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Research article

CORRELATION AND PATH COEFFICIENT ANALYSIS OF GRAIN YIELD AND YIELD COMPONENTS IN SOME BARLEY GENOTYPES CREATED BY FULL DIALLEL ANALYSIS IN SULAIMANI REGION FOR F_2 GENERATION

*Sherwan Esmail Tofiq, **Taban Najmalddin Hama Amin , ***Suaad Muhammad Sheikh Abdulla , ****Dana Azad Abdulkhaleq

*,**,***,****Plant Breeding and Genetics , Field Crops Department , Faculty of Agricultural Sciences , University of Sulaimani , Kurdustan Region , Iraq
Email : tabantaby@yahoo.com

ABSTRACT: This investigation was conducted at Qlyasan Agricultural Research Station, Faculty of Agricultural Sciences, University of Sulaimani (Lat 35° 34 307 ; N, Long 45° 21 992 ; E, 765 masl) during (2013 – 2014) to estimate the simple correlation coefficient among characters and to determine the path analysis between grain yield and their components. Using five parents and their 20 crosses made by 5x5 full Diallel cross system in this experiment. The results confirm the presence of highly significant and positive correlation between grain yield with No. of spikes / plant , weight of spikes / plant , 1000 grain weight and biological yield , while significant and positive correlation between grain yield with plant height and average grain weight / plant were observed . Maximum positive direct effect on grain yield recorded by No. of spikes / plant with 0.538. Maximum positive indirect effect in grain yield recorded by weight of spikes / plant via No. of spikes / plant with 0.331.
Key words: Correlation, path Coefficient, Grain yield, Barley genotypes

INTRODUCTION

To identify the dimension of the effect of each yield component on grain yield is of importance for use in defining selection criteria for improving new varieties. Path coefficient and correlation analysis are used widely in many crop species by plant breeders to define the nature of complex interrelationships among yield components and to identify the sources of variation in yield. Knowledge derived in this way selection criteria can be developed to improve grain yield in relation to agricultural practices [1-5].

Relationships between two metric characters can be positive or negative, and the cause of correlation in crop plants can be genetic or environmental [6]. Path analysis is used to describe the directed dependencies among a set of variable. This includes models equivalent to any form of multiple regression analysis, factor analysis , canonical correlation analysis , discriminate analysis , as well as more general families of models in the multivariate analysis of variance and covariance analysis , assuming yield is a contribution of several characters which are correlated among themselves and to the yield . Path coefficient analysis was suggested by [7] and described by [8] which was calculated to detect the relative importance of characters contributing to grain yield [9]. It has been applied to a vast array of complex modeling areas, including sociology and econometrics [10]. Path-coefficient analysis is one of the reliable statistical techniques which allow quantifying the interrelationships of different components and their direct and indirect effects on grain yield through correlation estimates [11].

MATERIALS AND METHODS

This investigation was carried out at Qlyasan Agricultural research station, Faculty of Agricultural Sciences, University of Sulaimani (Lat 35° 34 307 ; N, Long 45° 21 992 ; E, 765 masl), 2 km North West of Sulaimani city. Five varieties of two-rowed barley (*Hordum distichon* L.) namely (Local Barley, Zanbaka, ARTa/3/Avar, Roho/ Zanbaka and Avar/H/ Sout) were introduced from the Ministry of Agricultural, Sulaimani research station, Bakrajo, Sulaimani, Iraq.

Seed of 20 F_2 generation with their parents were sown in the field experiment in a randomized complete block designed with (3) replications during (2013 – 2014) at Qlyasan location. Trial was accomplished according to normal field practices. At full maturity, the central two rows of each plot were harvested manually by hand. Measurements were taken on the following parameters {Plant height (cm), average grain weight / plant (mg), No. of grains / spike , weight of grains / spike (g) , No. of spikes / plant , weight of spikes/plant (g), spike length (cm), 1000-grain weight (g), biological weight/ plant (g), harvest index and grain weight/plant (g)}.

