

Correlation and path analysis for yield and yield contributing characters in wheat (*Triticum aestivum* L.)

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Abstract: Correlation coefficients were determined in fifteen wheat genotypes for plant height, days to heading, days to maturity, 1000-kernel weight, spike length, number of tillers per plant, number of spikelets per spike and grain yield per plant. The result revealed that grain yield per plant was positively and highly significantly correlated with days to maturity but negatively and highly significantly associated with plant height. Days to maturity had highest positive direct effect on yield.

Key words: *Triticum aestivum*, yield contributing characters, path analysis, correlation.

Introduction

Wheat (*Triticum aestivum* L.) is an imperative rabi crop and main stable food source for world population. In Pakistan, wheat is grown on 8578.1 thousands hectares with an average yield of 2716 kg/ha (MINFAL, 2007). This yield is far below than in most producing countries of the world due to water deficit conditions, high temperature and varying environmental conditions. Meeting this challenge will require efforts in multiple areas, one of which will be the development of high yielding varieties that are better adapted to a wide range of environments. Both genotype and the environment affect grain yield and yield components of wheat. For that purpose, effective plant selection characters that

are associated with yield are obligatory. Thus, a study on the correlation and direct and indirect effects of yield components provides the basis for a successful breeding plan (Choudhry *et al.* 1986). The objective of this study was to determine the correlation and path analysis of yield and yield contributing characters in bread wheat and to assess their suitability in a breeding plan.

Materials and Methods

The research was conducted in the research area of Wheat Research Institute, Ayub Agriculture Research Institute, Faisalabad (longitude 73° and 74° East, latitude 30° and 31.5° North, at an elevation of 605 feet above sea level) during two years (2007 and 2008) under normal irrigation condition. Fifteen wheat lines/varieties were planted in a randomized complete block design with three replications. The total plot size was 5 m x 1.06 m with PxP and RxR distance 9 cm and 30 cm, respectively. Throughout the season, appropriate control measures were utilized as needed for insect, pests and weed control; to raise healthy population.

At maturity ten guarded plants were randomly selected from each replication, and data were collected for plant height, days to heading, days to maturity, 1000-grain weight, spike length, number of productive tillers per plant, number of spikelets per spike, and grain yield per plant. The data were statistically analyzed by using method of Steel *et al.* (1997). Genotypic and phenotypic correlation coefficients were determined according to Kwon and Torrie (1964). Path coefficient was calculated by the technique of Deway and Lu (1959).

Result and Discussion

Correlation coefficients

The correlation between plant height and yield was observed to be negative and highly significant at both genotypic and phenotypic levels, indicating that selection of short stature genotypes may be effective for better grain yield. Similar results have been found by Saeed (1995), Khan *et al.* (2003) and Iqbal *et al.* (2007).

Days to heading showed negative association with yield at both genotypic and phenotypic levels. However, the associations were insignificant. Yildirm *et al.* (1996), Mondal *et al.* (1997), Narwal *et al.* (1999) and Ismail (2001) found similar results in their studies.

1000-kernel weight showed positive association with yield both at genotypic and phenotypic levels. This result is in agreement with the results of Mondal *et al.* (1997), Dokuyucu and Akaya (1999), Mondal and Khajuria (2001) and Sarkar *et al.* (2002). 1000-kernel weight was also negatively, but insignificantly, correlated at both genotypic and phenotypic levels with plant height and days to heading. Similar results were found by Shahid *et al.* (2002) and Saleem *et al.* (2006), who reported that 1000-kernel weight was negatively and insignificantly correlated at genotypic and phenotypic levels with plant height.

The results depicted (Table 1) a positive correlation between spike length and yield at both genotypic and phenotypic levels. Kashif and Khaliq

(2004) also reported similar findings. However, spike length showed highly significant and positive genotypic correlation with 1000-kernel weight. Saleem *et al.* (2006) found similar results in their study.

