Bulgarian Journal of Agricultural Science, 17 (No 6) 2011, 773-776
Agricultural Academy

REGRESSION ANALYSIS OF GRAIN WEIGHT PER PLANT IN BARLEY CROSSES

N. AKGUN and A.TOPAL
Selcuk University, Agricultural Faculty, 42031 Konya, Turkey

Abstract

AKGUN, N. and A.TOPAL, 2011. Regression analysis of grain weight per plant in barley crosses. *Bulg. J. Agric. Sci*., 17: 773-776

The knowledge of inheritance mode is a permanent requirement in successful plant breeding. Grain weight per plant has been investigated in a trial consisting of 4 divergent barley varieties (Bulbul 89, *V. nudum* L., Karatay 94 and *H. spontaneum* Koch.) grown in 4x4 diallel. ANOVA showed meaningful contribution both, additive and non-additive components in total variation. Regression analysis revealed different array of dominant and recessive alleles, as well as, complex inheritance system was detected. The *V. nudum* L. held predominant number of recessive genes, while variety Karatay 94 harboured more dominant genes for the trait in study. The results were strongly influenced by parental divergence and complexity of the inheritance system for the trait in study.

Key words: barley, grain weight per plant, diallel, regression analysis

Introduction

Cereals are of great economic importance and are the basis of human and animal nutrition. The constant desire to obtain and use more fertile genotypes from on hand in the practice leads to a narrowing of the genetic variation and depletion of the gene pool. It is therefore important to expand genetic genotype, to increase the yield and quality and be able to resist on the adverse environmental conditions (Borojevic and Misic, 1987). The mass of grains per plant is a yield component, whose inheritance is on complex genetic basis and is subject of the strong pressure for selection in breeding programs (Borojevic, 1990). Milestone in the growing of barley and other cereals in recent years is that they must possess the characters such as precocity and resistance to drought and frost, which largely determine yield and production. To accomplish this purpose, we need to examine the genetic potential of the standard and local varieties and their crosses as the potential for sustainable yields. The aim of our study was the application of regression analysis in diallel crosses to determine the genetic structure of the inheritance of grain weight per plant for barley, the distribution of dominant and recessive genes between parental components and effects of gene interactions.

Materials and Methods

For the purposes of the study four different genotypes of barley were select, which were crossed reciprocally in 4x4 full diallel. F_1 progeny

E-mail: nakgun@selcuk.edu.tr; nakgun2009@gmail.com

was obtained from the most popular varieties Bulbul 89 and Karatay 94 and local populations of v. nudum L. (with naked kernels and precocity) and *H. spontaneum* Koch., which is resistant to frost. F_1 crossings were sown in rows 2 m long with 20 cm distance, distance between plants in the row 10 cm in the experimental field of Agricultural Faculty (Konya, Turkey) in four replications, using a randomized block design in 1999. The mass of grains for each plant was analyzed at full maturity stage of the plants. The main sample consisted of 10 plants per replication. In processing the data the model 'regression analysis' was used (Hayman, 1954; Mather and Jinks, 1977). General combining ability (GCA) and specific combining ability (SCA) were determined by the method of Griffing (1956), model 2 (parents and F_1 generation). Statistical package MSTAT-C program was used.

Results and Discussion

Means of the property of the parents and their off-spring, engaged in the study, varied widely. The lowest average was observed in naked *V. nudum* L. (4.71 g) and the highest in variety Karatay 94 (19.81 g). In the F_1 generation values ranging from 7.37 g (*V. nudum* L. x *H. spontaneum* Koch.) to 18.33 g of *V. nudum* L. x Karatay 94 (Table 1). We think the result is a consequence of the existence of genetic differences between parents. ANOVA of combining ability showed the crucial importance of the values for GCA and SCA. This indicates the presence of both, additive and non-additive components in the inheritance of grain weight per plant (Table 2). These results are consistent with those quoted by Kamaluddin et al. (2007), Petrovic and Dimitrijevic (2009).

The value of the component of additive variance (D= 43.43) is greater than that of the dominant (H_1= 10.76 and H_2= 9.44), indicating that genetic variance of the mass of grains per plant depends mainly on the effects of genes with additive effects. The value of H_1 is greater than that of H_2, which indicates that positive and negative alleles on these loci are not in equal proportions in the parents. This is reflected in the correlation $u \neq v$, where are the values of the dominant frequency (u=0.63) and frequency of the recessive genes (v=0.37). The positive value of F (interaction of additive x dominant effects) F = 9.28, showing greater influence of the dominant gene to the recessive, which is consistent with the value of the frequencies of dominant and recessive genes. The unequal distribution of dominant and recessive alleles is similarly showed by the amount of $H_2/4H_1$ = 0.22. The value obtained from the average degree of dominance $(H_1/D)^{0.5}$ = 0.50 shows a partial degree of dominance in the inheritance of grain weight per plant. The ratio of the total number of dominant and recessive alleles is K_D/K_R= 1.55, which indicates that the greater influence of dominant genes in the inheritance of the property studied (Table 3).

The position of the points of the chart shows that the local population *V. nudum* L., contains the most recessive genes, taking into account the maximum values of Wr and Vr. Minimum values of Wr and Vr for Karatay 94 indicate that the relative number of dominant genes is greater than that of recessive seen for this property in this genotype.

