CorrelationandPathCoefficientAnalysisinWheat(*Triticumaestivum*L.)

Abstract

The present investigation was conducted by taking 137 genotype of bread wheatwith4checksinRandomizeBlockDesignforthe studyofcorrelationandpathcoefficient analysis.The observations were recorded on 13quantitative characters.The grain yieldper plant exhibited highly significant and positive correlationwith biologicalyieldperplant(0.31) followed by harvest index(0.18)and 1000-grain weight (0.11).Thehighestpositivedirect effect on grainyieldperplantwasexertedbybiologicalyieldperplant(0.30)followedby1000-grain weight (0.16), harvest-index(0.13),tillersperplant(0.10), grains per spike(0.08),days to maturity(0.02) and peduncle length (0.01).Thus, biological yield per plant, harvest index and 1000-grain weightcan be utilized for selection of elite genotypes with better grain yield.

Keywords: Wheat (*Triticum aestivum*),Correlation Coefficient, Path Coefficient, Grain yield and Harvest Index.

Introduction

The greatest cereal crop in the world, wheat (*Triticum aestivum* L. em. Thell), is a member of the Gramineae family and the genus Triticum. Because of its large acreage, excellent productivity, and significant role in the global food grain trade, it has been referred to as the "King of cereals". There are many different ways to eat wheat, including bread, chapatti, porridge, flour, suji, and more. India is the world's second-largest consumer and producer after China. In India, the wheat crop covered 31.12 million hectares area during 2020-21, with 109.59 million tonnes of output and an average productivity of 35.21 q/ha. (**Anonymous, 2022-23**).As a complex character, yield is influenced by a number of auxiliary characters and the environment in which they exist. Examining the relationships between the different characters that make up the yield is part of probing the structure of the yield. In this sense, selection to simultaneously increase yield and yield-attributing characters is aided by genotypic and phenotypic correlation, which indicates the degree of association between various characters. In order to evaluate the relative contributions of each component character to the yield, path coefficient analysis additionally aids in the partitioning of correlation coefficients into direct and indirect effects. The current investigation has been conducted while keeping the aforementioned points in mind.

MaterialandMethods

At the Main Experimental Station Research Farm of PiliKothi farm, Tilak Dhari Post Graduate College Jaunpur (U.P.), a field experiment was conducted during Rabi 2019–20. The purpose of the experiment was to assess the 137 wheat germplasm lines in the Randimized Block Design against four checks (UP-2338, PBW-550, NW-1067, and NW-

5054). Thirteen characters were used to record the observations: days to 50% flowering, days to maturity, plant height (cm), number of tillers per plant, flag leaf area (cm), amount of chlorophyll (mg/100g), length of spike, peduncle length (cm), number of grains per spike, 1000-grain weight, biological yield per plant (g), harvest index, and number of grains per plant (g). The correlation and path coefficients for the data on the aforementioned characters were estimated using the methods of Searle (1961) and Dewey and Lu (1959) respectively.

ResultandDiscussion

In most crops, the grain yield, also known as the economic yield, is a complex characteristic that results from the multiplicative interaction of a number of other characteristics known as yield components. The balance or overall net effect created by different yield components, either directly or indirectly through their interactions with one another, forms the basis of the genetic architecture of grain yield in wheat and other crops. Selection for yield by itself would therefore not be very important unless it were combined with selection for the different component characters that condition it. Therefore, identifying key component traits and learning more about how they relate to yield as well as to one another can be very helpful in creating effective breeding strategies for the evolution of high-yielding varieties. The degree of linear association between two variables or characters is measured by the correlation coefficient, which aids in our comprehension of the type and strength of the relationship between yield and yield components. Simple correlation coefficients between the 13 quantitative characters used in the current study were calculated and are shown in **Table 1**. Following the harvest index (0.18) and 1000-grain weight (0.11), the grain yield per plant showed a highly significant and positive correlation with the biological yield per plant (0.31). Previous researchers (**Khan *et al.*, 2002; Sharma*et al.*, 2006; Sharma and Singh; 2009; Anwar *et al.*, 2009; Deepti Bist 2009; Singh *et al.*, 2010; Khokhar *et al.*, 2010; Singh *et al.*, 2012; Potdukhe *et al.*, 2013; Kumar *et al.*, 2014; Dutamo*et al.*, 2015; Singh *et al.*, 2017**) have also noted a strong positive association between grain yield and one or more of the aforementioned traits. The aforementioned discussion demonstrated that there was a significant and positive correlation between grain yield per plant and the key yield components, such as biological yield per plant, harvest index, and 1000-grain. This shows that elite genotypes with higher yields can be selected using these characters.

