Correlation and regression studies in semi-dwarf spring wheat (*Triticum aestivum* L.)

Jamali R[1] and Jamali KD[2&3]
[1]Department of Biotechnology and Genetic Engineering University of Sindh Jamshoro Pakistan
2Department of Plant breeding and genetics, Sindh Agriculture University Tando Jam Pakistan
3Permanent address: Nuclear Institute of Agriculture, Tando Jam Pakistan

ABSTRACT

The correlation and regression studies have shown that plant height is negatively and significantly correlated for grain yield in varieties W.L-711 and H.D.2009, however, it is positively and significantly correlated in varieties Mehran and Tesopeco. Number of tillers per plant is positively and highly significant with yield per plant in all the varieties. Spike length is another very important character the varieties showed positive and highly significant results were Z.A-77, Pavon, Sonalika, W.L711 and Mehran. Torim another variety showed positive and significant association with grain yield per plant for spike length. Positive and highly significant associations were achieved in varieties Pavon, Sonalika, Mehran and Tesopeco. Positive and significant correlation was observed for number of spikelets in variety Torim. All the varieties have shown positive and highly significant correlation results for number of spikes per plant with grain yield. Numbers of grains per spike results showed that varieties Pavon, Sonalika and Mehran were positively and significantly correlated with grain yield per plant. However, Tesopeco variety showed highly and significant positive correlation with grain yield for number of grains per spike. All the varieties showed positive and highly significant correlation with grain yield for the character harvest index.

Key-words: Plant height, correlation and regression, agronomic characteristics, yield and yield components, harvest index.

INTRODUCTION

Among the cereals, wheat ranks first in area and production in the world. It has played a very vital role in stabilizing the food grains production over the past few years. In Pakistan the crop is being grown throughout the country on an area of about 8.494 million hectares and production was 23.5 million tonnes during the year 2006-07, which is an improvement of 10.5% compared with last year (2005-06). We need to feed a growing population. During the last hundred years, wheat breeders in Europe and other parts of the world were working on increasing the yield of wheat by reducing plant height, to make the plants resistant to lodging in conditions of intensive agriculture. For this reason, plants with short and stiff straw, based on their phenotypic expression, from natural populations or from generations that had been crossed with dwarf varieties have been selected. Some of the countries in the region turned from importers of wheat to exporters of wheat (Borojevic 2000). Waddington et al. (1986) reported that 1000 grain weight was reduced slightly in modern high grain number cultivars. In the pre-green revolution era the major factor of low yield of varieties was their tallness which is negatively correlated with yield (Hatam and Akbar, 1995). Shahid et al. (2002) reported that the plant height showed a strong negative genotypic correlation with grain yield. Spiertz et al. (1971) concluded that to increase grain yield selection in the F_2 population should be for plants having high harvest index and high biological yield because all these characters are correlated with grain yield. Razzaq et al. (1986) reported that duration of vegetative period has a positive influence on grain filling period. The aims of the present studies were to evaluate certain characters and their relationship with yield in different varieties and to design a future strategy for the selection of breeding material.

MATERIALS AND METHODS

Ten commercial varieties of wheat were selected from germplasm to study the quantitative characters and their relationship between the characters. The varieties were Z.A-77, Pavon, Sonalika, W.L-711, H.D.2009, Mehran, Pak-70, Tesopaco, Torim and Arz. The experiment was laid out in complete randomised block design with four replicates. The size of plot was 30.6 X 7.2 meters and ten sub-plots were maintained in a replicate with four rows in each sub-plot. At harvest the data for characters such as plant height (cm), number of tillers per plant, spike length (cm), number of spikelets per spike, number of spikes per plant, number of grains per spike, yield per plant (g) and harvest index were recorded.

RESULTS AND DISCUSSION

The results of correlation (r), coefficient of determination (r^2) and coefficient of regression (b) are presented in Table 1 and 2. The correlation studies have shown that plant height is negatively and significantly correlated in varieties W.L-711 and H.D.2009, however, it was positively and significantly correlated in varieties Mehran and Tesopeco. These results suggest that an increase in height may reduce

the yield significantly in varieties W.L. 711 and H.D.2009. Muhammad et al. (2006) reported that plant height had negative genotypic and phenotypic correlation with harvest index and grain yield. These findings do agree with our results in which, some of the varieties had positive correlation for plant height with grain yield within major dwarfing gene group (Law et al. 1978). However, Busch and Rauch, (1993) reported the lack of a positive association between plant height and grain yield. Villareal et al. (1992) reported the negative correlation for plant height and grain yield within the groups of single gene dwarf. It suggests that genetic background or environment may be playing a significant role for either positive or negative impact of plant height on grain yield. On the other hand varieties Mehran and Tesopeco had an increase in height that may increase the yield. Coefficient of determination results suggest that 21.1%, 11.8%, 17.5% and 19.4% variability in yield could be due to variation in plant height in varieties W.L-711, HD.2009, Mehran and Tesopeco respectively. Coefficients of regression results suggest that an increase by one centimetre may reduce by 0.423 and 0.336 (g) of yield in varieties W.L.-711 and H.D.2009, respectively. However, an increase in one centimetre in plant height in varieties Mehran and Tesopeco may increase the yield by 0.555 and 1.429 (g), respectively. Number of tillers per plant had positive and highly significant correlation with yield per plant in all the varieties. Moral et al. (2003) while studying the correlation analysis for different temperature-moisture regime combinations reported that, number of spikes/tillers per square meter was positively related to grain yield only under rainfed combinations of both temperature regimes. These results suggest that selections should be based on number of tillers per plant / per unit area for developing new wheat varieties. Number of tillers per unit area is one of the yield components in wheat. Spike length is another very important character the varieties showed positive and highly significant results were Z.A-77, Pavon, Sonalika, W.L711 and Mehran. The variety Torim showed positive and significant association for spike length with grain yield per plant. Singh et al. (2001) reported that the spike length had positive and highly significant correlation with grain yield of main spike. Positive and highly significant associations were achieved for spikelets per spike in varieties Pavon, Sonalika, Mehran and Tesopeco with grain yield per plant. Positive and significant correlation was observed for number of spikelets in variety Torim with grain yield per plant.

