling rate and seed filling duration are proposed. Increasing plant yield could enable breeders to better realize the desired increment in drought stress resistance of durum wheat genotypes and yield stability. Increasing in traits plant height and

peduncle length can improve photosynthetic reservoir in durum wheat genotypes. Golparvar *et al* [5] and Khan *et al* [7] have reported similar results for breeding these important traits in durum wheat genotypes.

Table 2: Principal factor matrix after varimax rotation for traits of durum wheat cultivars (n=20).

	Factor 1	Factor 2	Factor 3	Factor 4	Community
Seed yield	**0.92**	0.19	0.12	0.32	0.88
Spike weight	0.12	0.18	0.08	0.06	0.80
Spike harvest index	-0.08	-0.03	0.13	0.03	0.65
Plant harvest index	0.12	0.07	0.05	-0.01	0.98
Seed spike^{-1}	-0.17	**0.82**	0.01	-0.07	0.90
Biological yield	**0.83**	-013	-0.02	-0.01	0.96
Spikelet spike^{-1}	-0.21	**0.80**	0.01	-0.06	0.97
Spike yield	-0.02	**0.81**	0.012	0.07	0.90
1000-seed weight	0.11	0.32	0.030	0.49	0.56
Spike length	0.03	-0.01	0.0.1	0.15	0.45
Plant height	0.03	0.09	-0.07	**0.70**	0.72
Peduncle length	0.07	0.43	0.010	**0.81**	0.51
Seed filling duration	0.05	0.08	**0.82**	-0.09	0.93
Seed filling rate	0.47	-0.14	**0.79**	0.08	0.92
Protein percentage	**0.70**	-0.03	-0.35	0.08	0.73
Protein yield	**0.89**	-0.10	0.03	0.02	0.71

Correlation analysis helps to determination effective traits in order to indirect selection superior genotypes. On the other hands, factor analysis is suitable multivariate technique in identify and determination of independent factors that are effective on plant traits separately. Varimax rotation maximizes variance between factors since factors that accounted for higher variations between traits are more important that others. Because of that, traits effective in every factor were identified and factors also entitled based on traits having loading factor greater than 0.5. Therefore, correlation and factor analysis helps breeders to genetic improvement traits such as yield that have low heritability specifically in early generations via indirect selection for traits effective on this [9,10,15,4,8].

In conclusion, selection of the best genotypes through traits such as no.seed/spike, spike yield, number of seed filling rate, biological yield and protein percentage which have higher heritability than seed and protein yield especially in early generations and strongly associated with these traits are emphasized in this study for genetic improvement of seed and protein yield.

REFERENCES

[1] Araus, J.L., D. Villegas, N. Aparicio, L.F. Garcia, S. Elhani, Y. Rharrabti, J.P. Ferrio, C. Royo, 2003. Environmental factors determining carbon isotope discrimination and yield in durum wheat under Mediterranean conditions. Crop Sci., 43: 170-180.

[2] Ali, M.A., N.N. Nawab, G. Rasool, M. Saleem, 2008. Estimates of variability and correlations for quantitative traits in Cicer arietinum L. J. Agric. Social Sci., 4(4): 177-179.

[3] Chowdhry, M., I. Rasool, I. Khaliq, T. Mahmood, M.M. Gilani, 1999. Genetics of some metric traits in spring wheat under normal and drought environment. Rachis Newsletter, 18(1): 34-39.

[4] Dogan, R., 2009. The correlation and path coefficient analysis for yield and some yield components of durum wheat (Triticum turgidum var. durum L.) in west Anatolia conditions. Pak. J. Bot., 41(3): 1081-1089.

[5] Golparvar, A.R., A. Ghasemi-Pirbalouti, H. Madani, 2006. Genetic control of some physiological attributes in wheat under drought stress conditions. Pak. J. Bio. Sci., 9(8): 1442-1446.

[6] Harman, H.H., 1976. Modern factor analysis. 3nd ed. University of Chicago Press, Chicago, 376 pp.

[7] Khan, A.A., M.A. Alam, M.K. Alam, M.J. Alam, Z.I. Sarker, 2013. Genotypuc and phenotypic correlation and path analysis in durum wheat. Bangladesh J. Agril. Res., 38(2): 219-225.

[8] Leilah, A.A., S.A. Al-Khateeb, 2005. Statistical analysis of wheat yield under drought conditions. J. Arid. Environments, 61: 483-496.

[9] Mohamed, N.A., 1999. Some statistical procedures for evaluation of the relative contribution for yield components in wheat. Zagazig. J. Agric. Res., 26(2): 281-290.

[10] Quarrie, S.A., J. Stojanovic, S. Pekic, 1999. Improving drought tolerance in small-grain cereals: A case study, progress and prospects. Plant Growth Regulation, 29: 1-21.

[11] Rao, C.R., 1952. Advanced statistical method in biometric research. John Wiley and Sons, New York, 526 pp.

[12] Richards, R.A., 1996. Defining selection criteria to improve yield under drought. Plant Growth Regulation, 20: 157-166.

[13] Seiler, G.J., R.E. Stafford, 1985. Factor analysis of components of yield in guar. Crop Sci., 25: 905-908.

[14] Sharma, S., 1996. Applied multivariate techniques. 1nd ed. John Wiley and Sons, New York, 493 pp.
[15] Tadesse, W., E. Bekele, 2001. Factor analysis of yield in grasspea (*Lathyrus sativus* L.). Lathyrus Lathyrism Newsletter, 2: 416-421.