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Interrelationships and path coefficient analysis for yield and component characters in barley [*Hordeum vulgare* (L.)]

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ABSTRACT

The study was conducted to estimate phenotypic and genotypic correlations and to partition phenotypic correlation coefficients into direct and indirect contributions of different component traits towards grain yield in barley from the data recorded on 49 diverse genotypes grown at the Punjab agricultural university, Regional Research Station, Bathinda during *rabi* 2004-05. Observations were recorded on grain yield per plant (g), days to spike, plant height (cm), tillers per plant, spike length (cm), grains per spike, 100 grain weight (g) and harvest index. Positive association of grain yield per plant was observed with grains per spike, harvest index, plant height and spike length whereas negative association with days to spike. Path coefficient analysis revealed that grains per spike had maximum positive direct effect followed by 100 grain weight and plant height upon grain yield whereas spike length had negative direct effect on grain yield. it was concluded that grain yield in barley may be improved by selection of early flowering/ maturing, tall genotypes with more number of grains per spike in the segregating populations.

Key words : Correlations, Path analysis, Barley, *Hordeum vulgare*.

INTRODUCTION

Barley is an important cereal crop grown in *rabi* season in the Punjab state. Besides providing feed and fodder it is also useful to the beer industry by the way of providing malt. Cultivation of barley can add to diversification from the conventional paddy-wheat cycle prevailing in the state. In order to encourage the farmers to shift from wheat to barley, development of high yielding varieties of barley is an important challenge to the breeders. Hybridization followed by selection of desirable types in the segregating generations has been widely used for varietal improvement in barley. Yield, however, is a complex character controlled by many component characters. These components are usually less susceptible to environmental fluctuations than yield *per se* and are thus relatively more amenable to improvement. The efficiency of selection in the segregating generations will increase if the nature and magnitude of interrelationships among component characters and grain yield is understood. Correlations provide the estimates of degree of association between characters whereas path analysis helps to resolve these correlations into direct and indirect contributions of different component characters towards yield and thus unravels the cause of apparent correlations. The present study was, therefore, undertaken to estimate correlations and path coefficients for important characters in barley.

MATERIALS AND METHODS

The experimental material comprising of 49 diverse genotypes of barley were grown in Randomized Block Design with three replications at the Punjab Agricultural University, Regional Research Station, Bathinda during *rabi* season 2004-05. All the genotypes were planted in two rows of 4 m length with spacing of 22.5 x 10 cm. Data on 5 randomly selected plants from each genotype in each replication were recorded on grain yield per plant (g), days to spike, plant height (cm), tillers per plant, spike length (cm), grains per spike, 100 grain weight (g) and harvest index. Analysis of variance for all characters was carried out to test the significance of difference among genotypes for different characters. Phenotypic as well as genotypic correlations between characters were worked out from the means of different characters following Panse and Sukhatme (1978). The significance of phenotypic correlations was tested against table values at n-2 degrees of freedom as given by Fisher and Yates (1938). Path coefficient analysis was performed according to Dewey and Lu (1959) using phenotypic correlation coefficients.

RESULTS AND DISCUSSION

Significant differences among genotypes were observed for all the characters studied. So all possible phenotypic and genotypic correlations between different characters were calculated which are presented in Table 1. Phenotypic and genotypic correlations observed between different characters are in complete agreement with each other. Significant positive association of grain yield per plant was observed with plant height (0.239), spike length (0.183), grains per spike (0.583) and harvest index (0.507). Hennaway (1997) also reported positive significant association of grain yield with grains per spike

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Table 1 : Phenotypic (above diagonal) and genotypic (below diagonal) correlations among different characters in barley

