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ESTIMATION OF INTERRELATIONSHIPS AMONG YIELD AND YIELD RELATED ATTRIBUTES IN WHEAT LINES

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Abstract

The experimental material was sown in the experimental area of Department of Plant Breeding and Genetics, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi during 2004-2005, comprising of 10 wheat genotypes viz., Chakwal-86, Iqbal-2000, Uqab-2000, GA-2002, 00FJ03, IC-001, IC-002, NR-234, 3C061 and 3C062 for determination of interrelationships among yield and yield related characters. Analysis of variance showed highly significant differences among the genotypes for all the traits. The correlation coefficient indicated that spike length, number of spikes per plant, number of spikelets per spike, number of grains per spike, number of tillers per m^2, 1000grain weight were significantly and positively correlated with grain yield per plant, while days to heading, days to maturity and plant height showed non significant correlation with grain yield per plant.

Introduction

Emphasis is given to explore the ways and means to increase the production of wheat to meet the increasing demand of food grains for the growing population. Currently it is not possible to increase the area under wheat due to other competing crops and rusticated supply of irrigation water. Use of varieties with better yield potential and wide range of adaptability is of prime importance for increasing wheat production. Thus development of high yielding wheat cultivars has always been a major objective of wheat breeding programs throughout the world. Extensive testing of wheat genotypes under varying environments has been practiced for screening relatively stable cultivars (Aggarwal & Sinha, 1984).

Yield in wheat is very complex trait and is a result of interaction between various yield components. Knowledge of association between any two traits or among various traits is of immense importance to make the desired selection of combination of characters. Further, correlation analysis provides information about the correlated response of important plant characters to selection. Different researchers like Amin *et al*., (1990), Chowdhry *et al*., (1991), Amin *et al*., (1992), Akhtar *et al*., (1992), Alam *et al*., (1992), Bahadur *et al*., (1993), Adnan *et al*., (1994), Ramzan *et al*., (1994), Akbar *et al*., (1995), Ali *et al*., (1997), Ansari *et al*., (1997), Gupta and Verma (2000), Subhani *et al*., (2000), Ihsanullah and Mohammad (2001), Soomro *et al*., (2001), Shahid *et al*., (2002), Ahmad *et al*., (2003), Ashfaq *et al*., (2003), Asif *et al*., (2003), Khan *et al*., (2003), Shah *et al*., (2003), Asif *et al*., (2004), Hassan *et al*., (2004), Khaliq *et al*., (2004) and Mohammad *et al*., (2004); Akram *et al*., (2008) and Yagdi & Sozen (2009), in their studies have reported interrelationship among yield related attributes in wheat. Keeping in view above problems, the study was carried out to evaluate the potential of wheat genotypes for estimation of correlation of various characters among themselves and with grain yield under rainfed conditions of Rawalpindi.

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Materials and Methods

The experimental material used in the present study comprised of 10 wheat genotypes viz., Chakwal-86, Iqbal-2000, Uqab-2000, GA-2002, 00FJ03, IC-001, IC-002, NR-234, 3C061 and 3C062 differing for the characters studied. The seed of cultivars/lines was obtained from Barani Agricultural Research Institute, Chakwal & National Agricultural Research Center, Islamabad. The experiment was sown in the experimental area of Department of Plant Breeding and Genetics, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi during 2004-2005. Layout design followed randomized complete block design with three replications and seeds were sown in 4-meter long rows with 30 cm of row to row distance and 10cm of plant to plant distance. All the cultural practices were performed as recommended.

The plant data during the cropping season and after harvesting the plants were noted. The data were collected on 10 randomly selected plants in each row for different parameters viz., heading, days to maturity, plant height, spike length, number of spikes per plant, number of spikelets per spike, number of tillers per m^2, number of grains per spike, 1000 grain weight and grain yield per plant. Significance of the data was ascertained by analysis of variance as given by Steel & Torrie (1980).

Correlation coefficient analysis: Simple correlation coefficients between yield and yield related characters was computed according to the formula given by Steel & Torrie (1980).

$$r_{xy} = \frac{\sum XY - (\sum X)(\sum Y)/n}{[\{\sum X^2 - (\sum X)^2/n\}\{\sum Y^2 - (\sum Y)^2/n\}]^{0.5}}$$

Where
r = Correlation coefficient
X= First variable
Y= Second variable
n = Total number of observations
$\sum$ = Sum total of the observations.