In order to separate the observed correlation coefficients into the direct and indirect effects of independent variables on the dependent variable, Sewall Wright (1921) developed the concept of path-coefficient analysis. Path analysis is not the same as simple correlation; the former measures only the mutual association, ignoring the causation, while the latter highlights the causes and their relative importance. In order to determine the relative importance of various yield-contributing characters, path analysis has become a potent and popular technique for understanding the direct and indirect

contributions of different characters to economic yield in crop plants. **Table 2** presents the findings of a path-coefficient analysis among 13 quantitative characters using simple correlation coefficients. The plant's biological yield (0.30) had the largest positive direct impact on grain yield per plant, followed by the weight of 1000 grains (0.16), harvest index (0.13), tillers per plant (0.10), grains per spike (0.08), days to maturity (0.02), and peduncle length (0.01). **Singh and Sharma, 2007; Khan *et al.*, 2008; Anwar *et al.*, 2009; Kumar *et al.*, 2014; Dutamo*et al.*, 2015; Singh *et al.*, 2017; Sharma*et al.*, 2006**also reported the similar findings.The direct effects of the remaining characters were determined to be insignificant enough to warrant consideration.

Compared to most previous reports in wheat, the current study found that a smaller percentage of the direct and indirect effects of various characters achieved high order values. The majority of the direct and indirect effect estimates were deemed too low to have any meaningful impact. This could be explained by the extremely high levels of genetic diversity and variability found in a sizable number of native varieties/lines. Different kinds of character associations in different lines may have resulted from the existence of different character combinations in various varieties/lines. Therefore, the existence of multiple opposing character associations and interrelationships may have caused opposing associations to cancel each other out, lowering the overall impact or effect. In the current investigation, harvest index, 1000-grain weight, and biological yield per plant were found to be significant direct yield contributing variables through correlation and path coefficient analysis. The findings of **Sharma *et al.* (2006), Anwar *et al.* (2009), Singh *et al.* (2010), Singh *et al.* (2012), Potdukhe *et al.* (2013), Kumar *et al.* (2014), Dutamo*et al.* (2015), and Singh *et al.*(2017)** are comparable to these results. The aforementioned characters were worthy of consideration when formulating a selection strategy intended to produce high-yielding wheat varieties.

Table 1: Estimates of phenotypic and genotypic correlation coefficients among different characters in wheat

Characters		Days to flowering	Days to maturity	Plant height (cm)	Tillers per plant	Flag leaf area (cm)	Chlorophyll content (mg/100g)	Spike length (cm)	Peduncle length (cm)	Grains per spike	1000-grain weight (g)	Biological yield per plant (g)	Harvest index(%)	Grain yield per plant (g)
Days to flowering	**G**	**1.000**	1.147**	0.655**	0.108*	-0.026	0.591**	0.766**	0.849**	-1.621**	-0.288**	0.180**	-0.035	-1.023**
	P	**1.000**	0.186**	-0.022	0.024	0.018	-0.008	0.070	0.056	-0.018	-0.009	0.036	-0.022	-0.052
Days to maturity	**G**		**1.000**	-0.023	0.229**	-0.698**	-0.172**	1.146**	2.694**	0.477**	0.362**	-0.117**	-0.125**	-0.645**
	P		**1.000**	-0.051	0.001	-0.092	0.024	0.003	-0.002	-0.007	-0.006	-0.006	-0.096*	0.003
Plant height (cm)	**G**			**1.000**	-0.072	0.291**	0.455**	-0.089	0.005	-0.655**	-0.460**	0.646**	0.164**	0.015
	P			**1.000**	0.038	0.120*	-0.017	-0.034	-0.026	-0.028	-0.198**	0.232**	0.073	0.026
Tillers per	**G**				**1.000**	0.509**	-0.305**	0.010	0.382**	0.109*	0.025	0.199**	0.125*	0.109*

plant	**P**				**1.000**	0.096*	-0.002	-0.002	0.044	0.053	-0.002	0.034	0.006	0.113*
Flag leaf area (cm)	**G**					**1.000**	1.180**	0.093	-0.665**	1.199**	-0.092*	-0.076	-0.212**	0.117*
	P					**1.000**	0.027	0.008	0.031	0.049	-0.097	-0.011	-0.005	-0.070
Chlorophyll content (mg/100g)	**G**						**1.000**	1.375**	3.260**	-2.423**	-0.791**	-0.001	-0.599**	-0.262**
	P						**1.000**	0.021	0.070	0.036	0.082	0.013	-0.012	-0.102*
Spike length (cm)	**G**							**1.000**	0.605**	1.158**	0.437*	-0.217**	-0.819**	-0.058
	P							**1.000**	-0.012	-0.003	0.017	-0.061	-0.108*	-0.108*
Peduncle length (cm)	**G**								**1.000**	2.782**	1.340**	0.247**	-0.814**	0.488**
	P								**1.000**	-0.032	0.050	-0.040	-0.033	0.000
Grains per spike	**G**									**1.000**	-0.085	-0.657**	0.914**	0.609**
	P									**1.000**	0.012	-0.003	0.037	0.093*
1000-grain weight (g)	**G**										**1.000**	-0.301**	-0.318**	0.278**
	P										**1.000**	-0.087	-0.188**	0.116*
Biological yield per plant (g)	**G**											**1.000**	0.269**	0.343**
	P											**1.000**	0.238**	0.318**
Harvest index(%)	**G**												**1.000**	0.347**
	P												**1.000**	0.187**