Character	Grain yield / plant	Days to spike	Plant height	Tillers / plant	Spike length	Grains / spike	100 grain weight	Harvest index
Grain yield / plant	1.000	-.0252**	0.239**	0.144	0.183**	0.583**	0.014	0.507**
Days to spike	-0.288	1.000	-0.061	-0.377**	-0.324**	0.003	-0.335**	-0.034
Plant height	0.258	-0.034	1.000	0.165*	0.433**	0.029	0.240**	-0.019
Tillers / plant	0.043	-0.542	0.183	1.000	0.330**	-0.461**	0.409**	-0.218**
Spike length	0.184	-0.495	0.621	0.545	1.000	-0.041	0.271**	-0.255**
Grains / spike	0.629	0.022	0.001	-0.639	-0.134	1.000	-0.526**	0.532**
100 grain weight	0.000	-0.395	0.214	0.615	0.423	-0.612**	1.000	-0.307**
Harvest index	0.619	-0.010	-0.126	-0.451	-0.392	0.743	-0.542	1.000

* and ** indicates significance of value at P=0.05 and P=0.01, respectively

and harvest index. Plant height appeared to be a desirable trait as it showed positive association with tillers per plant (0.165), spike length (0.433), and 100 grain weight (0.240). Tillers per plant too showed positive correlation with spike length (0.330) and 100 grain weight (0.409). The significant positive association of spike length with 100 grain weight (0.271) showed that longer spikes accommodated bold grains rather than having more number of grains. The significant positive association observed between grain per spike and harvest index (ratio of grain yield to the total biological yield) again indicated the importance of grains per spike in increasing grain yield in barley. Choo *et al*. (1980) also reported highest correlation of grains per spike to grain yield. The significant negative association of days to spike with tillers per plant (-0.377), spike length (-0.324) and 100 grain weight (-0.335) suggested that late maturing genotypes tend to have less number of tillers, reduced spike length and lighter (shriveled) grains. Significant negative correlation between tillers per plant and harvest index (-0.218) revealed that tillers contribute more to biological yield as compared to their contribution to grain yield. Significant negative association of 100 grain weight with harvest index (-0.307) showed that bold grains tend to reduce number of grains as indicated by the negative correlation between 100 grain weight and grains per spike. It, therefore, seems that selection for bold grains will not be desirable.

Portioning of phenotypic correlation coefficients of various component characters with grain yield into direct and indirect contributions (Table 2) revealed that grains per spike had the maximum (0.564) direct effect upon grain yield followed by 100 grain weight (0.321) and plant height (0.124). Tewari *et al*. (1980) also reported that grains per spike followed by 100 grain weight contributed directly to yield in barley. Maximum direct effect of number of grains per ear towards grain yield was also reported by Verma *et al*. (2007). The direct contributions of days to spike, spikes per plant and harvest index were negligible. Grains per spike also contribute to grain yield indirectly via harvest index (0.276). However, 100 grain weight rather has negative indirect effect upon grain yield via grains per spike (-0.659). Plant height along with its direct effect also contributes to grain yield to some extent via other traits. So it is concluded that grain yield in barley may be improved by selection of early flowering/ maturing, tall genotypes with more number of grains per spike in the segregating populations.

Table 2 : Path coefficient analysis for grain yield versus other characters in barley

Character	Days to spike	Plant height	Tillers / plant	Spike length	Grains / spike	100 grain weight	Harvest index	PCC* with grain yield / plant
Days to spike	-0.034	-0.008	-0.195	0.072	0.004	-0.107	0.016	-0.252
Plant height	0.002	0.124	0.085	-0.096	0.037	0.077	0.010	0.239
Tillers / plant	0.013	0.020	0.018	-0.073	-0.078	0.131	0.113	0.144
Spike length	0.011	0.054	0.171	-0.221	-0.052	0.087	0.132	0.183
Grains / spike	0.038	0.004	-0.139	0.009	0.564	-0.169	0.276	0.583
100 grain weight	0.010	0.030	0.212	-0.060	-0.659	0.321	0.160	0.014
Harvest index	0.001	-0.002	-0.113	0.056	0.667	-0.098	-0.004	0.507

Bold means direct effect * PCC stands for phenotypic correlation coefficient

Residual variation : 0.348

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