The significance of correlation was tested against the value of t- tabulated using the following formula, given by Steel & Torrie (1980).

$$T = \frac{r\,(n-2)^{0.5}}{(1-r^2)^{0.5}}$$

Where
r = Correlation coefficient
n-2 = Degree of freedom

Results and Discussion

Highly significant differences among the genotypes indicated sufficient genetic variability for selection of superior genotypes (Table 1). Simple correlation coefficients were observed for all possible combinations of 10 different parameters (Table 2). The observations regarding the association of various characters are described separately as follows:

Table 1. Mean squares of yield and yield related attributes in wheat lines.

Source of variance	Degree of freedom	Days to heading	Days to maturity	Plant height	Spike length	Number of spikes per plant	Number of spikelets per plant	Number of grains per spike	Number of tillers per m^2	1000 Grain wight	Grain yield per plant
Genotypes	9	9.041**	8.37**	48.98**	2.626**	2.904**	4.981**	29.93**	4484.74**	164.457**	43.798**
Replications	2	0.233	1.3	0.133	0.4	0.833	0.433	6.433	44.8	2.75	
Error	18	0.641	0.893	2.356	0.437	0.537	0.581	1.952	70.874	2.484	19.387

** = Highly significant

Table 2. Simple correlation coefficient among yield and yield related attributes in wheat lines.

Traits	Days to maturity (days)	Plant height (cm)	Spike length (cm)	Number of spikes per plant	Number of spikelets per spike	Number of grains per spike	Number of tillers per m^2	1000grain weight (gm)	Grain yield per plant (gm)
Days to heading	0.728*	- 0.063^{NS}	0.019*	- 0.5^{NS}	0.133^{NS}	0.031^{NS}	- 0.528^{NS}	- 0.373^{NS}	- 0.376^{NS}
Days to maturity		0.201^{NS}	0.095*	- 0.556^{NS}	0.131^{NS}	0.016^{NS}	- 0.528^{NS}	- 0.055^{NS}	0.14^{NS}
Plant height			0.574*	- 0.043^{NS}	0.617*	0.533^{NS}	0.111^{NS}	0.079^{NS}	0.486*
Spike length				0.032^{NS}	0.2*	0.106*	- 0.008^{NS}	- 0.002^{NS}	0.141*
Number of spikes per plant					- 0.066^{NS}	- 0.092^{NS}	0.956**	0.527*	0.237*
Number of spikelets per spike						0.951**	- 0.001^{NS}	- 0.093^{NS}	0.002*
Number of grains per spike							0.008^{NS}	- 0.288^{NS}	0.128*
Number of tillers per m^2								0.443^{NS}	0.257*
1000grain weight									0.446*

* = Significant

** = Highly significant

NS = Non significant

A positive and significant correlation was observed between days to heading and days to maturity. It means that with the increase in days to heading there was a significant increase in days to maturity. These results suggested that the genotypes that took less days to heading were likely to mature earlier and *vice versa* as discussed by Ahmed *et al*., (1987). There was a negative and non significant Correlation between days to heading and plant height. There was a positive and significant correlation between days to heading and spike length. The results suggested that the genotypes that took more days to heading were likely to have more spike length as reported by Amin *et al*., (1992). Days to heading were negatively and non significantly correlated with number of spikes per plant, similar results were observed by Ahmad *et al*., (2003). There was a non significant and positive correlation between days to heading and number of spikelets per spike as in conformity with the findings of Bhullar *et al*., (1982). Days to heading and number of grains per spike were correlated positively and non-significantly. A negatively and non significant correlation was found between days to heading and number of tillers per meter^2. It means that with the increase in days to heading there was no significant decrease in number of tillers per meter^2. These results suggested that the genotypes that took more days to heading were likely to have somewhat decrease in number of tillers per meter^2. There was a non significant and negative correlation between days to heading and 1000grain weight as also reported by Ahmad *et al*., (2003). Days to heading were negatively and non significantly correlated with grain yield per plant in accordance with the findings of Zar & Khan (1980).

