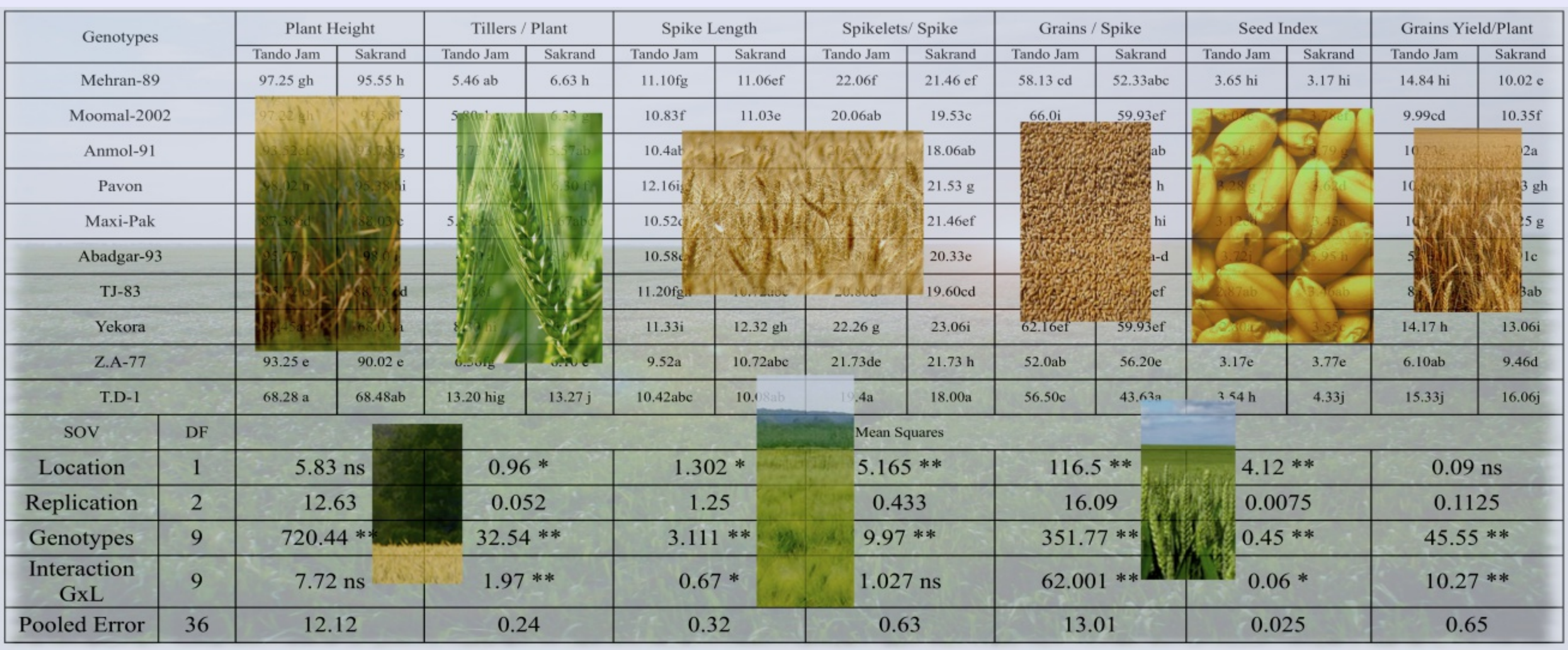
Number 4 Issue 1 February 2014

International Biotechnology Color Journal

A Scientific Peer Reviewed Journal with Focus on BIOTECHNOLOGY
and Covering Its Many Hues, Tints, Tones & Shades



