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Correlation and path analysis in wheat

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Abstract

Genotypic correlations were of higher magnitude compared to their corresponding phenotypic correlations for most of the character combinations. Grain yield per plant exhibited significant stable and positive association with biological yield per plant, 1000 grain weight, length of spike and plant height at genotypic and phenotypic level. This indicates that any selection based on these characters will enhance performance and improvement in wheat. Path analysis of phenotypic and genotypic exhibited high positive and direct effect of biological yield per plant followed by length of spike, days to maturity and harvest index on grain yield per plant. High indirect positive contribution of plant height and length of spike mainly via number of tillers per plant; plant height and number of grain per spike mainly via length of spike; biological yield per plant mainly via 1000 grain weight; days to maturity and plant height mainly via biological yield per plant; days to 50% flowering, plant height, days to maturity and 1000 grain weight mainly through harvest index. This indicates that effectiveness of selection for high grain yield could be enhanced by inclusion of biological yield per plant, days to maturity, 1000 grain weight, length of spike, plant height, number of grains per spike and harvest index as a selection criterion.

Key Words: *Triticum aestivum*, correlation and path coefficient

Introduction

In India, wheat is the second most important cereal food crop after rice and accounts for 31.5% of the total food grain basket of the country. India is the second largest wheat producing country in the world after China. The majority of wheat grown in India is represented by hexaploid spring type belonging to Triticum aestivum L. Em. Thell 2x=6x=42 (Nagarajan *et al.* 2007). Yield comprises number of characters. Information on component traits with yield and their contribution through direct and indirect effects are very important to evaluate the relative influence of agronomic character. The relative contribution both direct and indirect to yield of each trait, the interaction between them and also linkage among them can be examined by the path coefficient analysis. Such analysis has been employed to assess importance of various yield components by Sharma and Singh (2009). In the present investigation, an attempt was made to analyze the grain yield and its contributing traits of wheat varieties by the path coefficient analysis.

Materials and Methods

Fifty diverse accessions of wheat were evaluated for grain yield and its component traits in randomized block design with three replications during *rabi* 2010-2011 at crop research centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.). Each plot consisted of four rows of five meter length with row to row and plant to plant spacing of 23 and 10 cm, respectively. Observations were recorded on five competitive plants for days to 50% flowering, plant height, number of tillers per plant, duration of reproductive phase, days to maturity, length of spike, number of grains per spike, 1000 grain weight, biological yield per plant, grain yield per plant and harvest index. The Correlation coefficients were calculated as per the methods suggested by Searle (1961) and path coefficient were worked out as per the method of Dewey and Lu (1959).

Results and Discussion

In the present investigation, the correlation coefficients were estimated among eleven characters at phenotypic and genotypic levels. The genotypic correlation coefficient was, in general observed to be higher than that of phenotypic correlation coefficient, indicating the existence of strong inherent association for the various characters studied however, the phenotypic expression of the correlation was influenced by the environmental factors. Grain yield showed

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Table: 1: Estimates of correlation coefficient for genotypic (G) and phenotypic (P) levels among different characters in wheat

