Research Article

CORRELATION ANALYSIS FOR DIFFERENT PARAMETERS OF F₂ BREAD WHEAT POPULATION

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Abstract

This study was conducted at Plant Breeding and Genetics Research Farm The University of Agriculture, Peshawar during the crop season of 2010-11 to estimate correlation coefficients for various parameters of 20 wheat genotypes. Randomized complete block design (RCBD) was used with three replications. The genotypes included six parents and their fourteen F₂ crosses. Included parameters were plant height, days to maturity, grains spike⁻¹, spike weight, spikelet spike⁻¹ and grain yield plant⁻¹. Differences among the genotypes were highly significant for plant height and significant for days to maturity and spikelet spike⁻¹ while non-significant for grains spike⁻¹, spike weight, and grain yield plant⁻¹. Mean values for genotypes ranged between 65.07 to 88.93 cm for plant height, 166.3 to 171.0 for days to maturity, 53.3 to 70.4 for grains spike⁻¹, 2.89 to 4.42 g for spike weight, 18.7 to 21.9 for spikelet spike⁻¹ and 8.23 to 18.93 g for grain yield plant⁻¹. Grain yield plant⁻¹ was positive and highly significantly correlated with plant height, spike weight and grains spike⁻¹ while negative and highly significantly correlated with days to maturity. PS 2004 × PS 2005 could be used in further breeding programs as it had maximum grain yield plant⁻¹ and showed better performance for other parameters.

Keywords: Correlation; Analysis; F₂ Wheat population

Introduction

Wheat (*Triticum aestivum* L.) is the staple food for most of the world population including Pakistan [1]. Increased agricultural productivity occurred largely due to the development of high-yielding cultivars and increased fertilizer use. With the introduction of semi-dwarf wheat cultivars, wheat productivity has been increased in all the major cropping systems representing the diverse and varying agro-ecological conditions. Breeders can be enhanced wheat production through development of improved genotypes capable of producing better yield under various agro climatic conditions. Selection for grain yield can only be effective if desired genetic variability is present in the genetic stock. Plant breeders are interested in development of new varieties which are having high yield potential and therefore, the identification and use of genotypes with better genetic potential is a continuous prerequisite for synthesis of physiologically efficient and genetically superior genotypes [2].

Grain yield is a complex quantitative trait and highly influenced by genetic and environmental factors. Direct selection for this trait could be misleading so for successful selection information on the genetic variability and correlation of morpho-agronomic traits with grain yield are helpful. Correlation studies provide a better understanding of the association of different characters with grain yield. The study of associations among various traits is useful to breeders in selecting genotypes possessing groups of desired traits [3]. The present study was conducted to

estimate correlations coefficients for important parameters of F₂ wheat population.

Materials and Methods

This study was conducted at Plant Breeding and Genetics Research Farm, The University Of Agriculture, Peshawar during 2010-11. The experimental material comprised 20 wheat genotypes including six parents and their fourteen F₂ crosses (Table I). A randomized complete block design with 3 replications was used. Each entry consisted of 4 rows with row length of 3 meter. Row to row distance was maintained 30 cm. Standard cultural practices were carried throughout the growing season.

Results and Discussion

Data collected for different characters were analyzed using standard ANOVA procedure and are presented in the following paragraphs.

Analysis of variance showed highly significant differences among the genotypes for plant height (Table II). Plant height ranged from 65.07 to 88.93 cm (Table III). Maximum (88.93 cm) plant height was recorded for cross PS-2004 × PS-2005 while minimum (65.07 cm) for parent G-98. Plant height had positive and highly significant correlation with grain yield plant⁻¹ ($r = 0.453$) and spike weight

($r = 0.453$) (Table IV). In accordance to our study Lad et al. (2003) reported positive significant correlation of plant height with grain yield. Similarly positive and significant correlation between plant height and grain yield was also reported

Table I. List of genotypes included in the study.