There was a non significant and positive correlation between days to maturity and plant height. A positive and significant correlation was observed between days to maturity and spike length in agreement with the findings of Bhutta & Chaudhary (1984). There was a negative and non significant correlation between days to maturity and number of spikes per plant. There was a non significant and positive correlation between days to maturity number of spikelets per spike as reported Bhullar *et al*., (1982). Days to maturity was positively and non significantly correlated with number of grains per spike as observed by Hasssan *et al*., (2004). There was a negative and non significant correlation between days to maturity and number of tillers per meter^2. A negatively and non significant correlation was found between days to maturity and 1000grain weight. There was a non significant and positive correlation between days to maturity and grain yield per plant as reported by Serwet & Rana (1993) and Chaudhary *et al*., (1994). There was a positive and significant correlation between plant height and spike length similar with the findings of Bhutta & Chaudhary (1984). Plant height was negatively and non-significantly correlated with number of spikes per plant. A positive and significant correlation was observed between plant height and number of spikelets per spike as observed by Ansari *et al*., (1997) and Ahmad *et al*., (2003). A positive and non significant correlation was observed between plant height and number of grains per spike as in agreement with the findings of Ihsanullah & Mohammad (2001). There was a non significant and positive correlation between plant height and number of tillers per meter^2 as also reported by Ali *et al*., (1984). There was a positive and non significant correlation between plant height and 1000grain weight in conformation with the finding of Bhutta *et al*., (1980), Chowdhry *et al*., (1991) and Chaudhry *et al*., (1994). A positive and significant correlation was observed between plant height and grain yield per plant as reported by Khan (1990), Chowdhry *et al*., (1991), Akhtar *et al*., (1992) and Mohammad *et al*., (2004).

There was a positive and non significant correlation between spike length and number of spikes per plant. A positive and significant correlation was observed between spike length and number of spikelets per spike. It means that with the increase in spike length there was a significant increase in number of spikelets per spike as discussed by Adnan *et al*., (1994). There was a positive and significant correlation between spike length and number of grains per spike similar with the findings of Adnan *et al*., (1994) and Ansari *et al*., (1997). There was a negative and non significant correlation between spike length and number of tillers per meter^2. There was a negative and non significant correlation between spike length and 1000 grains weight. A positive and significant correlation was observed between spike length and grain yield per plant as observed by Akhtar *et al*., (1992) Adnan *et al*., (1994), Shahid *et al*., (2002) and Khaliq *et al*., (2004).

There was a negative and non-significant correlation between number of spikes per plant and number of spikelets per spike. Number of spikes per plant was negatively and non significantly correlated with number of grains per spike similar with the findings of Akbar *et al*., (1995). A highly significant and positive correlation was observed between number of spikes per plant and number of tillers per meter^2 in agreement with the findings of Bhutta & Chaudhry (1984) and Ihsanullah & Mohammad (2001). There was a positive and significant correlation between number of spikes per plant and 1000grain weight. There was a positive and significant correlation between number of spikes per plant and grain yield per plant These results are in conformity with the findings of Akhtar *et al*., (1992) and Akbar *et al*., (1995).

A highly significant and positive correlation was observed between number of spikelets per spike and number of grains per spike in accordance with the findings of Ahmad & Chaudhry (1987) and Mohammad *et al*., (2001). There was a negative and non significant correlation between number of spikelets per spike and number of tillers per meter^2. Number of spikelets per spike was negatively and non-significantly correlated with 1000grain weight. There was a positive and significant correlation between number of spikelets per spike and grain yield per plant in accordance with the findings of Bahadur *et al*., (1993), Khaliq *et al*., (2004) and Kashif & Khaliq (2004). Number of grains per spike was positively and non significantly correlated with number of tillers per meter^2. There was a negative and non significant correlation between number of grains per spike and 1000grain weight. A positive and significant correlation was observed between number of grains per spike and grain yield per plant in conformity with the findings of Alam *et al*., (1992), Bhadur *et al*., (1993), Mahmood & Shahid (1993), Adnan *et al*., (1994), Ramzan *et al*., (1994), Akbar *et al*., (1995) and Shahid *et al*., (2002).

Number of tillers per meter^2 was positively and non-significantly correlated with 1000grain weight similar with the findings of Bhutta *et al*., (1980) and Shahid *et al*., (2002). A positive and significant correlation was observed between number of tillers per meter^2 and grain yield per plant in conformity with the findings of Ahmad and Chaudhry (1987) and Ali *et al*., (1997). There was a positive and significant correlation between 1000grain weight and grain yield per plant These results were in accordance with the findings of Akhtar *et al*.,(1992), Alam *et al*., (1992), Ramzan *et al*., (1994), Ali *et al*., (1997) and Khaliq *et al*., (2004).

Results of the study showed that these genotypes may provide good source of material for further breeding program. It can also be concluded that grain yield per plant can be improved by utilizing these conditions among different characters of plant populations.

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