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# ESTIMATION OF CORRELATION COEFFICIENT AMONG SOME YIELD PARAMETERS OF WHEAT UNDER RAINFED CONDITIONS

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**Abstract**

Correlation studies were conducted in $F_2$ progenies of an 8x8 complete diallel cross of wheat genotypes, sown at the Department of Plant Breeding and Genetics, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi during 2002. The association among different yield contributing traits was studied at genotypic and phenotypic levels. The results revealed positive correlation in case of number of spikelets per spike, number of grains per spike and 1000 grain weight with grain yield at both genotypic and phenotypic levels. However, number of tillers per $m^2$ and spike length contributed negatively towards grain yield at both levels. Plant height was positively correlated with grain yield at genotypic level, whereas negatively correlated at phenotypic levels. It was, therefore, suggested that number of spikelets per spike, number of grains per spike and 1000 grain weight should be given emphasis for future wheat yield improvement programs.

## Introduction

Bread wheat is the most important and widely consumed food cereal of Pakistan. Manifestation of wheat yield fluctuates widely as a result of its interaction with environment because grain yield in wheat is a complex inherited character and is the product of several contributing factors affecting yield directly or indirectly. Wheat production can be enhanced through development of improved genotypes capable of producing better yield under various agroclimatic conditions and stresses (Inamullah *et. al.*, 2006). Selection for grain yield can only be effective if desired genetic variability is present in the genetic stock. Genotypic and phenotypic correlations are important in determining the degree to which various yield contributing characters are associated.

Several researchers have reported their findings regarding the correlation studies. Virk & Anand (1970) showed that in wheat grain yield was positively correlated with 1000 grain weight. Sandhu & Mangat (1985), Eunus *et al*., (1986), Chowdhry *et al*., (1991), Belay *et al*., (1993) and Aycecik & Yildirim (2006) reported positive correlation of grain yield with number of grains per spike, plant height and 1000 grain weight. Gupta *et al*., (1999) and Chowdhry *et al*., (2000) also conducted such studies and concluded that yield components like tillers per plant, grains per spike and 1000 grain weight are main contributors to grain yield in wheat.

The present study was therefore, conducted to estimate the relationship of different yield components towards grain yield. The information will be of importance to wheat breeders in future to follow wheat breeding programs under rainfed conditions.

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## Materials and Methods

The present study involved eight wheat genotypes i.e., Pak 81, Pothowar 93, Parwaz 94, Shahkar 95, Suleiman 96, Chakwal 97, Kohistan 97 and MH 97, selected on the basis of phenotypic diversity were sown during November, 2000 with two sowing dates to facilitate hybridization. Crossing of the varieties was performed during February/March 2001.Whereas, the parent varieties were self pollinated to maintain the true to type seed. At the time of harvesting, crossed spikes were individually harvested/threshed to have seed for raising $F_1$ generation.

The seed of 8x8 parent diallel (28 direct and 28 reciprocal crosses) along with their parents were sown in the field on 3rd of November, 2001 to raise $F_2$ generation. Randomized complete block design was followed in the experiment having three replications. Each treatment comprised of a single row of five-meter length in each replication. Inter row and interplant distances were kept at 30cm and 20cm respectively.

At maturity ten guarded plants were selected randomly and data were collected on plant height (cm), number of tillers per $m^2$, spike length (cm), number of spikelets per spike, number of grains per spike, 1000 grain weight (g) and grain yield per plant (g).

To ascertain the significance of data**,** the analysis of variance for all the characters was determined by using the technique given by Steel & Torrie (1980). After determining the significant differences, the data were further subjected to correlation coefficient analysis at both genotypic and phenotypic levels according to the method proposed by Searle (1961) and Kwon &Torrie (1964).

## Results and Discussion

The analysis of variance for plant height, number of tillers per $m^2$, spike length, number of spikelets per spike, number of grains per spike, 1000 grain weight and grain yield in spring wheat $F_2$ generation was carried out. The mean squares from analysis of variance given in Table.1 indicated that genotypic differences were significant ($P \leq 0.01$) for all the parameters studied. Genotypic and phenotypic relationship among the characters was studied and the coefficients are given in the Tables.2 and 3, respectively. The comparison of the coefficients showed that estimates of '$r_g$' are generally higher in magnitude than those of '$r_p$'. This revealed that association among these characters was under genetic control. The relationships among different plant characters are given here.

**Plant height:** Plant height had positive and significant relationship with number of spikelets per spike at both genotypic and phenotypic levels (Tables. 2 and 3). Whereas it was positively associated with number of tillers per $m^2$, number of grains per spike and 1000 grain weight. Positive correlation of plant height with number of tillers per $m^2$, number of grains per spike and 1000 grain weight was also reported by Sandhu & Mangat (1985), Eunus et al.,(1986) and Belay et al.,(1993). It had negative correlation with of grain yield at genotypic level. The phenotypic correlation ($r_p$) of plant height with spike length was also significantly negative. Negative correlation of plant height with grain yield was also reported by Li (1989), Chaudhry et al., (1994), Akbar et al., (1995) and Patil & Jain (2002). Negative correlation of plant height with grain yield and spike length suggested that increase in plant height would result in reduction of grain yield.