In other two parents is visible more the balance between dominant and recessive genes. Regression line intersects the ordinate above, a=5.31, which demonstrates superiority of the partial dominance in the inheritance of grain weight per plant in this study (Figure 1).

The results obtained by the method of Hayman are fully consistent with the data obtained by the method of Griffing (Table 4). It should be borne in mind that the analysis was conducted with genetically quite distant from each other parents, which is marked by the distribution of scores of parents in the diagram. To obtain more complete results for analysis, it's necessary for study of a larger number of parents and crosses in several agro-ecological environments and different years (Petrovic and Dimitrijevic, 2009). Such statement

Table 1
Data on 4x4 full diallel for barley grain yield, g

Genotype	Bulbul 89	*V. nudum* L.	Karatay 94	*H. spontaneum* Koch.
Bulbul 89	**17.62**	10.57	14.70	14.83
V. nudum L.	10.38	**4.71**	18.33	7.37
Karatay 94	15.96	12.18	**19.81**	17.48
H. spontaneum Koch.	14.99	9.20	16.76	**14.36**

$LSD_{0.05} = 3.26$

$LSD_{0.01} = 4.36$

Table 2
Combining ability analysis of grain weight per plant in barley crosses

Sources	Degree of freedom	Sum of squares	Mean of squares	F	F(0.05)	F(0.01)
Replication	3	26.39	8.80	2.44	8.58	26.37
Genotip	15	1081.80	72.12	19.99**	2.18	3.09
Error	45	162.29	3.61	-	-	-
GCA	3	216.13	72.04	79.90**	8.58	26.37
SCA	6	34.06	5.68	6.30*	3.75	7.10
Res.	6	21.06	3.51	3.89*	3.75	7.10
Error	45	40.57	0.90	-	-	-

Table 3
Estimation of components of variation (Hayman's analysis)

Components	Values
D	43.43
F	9.28
E	0.98
H_1	10.76
H_2	9.44
$(H_1/D)^{0.5}$	0.5
$H_2/4H_1$	0.22
u	0.63
v	0.37
K_D/K_R	1.55

Table 4
Estimation of components of variation (Griffing's Analysis)

Components	Values
D	35.58
H	4.77
E	0.98
$(H/D)^{0,5}$	0.37
H^2	0.96
h^2	0.72
v^2GCA/v^2SCA	1.86

is interpreted in the experiments and results cited by Singh et al. (2004), based on a study of 10 diallel parents, F_1 and F_2 generations.

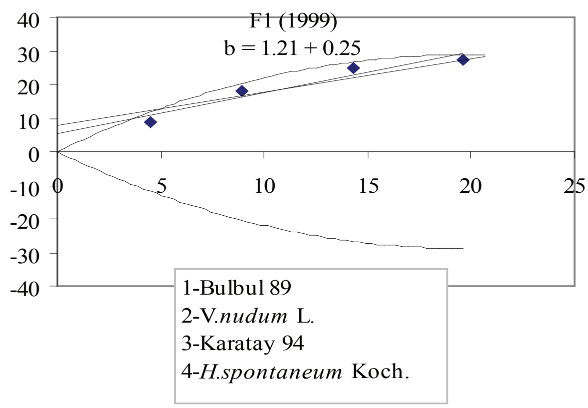

Fig. 1. Regresion analysis VrWr of grain weight per plant in barley crosses

Conclusions

The results of the analysis (Griffing and Hayman) show a complex system of inheritance of grain weight per plant in diallel crosses. This is due to parental divergence and complexity of inheritance system for the trait in the study. The V. *nudum* L. held predominant number of recessive genes, while variety Karatay 94 harboured more dominant genes for the trait in this study.

References

Borojevic, S. and T. Misic, 1987. Sorta kao faktor unapredenja poljoprivredne proizvodnje Jugoslovensko savetovanje, Uslovi i mogusnosti proizvodnje 6 miliona tona psenice, Novi Sad: 15-28.

Borojevic, S., 1990. Genetski napredak u povesanju prinosa psenice, VII Jugoslovenski simpozijum o nauțno-istrațivațkom radu na psenici, Novi Sad, *Savremena poljoprivreda*, **38**: 25-47 (Sr).

Griffing, B., 1956. Concept of general and specific combining ability in relation to diallel crossing systems, *Australian Journal of Biological Sciences*, **9**: 463.

Hayman, B. I., 1954. The theory and analysis of diallel crosses. *Genetics*, **39**: 251-271.

Kamaluddin, R., M. Singh, L. C. Prasad, M. Z. Abbin and A. K. Joshi, 2007. Combining ability analysis for grain filling duration and yield traits in spring wheat (*Triticum aestivum* L,em, Thell), *Genetics and Molecular Biology*, Brazil, **30 (**2): 411-416.

Mather, K. and J. L. Jinks, 1977. Introduction to biometrical genetics, *Cornell University Press*, Ithaca, New York.

Petrovic, S. and M. Dimitrijevic, 2009. Regresijska analiza mase zrna po biljci kod psenice, 44th Croatian and 4th International Symposium on Agriculture.

Singh, H., S. N. Sharma and R. S. Sain, 2004. Combinig ability for some quantitive characters in hexaploid wheat (*Triticum aestivum* L. Thell), 4th International Crop Science Congress, September, 2004, Brisbane, Australia, *Crop Science,* **28:** 1125-1127.

Received May, 23, 2011; accepted for printing October, 2, 2011.