S.No.	Treatments/Genotypes	S.No.	Treatments/Genotypes
1	Agricultural University Peshawar-4006 (AUP-4006)	11	PS 2004 × AUP-4606
2	Pirsabak 2005 (PS 2005)	12	PS 2004 × PS 2005
3	Ghaznavi-98 (G-98)	13	AUP-4606 × PS 2005
4	Agricultural University Peshawar-4606 (AUP-4606)	14	G-98 × PS 2005
5	Pirsabak 2004 (PS 2004)	15	AUP-4606 × AUP-4006
6	Fakhre Sarhad (FS)	16	AUP-4006 × PS 2005
7	G-98 × AUP 4606	17	AUP-4606 × G-98
8	PS2004 × G-98	18	PS 2005 × AUP-4006
9	AUP-4006 × PS 2004	19	PS 2005 × G-98
10	AUP-4006 × AUP-4606	20	PS 2005 × PS 2004

Data were recorded on plant height (cm), spike weight (g), grains spike⁻¹, days to maturity, spikelets spike⁻¹ and grain yield plant⁻¹ (g). Simple correlation among various traits were computed by the following formula.

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2} \sqrt{n(\sum y^2) - (\sum y)^2}}$$

Steel and Torrie [13]

Table 2. Mean squares for plant height, days to maturity, spikelets spike⁻¹, spike weight, grain spike⁻¹, and grain yield plant⁻¹.

Source of variation	d.f	Plant Height	Days to Maturity	Spikelets Spike ⁻¹	Spike Weight	Grains Spike ⁻¹	Grain Plant ⁻¹	Yield
Replications	2	39.38	2.60	3.82	0.07	37.89	5.38	
Treatments	19	67.02**	4.40*	2.65*	0.50	64.97	26.19	
Error	38	13.60	2.27	1.22	0.38	57.39	16.79	
CV (%)		4.69	0.89	5.44	16.84	11.89	29.62	

* = significant, ** = highly significant

by Khokhar et al [4] and Saleem et al [5].

Analysis for days to maturity showed significant differences among wheat genotypes (Table II). Among the genotypes minimum (166) days to maturity was taken by genotype PS-2004 while maximum (171 days) by PS-2005 × AUP-4006 (Table III). Days to maturity ranged from 166 to 171 days. Days to maturity had negative and highly significant correlation ($r = -0.442$) with grain yield plant-1 (Table IV).

Analysis of variance showed significant differences among the genotypes for spikelets spike-1 (Table II). Mean values for spikelets spike-1 ranged from 18.7 to 21.9 (Table III). Maximum spikelets spike-1 (21.9) was observed for parent AUP-4006 and their cross with PS-2004 while minimum (18.7) was recorded for PS-2005. Spikelets spike-1 had positive highly significant correlation with grains spike-1 while non-significant with grain yield plant-1 (Table IV). Similar relationship between spikelets

spike⁻¹ and grains spike⁻¹ was also published by Ali et al [6] and Munir et al [7].

Analysis of variance showed non-significant differences among the genotypes for spike weight (Table II). Mean value for spike weight ranged from 2.89 to 4.42 g (Table III). The maximum (4.42 g) spike weight was observed for cross PS-2005 × AUP-4006 and minimum (2.89 g) for parent, G-98 (Table IV). Spike weight had positive highly significant correlation with grain yield plant-1 ($r = 0.362$), plant height ($r = 0.499$) and grains spike-1 ($r = 0.693$).

Analysis of variance for grains spike-1 showed non-significant differences among the genotypes (Table II). Mean value for grains spike-1 ranged from 55.3 to 70.4 (Table III). Maximum (70.4 grains spike-1) was recorded for cross PS 2005 × AUP-4006 while minimum (55.3 grains spike-1) for PS 2005 × PS 2004 (Table III). Grains spike-1 had positive and highly significant correlation with grain

yield plant-1 ($r = 0.380$), spikelets spike-1 ($r = 0.359$) and spike weight ($r = 0.693$). Aliu et al [8] Khorkut and Bilgin [9] Munir et al. [7] and Yildirim et al. [10] reported positive and significant correlation of grains spike-1 with grain yield plant-1.