Correlation Analysis

The correlation coefficients were calculated to determine the degree of association of characters with yield and also among themselves. Phenotypic correlations were computed by using the formula given by [12].

Path Coefficient Analysis

The path coefficient analysis was carried out as suggested by [8, 12, 13, 14], Analysis of Moment Structures AMOS Ver. 18 Software).

RESULTS AND DISCUSSION

The correlation confection among studied characters represent in table 1. The character plant height correlated high significant and positively with average grain weight / plant with 0.513 , while it correlated significantly and positively with grain yield / plant with 0.406 , plant height had positive but non-significant correlation at genotypic level with grain yield . Grain yield in barley was most significantly correlated with plant height [15]. The Average grain weight/plant correlated high significantly and positively with No. of grain / spike and spike length with 0.598 and 0.554 respectively , while it correlated significantly and positively with weight of spikes / plant and grain yield / plant by 0.498 and 0.483 respectively , previous workers confirmed positive and significant correlation coefficients between grain weight and the yield components such as spike length , grain number / spike , grain weight / spike , spike number / plant [16, 17]. The character No. of grains / spike correlated high significantly and positively with spike length with 0.643, previously [18] reported that number of grain / spike correlated high significantly and positively with spike length , grain weight / plant and grain weight / spike.

Table 1: The Correlation Coefficient among Studied Characters

Characters	Plant height (cm)	Average grain weight/plant (g)	No. of grains/ spike	Weight of grains/ spike (g)	No. of spikes / plant	Weight of spikes/ plant(g)	Spike length (cm)	1000-grain weight (g)	Biological yield	Harvest index	Grain yield/ plant (g)
Plant height (cm)	1.000										
Average grain weight/plant (g)	0.513****	1.000									
No. of grains/spike	0.358	0.598**	1.000								
Weight of grains/spike(g)	0.004	-0.088	-0.210	1.000							
No. of spikes/plant	0.224	0.357	0.225	0.046	1.000						
Weight of spikes/plant(g)	0.351	0.498*	0.147	-0.039	0.615**	1.000					
Spike length(cm)	0.174	0.554**	0.648**	-0.063	0.372	0.282	1.000				
1000-grain weight(g)	0.287	0.381	-0.057	0.039	0.413*	0.469*	0.174	1.000			
Biological yield	0.093	0.190	-0.153	0.280	0.262	0.451*	0.136	0.438*	1.000		
Harvest index	-0.027	0.171	-0.258	0.106	-0.319	0.107	-0.030	0.277	0.695**	1.000	
Grain yield/plant (g)	0.406*	0.483*	0.208	0.132	0.841**	0.767**	0.322	0.581**	0.580**	0.038	1.000

The No. of spikes / plant gave high significant and positive correlation with weight of spikes / plant and grain yield / plant recording 0.615 and 0.841 respectively, while it correlated significantly and positively with 1000 grain weight recording 0.413, highly significant and positive correlation between number of spikes / plant and each of biological weight/plant and grain weight/plant were recorded, while significant and positive correlations between number of spike / plant and each of characters spike length, grain weight/spike and 1000 grain weight were observed previously by [19].

The character weight of spikes / plant showed highly significant and positive correlation with grain yield recording 0.767 and showed significant and positive correlation with 1000 grain weight and biological yield recording 0.469 and 0.451 respectively. The character 1000 grain weight correlated high significantly and positively with grain yield recording 0. 581, but significantly and positively with biological yield showing 0.438 , it was confirmed previously that 1000 grain weight had positive and significant correlation with grain weight at genotypic level was found ,while positively non-significant correlation at phenotypic level with grain weight [20], and 1000 grain weight positively and significantly correlated with the characters of grain weight/spike and average spike weight, while it was highly significant and positively correlated with spike weight/plant and grain weight / plant [18]. The character biological yield recorded high significant and positive correlation with harvest index and grain yield/plant showing 0.695 and 0.580 respectively, the character biological weight correlated high significantly and positively with all characters , similar results recorded previously by [18, 19]. Data in table 2 explain the direct and indirect effects of the characters in grain yield. Maximum positive direct effect produced by the character No. of spikes /plant recording 0.538 and followed by biological yield with 0.365.