Table 1. Correlation (r), coefficient of determination (r^2) and regression (b) values for characters straw length, number of tillers, spike length, number of spikelets per spike with grain yield per plant (g)

	Plant height (cm)		No. of tillers per plant		Spike length of main Spike (cm)		No. of Spikelets per spike	
	$r \pm r^2$	b	$r \pm r^2$	b	$r \pm r^2$	b	$r \pm r^2$	b
Z.A-77	–0.214ns	–	0.895±0.802**	0.417	0.431±0.185**	0.075	0.311n.s	–
Pavon	–0.033ns	–	0.846±0.716**	0.487	0.513±0.263**	0.054	0.403±0.162**	0.069
Sonalika	0.234ns	–	0.922±0.85**	0.982	0.545±0.297**	0.198	0.577±0.333**	0.292
W.L-711	–0.46±0.211**	0.423	0.905±0.818**	0.436	0.423±0.179**	0.051	0.304n.s	–
H.D-2009	–0.343±0.118*	0.336	0.833±0.694**	0.732	0.123n.s –	–	0.083n.s	–
Mehran	0.418±0.175**	0.555	0.768±0.59**	0.411	0.734±0.539**	0.143	0.6640.441**	0.219
Pak-70	0.075ns	–	0.866±0.749**	0.506	0.195n.s –	–	0.303n.s	–
Tesopaco	0.441±0.194**	1.429	0.901±0.812**	0.465	0.074n.s –	–	0.497±0.247**	0.103
Torim	0.016ns	–	0.960±0.922**	0.677	0.372±0.139*	0.069	0.318±0.101*	0.1
Arz	0.175ns	–	0.883±0.78**	0.55	0.211n.s	–	0.019n.s	–

Table 2. Correlation (r), coefficient of determination (r^2) and regression (b) values between number of spikes per plant, number of grains per spike and harvest index with grain yield per plant.

		No. of spikes per plant		No. of grains per spike		Harvest index	
Varieties	*Rht* genes	$r \pm r^2$	b	$r \pm r^2$	b	$r \pm r^2$	b
Z.A-77	Rht_1	0.886±0.786**	0.417	0.245n.s	–	0.873±0.762**	1.043
Pavon	Rht_2	0.921±0.848**	0.502	0.329±0.108*	0.293	0.826±0.682**	0.905
Sonalika	Rht_2	0.805±0.648**	0.514	0.3670.135*	0.644	0.757±0.574**	1.366
W.L-711	Rht_1	0.908±0.824**	0.439	–0.149	–	0.691±0.477**	0.663
H.D-2009	-	0.803±0.645**	0.713	0.038n.s	–	0.881±0.764**	1.01
Mehran	Rht_1	0.771±0.595**	0.417	0.365±0.133*	0.54	0.968±0.938**	1.4
Pak-70	Rht_1	0.879±0.773**	0.496	0.082n.s	–	0.888±0.788**	1.158
Tesopaco	Rht_2	0.903±0.815**	0.465	0.918±0.842**	0.756	0.882±0.777**	0.934
Torim	Rht_1Rht_2	0.909±0.826**	0.623	0.156n.s	–	0.953±0.908**	0.882
Arz	Rht_1	0.925±0.856**	0.574	0.11n.s	–	0.931±0.867**	0.974

All the varieties had shown highly significant and positive correlation results for number of spikes per plant with grain yield. Number of reproductive tillers/ spikes is another yield component in wheat, which increases the grain yield. Okuyama et al. (2004) also reported the positive correlation for number of spike/m^2 with grain yield. Positive (P = 0.05) and significant association was observed in varieties Pavon, Sonalika and Mehran for number of grains per spike with grain yield per plant. However, variety Tesopeco had shown highly significant (P = 0.01) and positive correlation with grain yield for number of grains per spike. All the varieties have shown positive and highly significant (P=0.01) correlation with grain yield for the character harvest index. Muhammad et al. (2006) reported the positive and highly significant correlation for harvest index with grain yield. Zand et al. (2004) reported a positive and significant correlation between grain yield and harvest index. Harvest index is very important character in semi-dwarf wheat for selecting genotypes for high yield.

In conclusion there are three characters which showed significant contribution towards the final grain yield are number of tillers per plant, number spikes per plant and harvest index. The coefficient of determination results suggest that in the above characters (number of reproductive tillers/spikes and harvest index) contribute more than 70% towards final grain yield except few varieties.

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