**Table 1: Analysis of variance of different yield traits in $F_2$ generation of spring wheat.**

| | Genotypic mean squares | Replication mean squares | Error mean squares |
|---|---|---|---|
| **Plant height (cm)** | 106.81** | 96.26** | 16.04 |
| **No. of tillers $m^{-2}$** | 3727.10** | 1723.60* | 420.10 |
| **Spike length (cm)** | 2.18* | $2.24^{NS}$ | 1.44 |
| **No. of spikelets $spike^{-1}$** | 15.59** | $8.89^{NS}$ | 3.55 |
| **No. of grains $spike^{-1}$** | 50.73** | 92.45** | 8.26 |
| **1000 grain weight (g)** | 25.62** | $33.40^{NS}$ | 16.91 |
| **Grain yield $plant^{-1}$ (g)** | 3506.10** | 3173.80** | 448.10 |

** = Highly significant, * = Significant; N.S. = Non-significant

**Table 2: Genotypic correlation coefficient among various yield traits in $F_2$ generation in spring wheat.**

| | No. of tillers ($m^{-2}$) | Spike length (cm) | Spikelts $spike^{-1}$ | Grains $spike^{-1}$ | 1000 grain Weight (g) | Grain yield $plant^{-1}$ (g) |
|---|---|---|---|---|---|---|
| **Plant height (cm)** | 0.024* | -0.681 | 0.338* | 0.132* | 0.169* | 0.003 |
| **No. of tillers ($m^{-2}$)** | | 0.366* | -0.147 | 0.123* | -0.102 | -0.369 |
| **Spike length (cm)** | | | 0.403 | 0.003 | -0.137 | -0.102 |
| **Spikelets $spike^{-1}$** | | | | 0.149* | 0.132* | 0.576* |
| **Grains $spike^{-1}$** | | | | | -0.033 | 0.089* |
| **1000 grain weight (g)** | | | | | | 0.026 |

* = Significant at 5% level

**Table 3: Phenotypic correlation coefficient among various yield traits in $F_2$ generation in spring wheat.**

| | No. of tiller ($m^{-2}$) | Spike length (cm) | Spikelets $spike^{-1}$ | Grains $spike^{-1}$ | 1000 grain weight (g) | Grain yield $plant^{-1}$ (g) |
|---|---|---|---|---|---|---|
| **Plant height** | 0.032 | -0.320** | 0.276** | 0.116 | 0.105 | -0.006 |
| **No. of tiller ($m^{-2}$)** | | 0.194** | -0.155* | 0.086 | -0.076 | -0.322** |
| **Spike length** | | | 0.201** | -0.001 | -0.043 | -0.092 |
| **Spikelets $spike^{-1}$** | | | | 0.128 | 0.097 | 0.457** |
| **Grains $spike^{-1}$** | | | | | 0.005 | 0.097 |
| **1000 grain weight (g)** | | | | | | 0.001 |

**** = Significant at 1% level , * = Significant at 5% level**

**Number of tillers $m^{-2}$:** At genotypic level number of tillers per $m^2$ was positively and strongly associated with number of grains per spike and spike length. At phenotypic level, number of tillers per $m^2$ was positively associated with spike length, while it had significantly negative correlations with number of spikelets per spike and grain yield per plant. Similar results have also been obtained by Cantrell &Haro- Arias (1986). The results indicated that number of tillers per $m^2$ is an important yield contributing factor and it can lead to more number of grains per spike. These results are in conformation with the findings of Sandhu & Mangot (1985), Srivastava (1988), Sharma (1993), Singh et al., (1999), Baser et al., (2000) and Shahid et al., (2002).

**Spike length:** Spike length had positive relationship with number of spikelets per spike at both genotypic and phenotypic levels. While it was positively correlated with number of grains per spike at genotypic level. These results are supported by the findings of earlier researchers like Eunus et al., (1986), Shah et al., (1988) and Gasper & Zama (1990).

**Number of spikelets spike$^{-1}$:** At both phenotypic and genotypic levels, number of spikelets per spike had significant correlation with grain yield. However, it had positive and significant association with number of grains per spike and 1000 grain weight at genotypic level. It showed positive association with number of grains per spike and 1000 grain weight at phenotypic level. The findings of these results emphasized the role of number of spikelets per spike upon ultimate increase of grain yield. These conclusions are in conformity with those of Khan and Hussain (1994) and Akbar et al., (1995).

**Number of grains spike$^{-1}$:** It had positive and significant association with grain yield at genotypic level. While positive and non significant association with grain yield at phenotypic level. Similarly it had significant positive relationship with 1000 grain weight but with negligible effects. The perusal of both the correlation coefficient results suggested that number of grains per spike should be given prime importance regarding its contribution to yield. These results are substantiated with those of Raina *et al*., (1982), Alam *et al*., (1992), Singh *et al*., (1999), Singh & Singh (2001), Lad *et al*., (2003), Aycecik & Yildirim (2006), and Inamullah *et al.*,(2006).

**1000 grain weight:** The results presented in Tables. 2 and 3 indicated that 1000 grain weight was positively and non-significantly correlated with grain yield at both genotypic and phenotypic levels. It was evident from the results that 1000 grain weight had pronounced influence upon wheat yield. The present findings are similar to those of Akbar *et al*., (1995), Hossain (1995) and Baser *et al*., (2000), Aycecik & Yildirim (2006) and Inamullah *et al.*,(2006), who also observed positive association of 1000 grain weight with grain yield.

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