Table 2: Estimates of direct and indirect effect of different characters on grain yield per plant at phenotypic and genotypic level in wheat

Characters		Days to 50% flowering	Days to maturity	Plant height (cm)	Tillers per plant	Flag leaf area (cm)	Chlorophyll content (mg/100g)	Spike length (cm)	Peduncle length (cm	Grains per spike	1000-grain weight (g)	Biological yield per plant	Harvest index (%)	Grain yield per plant (g)
Days to 50% flowering	**G**	**0.130**	0.055	-0.547	-0.079	-0.022	-0.023	-0.404	0.121	-0.349	-0.116	0.211	-0.001	-1.023**
	P	**-0.0603**	0.0053	0.0004	0.0025	-0.0010	0.0009	-0.0049	0.0010	-0.0016	-0.0016	0.0108	-0.0031	-0.052
Days to maturity	**G**	0.149	**0.048**	0.019	-0.169	-0.585	0.007	-0.604	0.384	0.103	0.145	-0.138	-0.005	-0.645**
	P	-0.0112	**0.0282**	0.0010	0.0001	0.0051	-0.0029	-0.0002	0.0000	-0.0006	-0.0010	-0.0018	-0.0132	0.003
Plant height (cm)	**G**	0.085	-0.001	**-0.836**	0.053	0.244	-0.018	0.047	0.001	-0.141	-0.185	0.759	0.006	0.015
	P	0.0013	-0.0014	**-0.0194**	0.0040	-0.0066	0.0020	0.0024	-0.0005	-0.0024	-0.0332	0.0699	0.0100	0.026
Tillers per plant	**G**	0.014	0.011	0.060	**-0.736**	0.426	0.012	-0.005	0.054	0.023	0.010	0.234	0.005	0.109*
	P	-0.0014	0.0000	-0.0007	**0.1042**	-0.0053	0.0002	0.0002	0.0008	0.0046	-0.0003	0.0101	0.0008	0.113*
Flag leaf area (cm)	**G**	-0.003	-0.033	-0.243	-0.374	**0.838**	-0.046	-0.049	-0.095	0.258	-0.037	-0.089	-0.008	0.117*
	P	-0.0011	-0.0026	-0.0023	0.0100	**-0.0551**	-0.0033	-0.0005	0.0006	0.0042	-0.0162	-0.0032	-0.0007	-0.070
Chlorophyll content (mg/100g)	**G**	0.077	-0.008	-0.381	0.224	0.989	**-0.039**	-0.725	0.465	-0.521	-0.318	-0.001	-0.024	-0.262**
	P	0.0005	0.0007	0.0003	-0.0002	-0.0015	**-0.1208**	-0.0015	0.0013	0.0031	0.0138	0.0040	-0.0016	-0.102*
Spike length (cm)	**G**	0.100	0.055	0.075	-0.008	0.078	-0.054	**-0.527**	0.086	0.249	0.176	-0.256	-0.032	-0.058

	P	-0.0042	0.0001	0.0007	-0.0002	-0.0004	-0.0026	**-0.0705**	-0.0002	-0.0002	0.0029	-0.0184	-0.0148	-0.108*
Peduncle length (cm)	**G**	0.111	0.129	-0.004	-0.281	-0.557	-0.128	-0.319	**0.143**	0.598	0.539	0.290	-0.032	0.488**
	P	-0.0034	-0.0001	0.0005	0.0046	-0.0017	-0.0085	0.0008	**0.0187**	-0.0028	0.0084	-0.0119	-0.0046	0.000
Grains per spike	**G**	-0.211	0.023	0.548	-0.080	1.005	0.095	-0.610	0.397	**0.215**	-0.034	-0.772	0.036	0.609**
	P	0.0011	-0.0002	0.0005	0.0055	-0.0027	-0.0043	0.0002	-0.0006	**0.0871**	0.0020	-0.0007	0.0050	0.093*
1000-grain weight (g)	**G**	-0.038	0.017	0.385	-0.018	-0.077	0.031	-0.230	0.191	-0.018	**0.402**	-0.354	-0.013	0.278**
	P	0.0006	-0.0002	0.0038	-0.0002	0.0053	-0.0099	-0.0012	0.0009	0.0010	**0.1680**	-0.0262	-0.0258	0.116*
Biological yield per plant	**G**	0.023	-0.006	-0.539	-0.147	-0.064	0.000	0.115	0.035	-0.141	-0.121	**1.176**	0.011	0.343**
	P	-0.0022	-0.0002	-0.0045	0.0035	0.0006	-0.0016	0.0043	-0.0007	-0.0002	-0.0146	**0.3013**	0.0327	0.318**
Harvest index (%)	**G**	-0.005	-0.006	-0.137	-0.092	-0.178	0.024	0.432	-0.116	0.196	-0.128	0.317	**0.039**	0.347**
	P	0.0013	-0.0027	-0.0014	0.0006	0.0003	0.0014	0.0076	-0.0006	0.0032	-0.0315	0.0717	**0.1373**	0.187**

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