Journal of Applied Science and Agriculture, 10(6) April 2015, Pages: 28-30

AENSI Journals

JOURNAL OF APPLIED SCIENCE AND AGRICULTURE

ISSN 1816-9112

Journal home page: www.aensiweb.com/JASA

Principle Components Analysis for Morphologic Features in Pinto Bean's Genotypes in Broujerd Climatic Conditions

Hadis Dalvand, Mahdi Javadian, Iman Bajalan

Young Researchers and Elite Club, Borujerd Branch, Islamic Azad University, Borujerd, Iran

A R T I C L E I N F O

Article history:
Received 12 October 2014
Received in revised form 1January 2015
Accepted 22 February 2015

Keywords:
Pinto bean, Principle components analysis, correlation, morphologic features.

A B S T R A C T

Background: This study was performed in order to analyze and categorize morphologic features of 15 genotypes belonging to Pinto bean in the form of complete random blocks plan in three replicates on Broujerd agricultural researches and natural resources station farm in 2011. **Objective:** The features under study included single-bush performance (g), biologic performance, harvest index, plant height (cm), knot number on main stem, sheath number on main stem, sheath length (cm), sheath width (cm), minor-stem number, a hundred-seed weight (g), sheath weight (g), sheath number in single bush, and seed number in sheath for single bush. **Results:** The results showed that the greatest correlation of single-bush seed yield is with the features harvest index (r = 0.76**), biologic yield (r=0.72**), and sheath weight (r = 0.51*). Also, it was recognized that the feature of sheath width is of negative and significant correlation with the feature of yield (r=0.59*). Principle components analysis demonstrated that the first 5 components, on the whole, explain 86 percent of changes in variables under study.

To Cite This Article: Hadis Dalvand, Mahdi Javadian, Iman Bajalan., Principle components analysis for Morphologic Features in Pinto Bean's Genotypes in Broujerd Climatic Conditions. ***J. Appl. Sci. & Agric.**, 10(6): 28-30, 2015*

INTRODUCTION

Pinto bean is one of the most highly used and desirable kinds of bean that because of having better digestion potential, being delicious and being quickly cooked is of importance. Biologic value of pulses' protein is high because of many necessary amino acids. Pulses, by having about 25% protein, are of very important role in providing human's required protein. The importance of pulses in Iran is after wheat and rice and bean has devoted half of cultivated level of pulses to itself. For this reason, it is of increasing importance to make its variety better. Modifiers usually confront with diverse characteristics of plant when recognizing genetic potential of lines and different values that influence their yield. Appropriate evaluation of these features makes it so difficult to conclude in this regard because of their low heredity and reciprocal genotype with environment. Values being estimated as phenotype correlation can be categorized into genetic and environmental parts. By studying correlation and using multi-variety statistical methods such as analysis to factors and causality analysis, we can identify the features effective on creating correlation among features (Jahanson and Wichern, 1982). Multi-variety analyses including step-by-step regression and analysis to factors are applied in order to interpret relationships among feature and group them based on these relationships. Through this it become possible to identify the most important features effective on yield and also covert factors having caused special structure of covariance matrix or correlation among features. Dargahi (2005) using analysis to main components about features with high correlation in white bean showed that 7 main components explained about 65/43 percent of whole variance in features. Denis *et al*., (1972) in examining morphologic features of yield components in bean's finite and infinite growth genotypes, used analysis to factors and main components. Analysis of all genotypes manifested three factors that explained 8/3, 31 and 14/31 percent, respectively, and on the whole 77/1 percent of all variation. Ebrahimi *et al*, (2010) using analysis to factors showed that 3 independent factors on the whole explained 82 percent of changes in all data.

This study aims to examine relationships of different features, identify the factors effective on genetic improvement of seed yield in Pinto bean's genotypes and uncover covert factors for recognizing internal relationships among morphologic features.

Methodology:

Corresponding Author: Mahdi Javadian, Young researchers and elite club, Borujerd Branch, Islamic Azad university, Borujerd, Iran.
E-mail: javadian.m123@gmail.com

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This study was performed in 2010-2011 using 15 genotypes of Pinto bean on Broujerd Agricultural and Natural Resources Research's field in the form of complete random blocks plan with 3 replicates. The operation to prepare land for planting included disc, correction, and creating planting rows. Each treatment included 4 rows with 4m in length, the number of planted seeds in each row was 50 and average distance over rows and among bushes was 10cm and distance between rows was 50cm.

The features under study were measured from bushes available in a meter square considering marginal effects and their mean was applied in statistical calculations. The measured features in this study are as follows: single-bush performance (g), biologic performance, harvest index, plant height (cm), knot number on main stalk, sheath number on main stalk, sheath length (cm), sheath width (cm), minor-stalk number, a hundred-seed weight (g), sheath weight (g), sheath number in single bush and seed number in sheath (all features had been considered for single bush). Simple correlation by Pearson method was conducted for all data. Then principle components analysis was used to determine internal relationships among features and categorize features effective on performance and eigenvalue, proportion, accumulated proportion were also computed for each one of derived components. In order to perform statistical analysis SPSS 18 was used.