Characters		Days to 50% Flowering	Plant height(cm)	No. of tillers/plant	Duration of reproductive phase	Days to maturity	Length of spike(cm)	No. of grains/spike	1000 grain weight(g)	Biological yield/Plant (g)	Grain yield/ Plant(g)	Harvest index(%)
Days to 50% flowering	G	1.000	0.129	0.057	-0.110	-0.100	0.121	-0.155	0.417**	-0.134	0.110	0.210
	P	1.000	0.078	0.032	-0.086	-0.048	0.082	-0.112	0.451**	-0.103	0.197	0.206
Plant height (cm)	G		1.000	0.360**	-0.068	0.243	0.435**	0.178	0.119	0.266	0.382**	0.342**
	P		1.000	0.380**	-0.059	0.214	0.389**	0.168	0.094	0.262	0.370**	0.326**
No. of tillers per plant	G			1.000	-0.150	-0.061	0.052	0.386**	0.372**	0.095	0.196	0.010
	P			1.000	-0.145	0.069	0.042	o.346*	0.396**	0.092	0.192	0.013
Duration of reproductive phase	G				1.000	0.216	-0.038	0.234	0.031	-0.096	-0.109	-0.023
	P				1.000	0.019	-0.001	0.192	0.023	-0.075	-0.083	-0.010
Days to maturity	G					1.000	0.638**	0.275	0.411**	0.687**	0.214	0.231
	P					1.000	0.668**	0.077	0.444**	0.670**	0.218	0.295
Length of spike(cm)	G						1.000	0.385**	0.365**	-0.122	0.435**	0.423**
	P						1.000	0.372**	0.375**	-0.123	0.529**	0.399**
No. of grains per spike	G							1.000	-0.205	0.686*	0.445**	-0.318
	P							1.000	-0.150	0.679**	0.510**	-0.280
1000 grainweight (g)	G								1.000	-0.105	0.680**	0.454**
	P								1.000	-0.082	0.618**	0.449**
Biological yield per plant (g)	G									1.000	0.778**	-0.198
	P									1.000	0.738**	-0.203
Grain yield perplant (g)	G										1.000	0.560**
	P										1.000	0.503**
Harvestindex (%)	G											1.000
	P											1.000

**significant at 1% and 5% level, respectively.

Table 2: Path coefficient analyses showing the direct and indirect effect of 11 characters on the grain yield at genotypic and phenotypic level of wheat

Characters with		Days to 50% Flowering	Plant height(cm)	No. of tillers/plant	Duration of reproductive phase	Days to maturity	Length of spike(cm)	No. of grains/spike	1000 grain weight(g)	Biological yield/Plant (g)	Harvest index (%)	Correlation Grain yield (g)
Days to 50% flowering	G	**0.029**	-0.002	0.060	0.050	-0.002	0.008	0.009	-0.017	-0.121	0.207	0.110
	P	**0.007**	-0.002	0.006	0.030	0.000	0.003	0.003	-0.001	-0.091	0.376	0.197
Plant height (cm)	G	0.004	**-0.017**	0.213	0.0070	-0.007	0.329	-0.010	-0.005	0.240	0.347	0.382**
	P	0.001	**-0.021**	0.305	0.0040	-0.001	0.314	-0.005	-0.001	0.232	0.352	0.370**
No. of tillers per plant	G	0.002	-0.001	**-0.005**	0.021	-0.001	0.003	0.017	-0.011	0.085	0.006	0.196
	P	0.006	-0.001	**-0.009**	0.011	0.001	0.002	0.009	-0.001	0.081	0.009	0.192
Duration of reproductive phase	G	-0.003	0.001	0.001	**-0.004**	0.014	-0.003	-0.013	-0.001	-0.080	-0.014	-0.109
	P	-0.001	0.001	0.001	**-0.006**	0.000	0.000	-0.006	0.000	-0.066	-0.007	-0.083
Days to maturity	G	-0.003	0.006	0.006	-0.031	**0.621**	-0.043	-0.015	-0.017	0.619	0.325	0.214
	P	0.006	0.002	-0.001	0.016	**0.608**	0.002	-0.002	0.000	0.450	0.064	0.218
Length of spike(cm)	G	0.004	-0.007	0.315	0.082	-0.013	**0.667**	-0.016	-0.011	-0.110	0.121	0.435**
	P	0.001	-0.008	0.326	0.063	-0.001	**0.636**	-0.008	-0.001	-0.109	0.121	0.529**
No. of grains per spike	G	-0.005	-0.003	0.001	-0.061	0.006	0.519	**-0.056**	0.149	0.077	-0.193	0.445**
	P	-0.001	-0.004	0.003	-0.037	0.001	0.410	**-0.031**	0.131	0.070	-0.188	0.510**
1000 grain weight (g)	G	0.012	-0.002	-0.001	0.046	0.008	0.018	0.011	**-0.042**	-0.095	0.270	0.680**
	P	0.001	-0.002	-0.002	0.021	0.000	0.006	0.005	**-0.005**	-0.073	0.387	0.618**
Biological yield per plant (g)	G	-0.004	-0.004	0.003	0.048	0.014	-0.008	0.005	0.513	**0.902**	-0.120	0.778**
	P	-0.001	-0.006	-0.001	0.032	0.001	-0.004	-0.002	0.440	**0.885**	-0.136	0.738**
Harvest index (%)	G	0.010	-0.004	0.005	0.000	0.011	0.013	0.018	-0.019	-0.178	**0.609**	0.460**
	P	0.002	-0.005	0.004	0.000	0.001	0.006	0.009	-0.002	-0.179	**0.671**	0.503**

