Full Length Research Paper

Correlation and relationships between seed yield and other characteristics in chickpea (*Cicer arietinum* l.) cultivars under deterioration

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This study was done in order to evaluate the relationships between grain yield and the other characteristics with two cultivars of chickpea (Hashem and Arman) in deterioration (0 (control), 7 and 14 days). The experiment was a factorial completely randomized design with 2 factors. It was conducted on a research farm at Gonbadekavoos High Education Center- Iran in 2009. At harvest time, height of the plants, filled and unfilled pods per plant, number of seeds per plant, plant dry weight and yield were measured. Results showed the yield had highly positive correlation with filled pod per plant (r = 0.96)) (p<0.01). In Arman and Hashem cultivar, yield had highly correlation with seed number per plant (r = 0.95) (p<0.01) Dependence of seed yield to height was great with deterioration 14 days; and the correlation coefficient between filled pod number and height after 7 days deterioration was significantly (P<0.01) negative (r = -0.95) (P<0.01) but it was of greater magnitude in 14 days deterioration (r = 0.79) (P<0.01).

Key words: Chickpea, correlation, deterioration, relationship, yield.

INTRODUCTION

The correlation is one of the most common and most useful statistics. A correlation is a single number that describes the degree of relationship between two variables. It is a statistical technique that can show whether and how strongly pairs of variables are related.

Chickpea is one of the most important crops in dry farm conditions of Iran and it plays an important role in rotation with dry farm wheat barely and colza. Approach to desirable aims in breeding plants usually knowing the correlation of plant characteristics is more important, because knowing these traits help us to predict crop yield. Understanding the correlation between yield and other characteristics under different treatments is very important. Chickpea is one of the most important pulse crops because it is an important source of protein and has a major role in human nutrition. The cultivated area

of chickpea is located in the third-highest pulse crop in the world. Chickpea is suitable for regions with warm weather and semi-dry conditions. It is traditionally planted in spring, but in warm regions it is planted in autumn. It can also be planted in autumn during colder times. Chickpea is resistant to dry conditions; its base temperature is 5°C but it can remain alive as low as -9°C.

Salehi et al. (2008) reported that there are significant correlations between number of seed per pod and number of pod per plant with grain yield in common bean (*Phaseolus vulgaris* L.). The study of correlation in chickpea has showed that pod number per plant and 100-seed weight have potential contribution to grain yield (Noor et al., 2003). Correlation analysis and relationship between grain yield and other quantitative traits in chickpea showed that the number of seeds per plant, pod number per plant and plant height have the highest positive correlation with grain yield (Kobraee et al., 2010). Guler et al. (2001) found positive and significant relationships statistically in the study of chickpea, between the number of seeds per pod and the number of pods per plant and between the number of seeds per

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Table 1. Correlation coefficient among various pair of characteristics in Hashem cultivar.

Characteristics	Height	Filled pod number per plant	Unfilled pod number per plant	Seed number per plant	Dry weight per plant	Yield	Plant dry weight per square
Height	1						
Filled pod number per plant	0.91**	1					
Unfilled pod number per plant	-0.88**	-0.97**	1				
Seed number per plant	0.91**	0.95**	0.88**	1			
Dry weight per plant	0.64**	0.76**	-0.78**	0.87**	1		
Yield	0.78**	0.85**	-0.82**	0.95**	0.93**	1	
Plant dry weight per square	0.53**	0.64**	-0.66**	0.79**	0.98**	0.88**	1

*, ** = Significant at P<0.05 and P<0.01 levels.

plant and the number of pods per plant negative and significant relationships were determined statistically between the number of pods per plant and 100 seed weight, between the number of seeds per pod and 100 seed weight and between the number of seeds per components of chickpea, under dry land conditions in the west of Iran reported to have found positive and significant relationships statistically between 100 seed weight and plant height, between seed yield and number of pods per plants and the number of seed per pod. Negative and significant relationships were determined statistically between number of pod per plant and 100 seed weight and between seeds per pod. Vaghela et al. (2009) reported seed yield per plant exhibited significant and positive correlation with biological yield, number of pods per plant, harvest index, number of seeds per pod, number of primary branches per plant and 100 seed weight at genotypic as well as phenotypic levels. Derya et al. (2008) significant and positive correlations between seed yield and total pod number, full pod number, seed number and seed weight reported.

The present study was subjected to find out correlation coefficients among characteristics of chickpea cultivars with deterioration treatment.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at Gonbad High Education Center on the research farm of the Faculty of Agricultural Iran, with Latitude 37°16'N, Longitude 55°12'E and Altitude 52 m. The soil was silty clay loam with pH, 7.9.