RESULTS AND DISCUSSION

The results relating to examining correlation coefficients between features have been presented in Table 1. The correlation results between features showed that seed yield holds positive and very significant correlations with the features of harvest index (r=0.76**), biologic performance (r=0.72**), and significant positive correlation with sheath weight (r=0.51*), and negative significant correlation with sheath width (r= -0.59). These results correspond well with results of other researchers. Ebrahimi *et al*, (2010) reported the greatest correlations of seed performance with sheath weight, biologic performance, seed number in bush and bush height Amini (1998) has reported greatest correlations of seed performance with sheath weight, sheath number, seed number in bush and biologic performance. Also, Habibi *et al*, (2006) has reported the most correlations of seed performance with seed number in sheath, sheath number in bush, sheath weight and biologic performance. The results of this study demonstrated that the highest positive correlation of seed performance is with harvest index (r=0.76**). The results of analysis to elements for all bean genotypes including proportion, cumulative percentage and eigenvalue have been demonstrated in Table 2.

Table 1: Phenotype correlation analysis of the features under study.

	¶A	B	C	D	E	F	G	H	I	J	K	L	M
A	1												
B	.18	1											
C	.07	.80**	1										
D	.36	.46	.47	1									
E	.38	.29	-.08	-.03	1								
F	-.2	-.54*	-.5	-.20	-.32	1							
G	.01	.08	.35	-.12	-.06	-.28	1						
H	.51*	.16	.12	-.05	.54*	-.2	.51*	1					
I	.25	-.34	-.08	.43	-.41	.34	-.38	.36	1				
J	.28	-.24	-.23	-.42	.20	.33	-.06	.32	.2	1			
K	.72**	.18	.27	.44	.32	-.05	-.07	.45	.37	.3	1		
L	-.59*	-.17	-.12	.3	-.2	-.07	.43	.03	-.44	-.35	.53*	1	
M	.76**	.11	-.08	.1	.2	-.29	-.03	.30	.04	.12	.1	-.3	1

¶**A:** yield; **B:** Height; **C:** knot number on main stem; **D:** sheath on main stem; **E:** sheath length; **F:** subsidiary-stem number; **G:** A hundred seed weight; **H:** sheath weight; **I:** sheath number in bush**; J:** seed number in sheath, **K:** biologic yield; **L:** sheath width; M: harvest index.

The first five components, in general, explain 86 percent of changes in variables under study (Table 2). The first constituent devoted 28/12 percent of variance among features to itself and played an important role in explaining changes in plant height, knot number, sheath number on main stem, and minor-branches number. Hence, it was named as germination constituent. Second, third, fourth and fifth components also explained 21/92, 17/71, 10, and 8/21 percent of changes among features, respectively, and were named as elements of first-order yield components, second-order yield components, seed yield and production factor, respectively.

Ebrahimi *et al*, (2010) expressed 3 factors in white bean having been named as yield factor, seed-characteristics factor and phonologic features, respectively. Amini (1998) in his study about bean has derived 3 above-mentioned factors. Habibi *et al*, (2006) said that 5 factors in red bean constituted 74/5 percent of whole variation.

Azizi *et al*., (2001) in a study about beans introduced 4 factors that the first and fourth ones were named as germination growth factors and second and third ones as yield factors. Because of the fact that in corrected original generations, heredity of yield is low, it can be possible to benefit from features such as harvest index, sheath weight, and

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biologic yield having high correlation with seed yield in this experiment and also higher heredity.

Table 2: Results of principle components analysis for the features under study.

		Principle components				
No.	Feature	1	2	3	4	5
1	Yield	.125	.638	.055	.742	.038
2	Height	.866	.063	.360	.013	.034
3	Knot number on main stem	.873	.155	-.033	-.157	.243
4	Sheath on main stem	.715	.263	-.390	.182	-.195
5	Sheath length	.063	.297	.842	.194	-.089
6	Subsidiary-stem number	-.620	.220	-.326	-.375	-.201
7	A hundred seed weight	.141	-.037	.013	-.012	.948
8	Sheath weight	-.008	.441	.469	.365	.630
9	Sheath number in bush	-.092	.441	-.761	.082	-.351
10	Seed number in sheath	-.545	.639	.207	-.042	.031
11	Biologic yield	.246	.889	-.037	.120	.096
12	Sheath width	-.130	-.658	.017	-.276	.532
13	Harvest index	-.014	.079	.082	.959	-.025
	Eigenvalue	2.83	2.66	1.95	1.87	1.86
	proportion	28.12	21.92	17.71	10.03	8.21
	cumulative	28.12	50.06	67.76	77.79	86

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