Tab. 1. Genotypic (r_g) and phenotypic (r_p) correlation (upper values show r_g and lower values show r_p) among grain yield and different yield contributing characters in wheat

Variable	GY	PH	DH	DM	1000KW	SL	TPP	SPS
GY	1							
	1							
PH	-0.7688**	1						
	-0.6835**	1						
DH	-0.0989	0.3079	1					
	-0.0794	0.1412	1					
DM	0.6427**	-0.6518**	-0.3269**	1				
	0.4466	-0.4356	0.1033	1				
1000KW	0.0588	-0.1201	-0.329	0.471	1			
	0.0723	-0.0376	-0.2235	0.2543	1			
SL	0.0488	-0.1606	-0.6704**	0.4125**	0.7471**	1		
	0.0652	-0.0346	-0.3338	0.0839	0.3863	1		
TPP	0.1504	-0.3509	0.0441	0.6667**	0.3414**	0.3471**	1	
	0.1209	-0.2169	0.0823	0.3252	0.2305	0.3283	1	
SPS	-0.2663	0.3316	-0.0718	0.1459	-0.153	-0.1274	0.1397	1
	-0.1938	0.2705	-0.1266	-0.0406	0.0428	-0.0384	0.1257	1

Grain Yield (GY), Plant Height (PH), Days to Heading (DH), Days to Maturity (DM), 1000 Kernel Weight (1000 KW), Spike Length (SL), Number of Tillers per Plant (TPP) and Number of Spikelets per Spike (SPS).
** Significantly at 1 % level.

Number of productive tillers per plant was positively and highly significantly associated with days to maturity, 1000-kernel weight and spike length at genotypic level. Positive correlations among the traits were found on phenotypic level; however, the correlations were insignificant. Chowdhry *et al.* (2000) reported similar results. This finding indicated that number of productive tillers per plant may be an effective trait to select higher yielding genotypes. Number of spikelets per spike was in negative relationship at both genotypic and phenotypic levels with yield and spike length. On the contrary, Kashif and Khaliq (2004) observed number of spikelets per spike as significantly and positively correlated with grain yield.

Path coefficient analysis

In this research, the response variable grain yield (GY) and seven predictor variables, plant height (PH), days to heading (DH), days to maturity (DM), 1000 kernel weight (1000 KW), spike length (SL), number of tillers per plant (TPP) and number of spikelets per spike (SPS), were studied for path coefficient (Table 2).

Tab. 2. Direct and indirect effect of yield contributing characters on wheat yield (the last column shows genotypic correlation)

Variable	PH	DH	DM	1000KW	SL	TPP	SPS	GY(rg)
P.H	(-0.4995)	0.2076	-0.6844	0.0557	-0.0959	0.2775	-0.0298	-0.7688
DH	-0.1538	(0.6741)	-0.3432	0.1525	-0.4001	-0.0349	0.0065	-0.0989
DM	0.3256	-0.2204	(1.05)	-0.2183	0.2462	-0.5274	-0.0131	0.6427
1000KW	0.06	-0.2218	0.4945	(-0.4634)	0.4459	-0.2701	0.0137	0.0588
S.L	0.0802	-0.452	0.4331	-0.3463	(0.5968)	-0.2746	0.0114	0.0488
TPP	0.1753	0.0298	0.7	-0.1582	0.2072	(-0.791)	-0.0125	0.1504
SPS	-0.1656	-0.0484	0.1532	0.0709	-0.076	-0.1105	(-0.0898)	-0.2663

Plant Height (PH), Days to Heading (DH), Days to Maturity (DM), 1000 Kernel Weight (1000 KW), Spike Length (SL), Number of Tillers per Plant (TPP), Number of Spikelets per Spike (SPS) and Grain Yield (GY).

The highest positive direct effect on yield were exhibited by days to maturity (1.05) followed by days to heading (0.6741). Singhara (2005) observed the highest positive direct effect of days to maturity on yield. Plant height had a negative direct effect on yield. Similar results were reported by Mondal *et al.* (1997) and Ahmad *et al.* (2003). The highest positive indirect effects on yield were observed for number of tillers per plant, followed by 1000 kernel weight, both via days to maturity.

Conclusion

The study of correlation and path analysis of this experiment revealed that high plant height causes low yield due to its negative correlation with yield while days to maturity is the best selection parameter for breeding high yielding wheat cultivars due to its positively significant genotypic association and highest direct effect on yield. This suggests that early maturing variety/line with moderate plant height gives more yield comparative to late maturing variety and high plant height.