Table 2: Path Analysis for Direct Effect (Diagonal Values) and Indirect Effect in Grain Yield

Characters	Plant height (cm)	Average grain weight/ plant (g)	No. of grains / spike	Weight of grains / spike (g)	No. of spikes / plant	Weight of spikes / plant (g)	Spike length (cm)	1000-grain weight (g)	Biological yield	Harvest index
Plant height (cm)	0.106	0.054	0.038	0.0004	0.024	0.037	0.019	0.030	0.010	-0.003
Average grain weight/plant (g)	0.019	0.036	0.022	-0.003	0.013	0.018	0.020	0.014	0.007	0.006
No. of grains / spike	0.047	0.079	0.132	-0.028	0.030	0.019	0.085	-0.008	-0.020	-0.034
Weight of grains / spike(g)	0.000	-0.003	-0.008	0.039	0.002	-0.002	-0.002	0.001	0.011	0.004
No. of spikes/plant	0.121	0.192	0.121	0.025	0.538	0.331	0.200	0.222	0.141	-0.171
Weight of spikes / plant(g)	0.066	0.093	0.028	-0.007	0.115	0.187	0.053	0.088	0.084	0.020
Spike length(cm)	-0.022	-0.069	-0.080	0.008	-0.046	-0.035	-0.124	-0.022	-0.017	0.004
1000-grain weight(g)	0.033	0.044	-0.007	0.004	0.047	0.054	0.020	0.115	0.050	0.032
Biological yield	0.034	0.069	-0.056	0.102	0.095	0.165	0.050	0.160	0.365	0.253
Harvest index	0.002	-0.013	0.019	-0.008	0.023	-0.008	0.002	-0.020	-0.051	-0.073
Grain yield(g)	0.406	0.483	0.208	0.132	0.841	0.767	0.322	0.581	0.580	0.038

Table-3 The t-Test for the Correlation Coefficient among Studied Characters

Characters	Plant height (cm)	Average grain weight/plant (g)	No. of grains/ spike	Weight of grains/ spike(g)	No. of spikes / plant	Weight of spikes/ plant(g)	Spike length (cm)	1000-grain weight (g)	Biological yield	Harvest index
Average grain weight/plant (g)	2.863									
No. of grains/spike	1.838	3.574								
Weight of grains/spike(g)	0.019	-0.423	-1.028							
No. of spikes/plant	1.105	1.833	1.107	0.220						
Weight of spikes/plant(g)	1.796	2.752	0.715	-0.188	3.742					
Spike length(cm)	0.849	3.190	4.082	-0.303	1.921	1.408				
1000-grain weight(g)	1.436	1.978	-0.276	0.186	2.178	2.543	0.850			
Biological yield	0.450	0.928	-0.740	1.401	1.301	2.425	0.658	2.334		
Harvest index	-0.131	0.834	-1.281	0.509	-1.613	0.516	-0.146	1.381	4.630	
Grain yield(g)	2.129	2.646	1.022	0.640	7.455	5.726	1.633	3.420	3.414	0.181
t (p = 0.05)	2.069									
t (p = 0.01)	2.807									

The negative direct effect value showed by spike length recording -0.124. Maximum positive indirect effect value produced by the character No. of spikes / plant via weight of spikes / plant recording 0.331 and followed by biological yield recording 0.253 via harvest index . Maximum negative indirect effect value was -0.171 produced by No. of spikes / plant via harvest index. [21], found that grain number / plant and 1000 grain weight had the greatest direct effect on grain weight / plant. Number of spike per meter has negative direct effect but all other the characters had also negatively indirect effect with grain yield. 1000 grain weight had negatively direct effect but only No. of spikelet and spike lengths were positively indirect correlated with grain yield. Spike length had negatively direct correlation with yield but all the other characters had positively indirect correlation with grain yield. Spike density had negatively direct correlation but No. of spike and spike length had positively indirect association with grain yield [16].

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