Residual values (G) = 0.03, Residual values (P) = 0.06
Bold values indicate direct effects

significant stable positive association with biological yield per plant (0.778, 0.738), 1000 grain weight (0.680, 0.618), length of spike (0.435, 0.529), number of grains per spike (0.445, 0.510) and plant height (0.382, 0.370) at genotypic and phenotypic level (Table 1). Thus, it can be inferred that selection based on any one of these traits either alone or in combination, will result in identifying high grain yielding strains. Similar findings for most of these characters have been reported by Yousaf *et al.* (2008), Sharma and Singh (2009) and Koul and Singh (2011). When interrelationships of different characters were monitored it was observed that Positive association of grain yield per plant with 1000 grain weight is in line with Khokhar *et al.* (2010) and Koul and Singh (2011). Positive correlation of grain yield per plant with number of grains per spike is in confirmation of the findings of Yousaf *et al.* (2008) and Koul and Singh (2011). Positive association grain yield per plant with length of spike was in agreement with this finding of Yousaf *et al.* (2008) and Khokhar *et al.* (2010). Positive correlation grain yield per plant with plant height was consonance with the findings of Sharma and Singh (2009), Khokhar *et al.* (2010) and Koul and Singh (2011). Selection for these traits could definitely be yielded towards productivity as they exhibited correlated response with grain yield. Negative but non significant correlation of grain yield with duration of reproductive phase (-0.109, -0.083) was obtained. Positive but non significant correlation of grain yield with days to 50% flowering (0.110, 0.197), number of tillers per plant (0.196, 0.192) and days to maturity (0.214, 0.218) were found. These findings are similar in agreement with earlier reported by Nagarajan et al. (2007), Yousaf et al. (2008) and Mohsin et al. (2009).

Results on the phenotypic and genotypic path coefficient exhibited high positive direct contribution of biological yield per plant (0.902, 0.885), length of spike (0.667, 0.636), days to maturity (0.621, 0.608) and harvest index (0.609, 0.671) towards grain yield (Table 2). The direct contribution of biological yield per plant, length of spike, days to maturity and harvest index with grain yield per plant observed in this study is also in confirmation with the findings of Mohsin *et al.*, (2009) and Khokhar *et al.*, (2010). High indirect positive contribution of length of spike mainly via number of tillers per plant (0.315, 0.326), number of grains per spike mainly via length of spike (0.519, 0.410), biological yield per plant mainly via 1000 grain weight (0.513, 0.440), days to maturity mainly via biological yield per plant (0.619, 0.450) and plant height mainly through harvest index (0.347, 0.352) was also observed which is in line with Dokuyuca and Akkaya, (1999), Sharma and Singh (2009) and Mohsin *et al.*, 2009. The contribution of residual effects that influenced grain yield was low at phenotypic level and genotypic level. From the results of path analysis, it appears that traits like plant height, biological yield per plant, length of spike, days to maturity, 1000 grain weight, number of grains per spike and harvest index are the most cordial components will ultimately increase the crop yield.

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