References

- Ahmad H.M., Khan B.M., Kissana N.S., Laghari S. (2003): Path coefficient analysis in bread wheat. *Asian J. Plant Sci.*, **2** (6): 491-494.
- Choudhry A.R., Shah A.H., Ali L., Bashir M. (1986): Path coefficient analysis of yield and yield components in wheat. *Pak. J. Agric. Res.*, **7** (2): 71-75.
- Chowdhry M.A., Ali M., Subhani G.M., Khaliq I. (2000): Path coefficient analysis for water use efficiency, evapo-transpiration efficiency and some yield related traits in wheat. *Pak. J. Biol. Sci.* **3** (2): 313-317.
- Dewey J.R., Lu K.H. (1959): A correlation and path coefficient analysis of components of crested wheat seed production. *Agron. J.*, **51**: 515-518.
- Dokuyucu T., Akaya A. (1999): Path coefficient analysis of correlation of grain yield and yield components of wheat (*Triticum aestivum* L.) genotypes. *Rachis Barley and Wheat. Newslett.*, **18** (2): 17-20.

- Iqbal M., Navabi A., Salmon D.F., Yang R.C., Spaner D. (2007): Simultaneous selection for early maturity, increased grain yield and elevated grain protein content in spring wheat. *Plant Breed.*, **126** (3): 244-250.
- Ismail A.A. (2001): Identification of selection traits for yield improvement of bread wheat using path analysis. *Assiut J. Agric. Sci.*, **32** (2): 63-84.
- Kashif M., Khaliq I. (2004): Heritability, correlation and path coefficient analysis for some metric traits in wheat. *Int. J. Agri. Bio.* **6** (1):138-142.
- Khan A.S., Ashfaq M., Asad M.A. (2003): A correlation and path coefficient analysis for some yield components in bread wheat. *Asian J. Plant Sci.*, **2** (8): 582-584.
- Kwon S.H., Torrie J.H. (1964): Heritability and inter-relationship among traits of two soybean population. *Crop Sci.*, **4**:196-198.
- MINFAL (2007): *Agriculture statistics of Pakistan*. Ministry of Food Agriculture and Cooperative, Food and Agriculture Div., Economic wing, Islamabad, Pakistan..
- Mondal A.B., Sadhu D.P., Sarkar K.K. (1997): Correlation and path analysis in bread wheat. *Environ Ecol.*, **15** (3): 537-539.
- Mondal S.K., Khajuria M.R. (2001): Correlation and path analysis in bread wheat (*Triticum aestivum* L.) under rainfed condition. *Environ Ecol.*, **18** (2): 405-408.
- Narwal N.K., Verma P.K., Narwal M.S. (1999): Genetic variability, correlation and path coefficient analysis in bread wheat in two climatic zones of Hayrana. *Agr. Sci. Digest, Karnal.*, **19** (2): 73-76.
- Saeed M.M. (1995): *Correlation and path coefficient analysis in wheat (Triticum aestivum L.)* M.Sc. (Hons) Agri. Thesis, Deptt. Pl. Br. Genet; Univ. Agri., Faisalabad, Pakistan.
- Saleem U., Khaliq I., Mahmood T., Rafique M. (2006): Phenotypic and genotypic correlation coefficients between yield and yield components in wheat. *J. Agric. Res.*, **44** (1): 1-6.
- Sarkar C.K.G., Srivastava P.D.L., Deshmukh P.S. (2002): Effect of terminal high temperature stress tolerance in bread wheat (*Triticum aestivum* L. Em. Thell): Estimation of character association and contribution of yield attributes to grain yield. *Ann. Agric. Res.*, **23**:75-78.
- Shahid M., Fida M., Tahir M. (2002): Path coefficient analysis in wheat. *Sarhad J. Agric.*, **18** (4): 383-388.
- Singhara G.S. (2005): Path analysis in some rye introgressed wheat derivatives, *Agric. Sci. Digest.*, **25** (3): 221-223.
- Steel R.G.D., Torrie J.H., Dickey D.A. (1997). *Principles and Procedures of Statistics*: McGraw Hill Book Co., New York, USA

**KORELACIONA I PATH ANALIZA PRINOSA I KOMPONENTI
PRINOSA KOD PŠENICE (*Triticum aestivum* L.)**

- originalni naučni rad -

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Rezime

Koeficijenti korelacije utvrđeni su kod petnaest genotipova pšenice za sledeće osobine: visinu biljke, broj dana do klasanja, broj dana do zrelosti, masu 1000 zrna, dužinu klasa, broj izdanaka po biljci, broj klasića po klasu i prinos zrna po biljci. Rezultati su pokazali pozitivnu i visoko značajnu korelaciju između prinosa zrna po biljci i dana do zrelosti, ali negativnu i visoko značajnu korelaciju sa visinom biljke. Broj dana do zrelosti imao je najveći pozitivan direktni uticaj na prinos.