Results revealed non-significant differences among wheat genotypes for grain yield plant-1 (Table II). Mean value for grain yield plant-1 ranged from 8.23 to 18.93 g (Table III). Maximum (18.93 g) grain yield plant-1 was observed for PS 2004 $\times$ PS 2005

while minimum (8.23 g) for PS 2005 $\times$ AUP-4006 (Table III). Grain yield plant-1 had positive and highly significant correlation with grains spike-1 ($r = 0.380$), spike weight ($r = 0.362$) and plant height ($r = 0.453$) while highly significant negative correlation with days to maturity ($r = -0.442$). In relation to our

study Anwar et al. [2] Khaliq et al. [11] and Lad et al. [12] also reported positive and significant correlation of grain yield plant-1 with grains spike-1 and spikelets spike-1.

PS-2004 $\times$ PS-2005 and PS-2005 $\times$ AUP-4006 were the best crosses identified showing better performance for maximum number of traits. Parents, like PS-2005, PS-2004, Ghaznavi-98 and AUP-4006 were the best parents involved in cross combinations. Therefore, use of parents like PS-2005, PS-2004, Ghaznavi-98 and AUP-4006 and cross combinations like PS-2004 $\times$ PS-2005 and PS-2005 $\times$ AUP-4006 would be more effective for evolving wheat genotypes for irrigated conditions.

Table 3. Mean values for plant height (cm), days to maturity, spikelets spike⁻¹, spike weight (g), grain spike⁻¹, and grain yield plant⁻¹ (g).

Genotypes	Plant height	Days to maturity	Spikelets spike ⁻¹	Spike weight	Grains spike ⁻¹	Grain yield Plant ⁻¹
AUP-4006	78.40	168.0	21.4	3.66	65.4	14.73
PS-2005	82.53	167.7	18.7	4.11	67.2	17.97
G-98	65.07	170.0	21.1	2.89	64.9	12.33
AUP-4606	74.97	169.7	21.9	3.69	66.5	10.83
PS-2004	77.13	166.3	20.6	3.61	64.7	15.73
Fakhre Sarhad	76.60	168.3	20.4	3.12	61.7	13.60
G-98 $\times$ AUP-4606	73.47	168.0	20.5	3.24	62.1	14.33
PS-2004 $\times$ G-98	79.93	167.0	19.0	3.44	59.2	11.63
AUP-4006 $\times$ PS-2004	78.47	168.3	21.9	3.38	61.7	15.67
AUP-4006 $\times$ AUP-4606	80.87	168.7	20.6	3.71	61.2	11.03
PS-2004 $\times$ AUP-4606	77.87	168.7	21.0	3.92	65.3	13.53
PS-2004 $\times$ PS-2005	88.93	167.0	19.7	4.24	69.9	18.93
AUP-4606 $\times$ PS-2005	82.80	168.3	20.7	4.36	68.3	15.33
G-98 $\times$ PS-2005	78.40	168.0	20.5	4.05	69.1	18.63
AUP-4606 $\times$ AUP-4006	83.07	170.0	19.7	3.84	65.5	12.27
AUP-4006 $\times$ PS-2005	79.67	170.3	20.2	3.62	57.9	10.10
AUP-4606 $\times$ G-98	78.20	168.3	19.9	3.59	64.2	16.97
PS-2005 $\times$ AUP-4006	77.93	171.0	21.2	4.42	70.4	8.23
PS-2005 $\times$ G-98	81.93	169.0	19.3	3.52	55.4	13.83
PS-2005 $\times$ PS-2004	74.67	167.3	18.9	3.29	53.3	11.03
LSD (5%)	2.36	0.96	0.71	0.40	4.85	2.62

Table 4. Correlation coefficients for plant height, days to maturity, spikelets spike⁻¹, spike weight, grain spike⁻¹, and grain yield plant⁻¹.

	Plant Height	Days maturity	to Spikelets spike ⁻¹	Spike weight	Grains spike ⁻¹	Grain yield plant ⁻¹
Plant height	--	-0.177	-0.111	0.499**	0.098	0.453**
Days to maturity	--	--	0.228	-0.014	0.0333	-0.442**
Spikelets spike ⁻¹	--	--	--	0.242	0.359**	0.158
Spike weight	--	--	--	--	0.693**	0.362**
Grains spike ⁻¹	--	--	--	--	--	0.380**

* = significant, ** = highly significant

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