Experimental design, treatments and statistical analysis

The experiment was a factorial completely randomized design with 2 factors and 3 replications. Factors included cultivars (Hashem and Arman) and deterioration (0 (control), 7 and 14 days). In the laboratory, seeds of Hashem and

plant and 100 seed weight. Amjad et al. (2009) reported significant correlation of grain yield per plant with pod number per plant, seed number per plant and seed number per pod. Talebi et al. (2007) with study correlation and path coefficient analysis of yield and yiel Arman were treated to deteriorate seeds. Groups of seeds were placed in mesh bags. Every bag was placed on a sieve suspended within a closed container above water during 7, and 14 days in 40°C. The bags did not contact the water at any point, but seeds could absorb the humidity in the dish. After treatment the seeds, they were planted on the farm.

All practices, planting, irrigation, protection, weed control and harvests were similar to the practices used by farmers in the area of Gonbadekavoos. Seeds were planted with high density and pulled the additional plants when they had 4 to 6 leaves. The area of each plot was 2.5 m^2, 5 rows in each plot and each plot was 5 m long. Distance between rows was 50 cm and distance between plants in the rows was 7 cm. All treating were similar to those that a farmer might use. At harvest, the two outside rows of each plot were discarded and the plants 0.5 m from the ends of each plot were discarded as well. Five plants from the sample area were harvested at random in order to calculate some characteristics and yield components. The rest of the plants were harvested to determine yield. The samples were oven-dried at 70° for 48 h. We measured the height of the plant, filled and unfilled pod number per plant, seed number per plant, plant dry weight and yield at harvest. Data was analyzed using SAS (SAS Institute, 1990).

RESULTS AND DISCUSSION

The correlation coefficient between plants characteristics of chick pea cultivar (Hashem) are given in Table 1. The seed yield had a highly positive and negative correlation with seed number (r = 0.95, P<0.01) and unfilled pods (r = -0.82, P<0.01) respectively. The seed yield was shown their significant (P<0.01) and positive correlation with plant height (r = 0.78, P<0.01) and dry weight (r = 0.93, P<0.01) (Table 1), but seed yield had a highly positive correlation with filled pod number in Arman cultivar (r = 0.96, P<0.01) (Table 2). This result shows that one of the

Table 2. Correlation coefficient among various pair of characteristics in Arman cultivar.

Characteristics	Height	Filled pod number per plant	Unfilled pod number per plant	Seed number per plant	Dry weight per plant	Yield	Plant dry weight per square
Height	1						
Filled pod number per plant	0.92**	1					
Unfilled pod number per plant	-0.92**	-0.95**	1				
Seed number per plant	0.99**	0.93**	-0.92**	1			
Dry weight per plant	0.88**	0.90**	-0.91**	0.90**	1		
Yield	0.80**	0.96**	0.84**	0.84**	0.86**	1	
Plant dry weight per square	0.86**	0.93**	0.89**	0.89**	0.97**	0.92**	1

*, ** = Significant at P<0.05 and P<0.01 levels.

Table 3. Correlation coefficient among various pair of characteristics chickpea cultivars without deterioration treatment.

Characteristics	Height	Filled pod number per plant	Unfilled pod number per plant	Seed number per plant	Dry weight per plant	Yield	Plant dry weight per square
Height	1						
Filled pod number per plant	-0.95	1					
Unfilled pod number per plant	0.55	-0.50	1				
Seed number per plant	-0.83	0.95**	-0.52	1			
Dry weight per plant	-0.73	0.89**	-0.44	0.97**	1		
Yield	-0.76	0.90**	-0.49	0.96**	0.98**	1	
Plant dry weight per square	-0.70	0.86**	-0.49	0.96**	0.99**	0.97**	1

*, ** = Significant at P<0.05 and P<0.01 levels.

Table 4. Correlation coefficient among pair of characteristics with deterioration after 7 days.

Characteristics	Height	Filled pod number per plant	Unfilled pod number per plant	Seed number per plant	Dry weight per plant	Yield	Plant dry weight per square
Height	1						
Filled pod number per plant	-0.85**	1					
Unfilled pod number per plant	-0.09	0.27	1				
Seed number per plant	-0.96**	0.84**	-0.02	1			
Dry weight per plant	-0.92**	0.76**	-0.24	0.95**	1		
Yield	-0.96**	0.89**	-0.14	0.96**	0.90**	1	
Plant dry weight per square	-0.95**	0.75**	-0.21	0.95**	0.97**	0.91**	1

*, ** = Significant at P<0.05 and P<0.01 levels.

reasons that cultivars have a different seed yield is due to differences between their seed yield correlation and their characteristics. These results are similar results of Guler et al. (2001), Amjad et al. (2009) and Kobraee et al. (2010).

The plant height had significant correlation with all characteristics except the unfilled pod per plant in both cultivars and highly positive correlation was observed between height and seed number per plant in Hashem (0.91, P<0.01) and Arman (r = 0.96, P<0.01) (Tables 1 and 2). This result shows which ever height is greater; the number of pod per plant will increase. The unfilled number per plant had significant negative correlation with all characteristic in both cultivars (Tables 1 and 2). This

result showed that unfilled pod character depends more on climate situations, meteorology parameters, and sufficient nutritional elements in the soil. Unfilled pods usually exist when the plant does not have a source of carbohydrate to fill out all plant pods. This appears when the climate is not suitable or there is not enough nutrition in soil.

In comparison without deterioration (Table 3) and deterioration after 14 days (Table 5); in deterioration, the role of height in seed yield, number seeds per plant and dependent on seed yield to plant height is more, height in deterioration 14 days had a determinative role in plant dry weight in square (Tables 3 and 5). When we compare the correlation between characteristics after 7 days (Table 4)

Table 5. Correlation coefficient among characteristics of chickpea cultivars with deterioration after 14 days.

Characteristics	Height	Filled pod number per plant	Unfilled pod number per plant	Seed number per plant	Dry weight per plant	Yield	Plant dry weight per square
Height	1						
Filled pod number per plant	0.79**	1					
Unfilled pod number per plant	-0.74**	-0.52	1				
Seed number per plant	0.77**	0.82**	-0.34	1			
Dry weight per plant	0.84**	0.91**	-0.51	0.96**	1		
Yield	0.75**	0.89**	-0.33	0.97**	0.98**	1	
Plant dry weight per square	0.86**	0.86**	-0.51	0.96**	0.97**	0.94**	1

*, ** = Significant at $P<0.05$ and $P<0.01$ levels.

and 14 days of deterioration (Table 5), it shows that the yield has a significantly negative correlation with height ($r = -0.96$, $P<0.01$) after 7 days deterioration (Table 4) but the yield has significant correlation with height ($r = 0.74$, $P<0.01$) after 14 days deterioration (Table 5).

The yield had the same correlation with filled pod numbers after 7 and 14 days deterioration (Tables 4 and 5). This shows filled pod numbers is a characteristic that the deterioration had no effect on it. The correlation between yield and unfilled pods differ in 7 and 14 days deterioration .It is not significant in 7 days deterioration (Table 5). This result shows 14 days deterioration plants are weak and grow less and the numbers of unfilled pods per plant are lower than plants under the 7 days deterioration. Correlation coefficients between yield and filled pod numbers in 7 and 14 days deterioration (Tables 4 and 5) is the same.

The correlation coefficient between filled pod numbers and height after 7 days deterioration is significantly negative ($r = -0.95$, $P<0.01$) (Table 4) but it is significant in 14 days deterioration ($r = 0.79$, $P<0.01$) (Table 5). This result shows that the effect of the height on unfilled pod numbers is greater in more deterioration and also leads to decrease yield. This is because the filled pod number is one of the most important component yields. In other words, when deterioration is greater the height will be less and lead to a decrease of filled pods number per plant which yield will decrease.

REFERENCES

Amjad MA, Nausherwan NN, Amjad A, Zulkiffal M, Sajjad M (2009). Evaluation of selection criteria in *Cicer arietinum* L. using correlation coefficients and path analysis. Aust. J. Crop Sci., 3(2): 65-70.

Derya y, Anlarsal AE (2008). Performance of some winter chickpea (*Cicer arietinum* L.) genotypes in Mediterranean conditions Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 36(2): 35-41.

Guler Mustafa M, Sait A, Ulukan H (2001). Determining relationships among yield and some yield components using path coefficient analysis in chickpea (*Cicer arietinum* L.) European J. Agron., 14 (2): 161-166

Kobraee S, Shamsi K, Rasekhi B, Kobraee S (2010). Investigation of correlation analysis and relationships between grain yield and other quantitative traits in chickpea (*Cicer arietinum* L.). African Journal of Biotechnology 9(16): 2342-2348.

Noor F, Ashraf M, Ghafoor A (2003). Path analysis and relationship among quantitative traits in chickpea (*Cicer arietinum* L.). Pakistan J. Biol. Sci., 6(6): 551-555.

Salehi M, Tajik M, Ebadi AG (2008). The Study of Relationship between Different Traits in Common Bean with multivariate statistical methods. American- Erusion J. Agric. Environ. Sci., 3(6): 806-809.

SAS Institute (1990). SAS procedures guide: version 6. 3. SAS Institute; Cary, NC.

Talebi R, Fayaz F, Babaeian Jelodar NA (2007). Correlation and path coefficient analysis of yield and yield components of chickpea (Cicer arietinum L.) under dry land condition in the West of Iran. Asian J. Plant Sci., 6: 1151-1154.

Vaghela MD, Poshiya VK, Savaliya JJ, Davada BK, Mungra KD (2009). Studies on character association and path analysis for seed yield and its components in chickpea (*cicer arietinum* L.). Legume Res., 32(4): 245-249.