Genotypes	Plant Height		Tillers / Plant		Spike Length		Spikelets/ Spike		Grains / Spike		Seed Index		Grains Yield/Plant	
	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand
Mehran-89	97.25 gh	95.55 h	5.46 ab	6.63 h	11.10fg	11.06ef	22.06f	21.46 ef	58.13 cd	52.33abc	3.65 hi	3.17 hi	14.84 hi	10.02 e
Moomal-2002	[illegible]	[illegible]	[illegible]	[illegible]	10.83f	11.03e	20.06ab	19.53c	66.0i	59.93ef	[illegible]	[illegible]	9.99cd	10.35f
Anmol-91	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18.06ab	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pavon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21.53 g	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Maxi-Pak	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21.46ef	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Abadgar-93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20.33e	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TJ-83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19.60cd	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yekora	[illegible]	[illegible]	[illegible]	[illegible]	11.33i	12.32 gh	22.26 g	23.06i	62.16ef	59.93ef	[illegible]	[illegible]	14.17 h	13.06i
Z.A-77	93.25 e	90.02 e	[illegible]	[illegible]	9.52a	10.72abc	21.73de	21.73 h	52.0ab	56.20e	3.17e	3.77e	6.10ab	9.46d
T.D-1	68.28 a	68.48ab	13.20 hig	13.27 j	10.42abc	[illegible]	[illegible]	18.00a	56.50c	43.63a	3.54 h	4.33j	15.33j	16.06j

SOV	DF	Mean Squares						
Location	1	5.83 ns	0.96 *	1.302 *	5.165 **	116.5 **	4.12 **	0.09 ns
Replication	2	12.63	0.052	1.25	0.433	16.09	0.0075	0.1125
Genotypes	9	720.44 **	32.54 **	3.111 **	9.97 **	351.77 **	0.45 **	45.55 **
Interaction GxL	9	7.72 ns	1.97 **	0.67 *	1.027 ns	62.001 **	0.06 *	10.27 **
Pooled Error	36	12.12	0.24	0.32	0.63	13.01	0.025	0.65

Zahoor et al.,
Evaluation and selection of bread wheat genotypes grown under different environments

Produced and hosted by *Centro de Investigación Científica de Yucatán, A.C.*,
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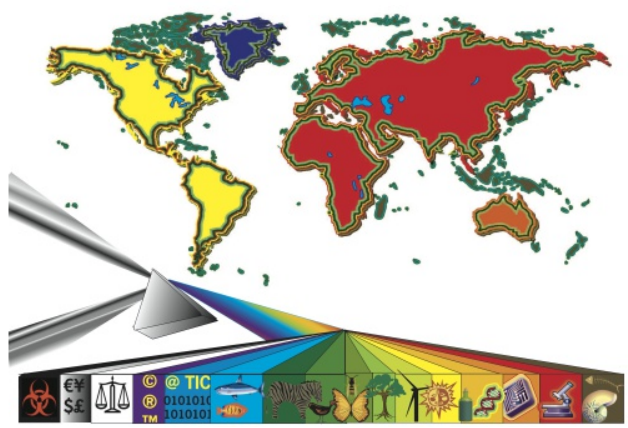
Susana Lozano Muñiz

President of the Foundation



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Editorial section

International Biotechnology Color Journal (IBCJ) is an electronic Open Access journal, devoted to rapidly publishing full peer-reviewed articles covering all the fields of biotechnology. Though the central focus of IBCJ is to publish scientific papers, it provides a forum for reviews of special interest, notes presenting relevant findings in a short format, essays with new technical advances or relevant updates of reported protocols, book reviews, scientific meetings, and letters to the editor. Instructions for every type of contribution are presented in the journal's Homepage and in PDF format in the last issue of each year.

The Editorial Board of IBCJ is fully committed to publish articles innovating in all areas of biotechnology. Contributions are reviewed from a rigorous optic of scientific criticism; thus, any original contribution that fits within the scope of the journal and promotes the advancement of biotechnology are particularly welcome.

Editorial comments to the contents of this issue

By José Juan Zúñiga-Aguilar, Chief editor.

In this issue, Zahoor and coworkers analyze the correlation of different morphological traits with grain yield in a number of wheat genotypes. Hopefully, the results of this study may help plant breeders to improve the plant breeding process, through a more meaningful set of phenotypical selection markers.

A brief comment stressing the a good Editorial practice at IBCJ ir reprinted in this number (with minor updates), because we feel this not a minor issue in the current Science Editorial industry.

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Why to publish on IBCJ?

By Rogelio Rodríguez-Sotres

Dear reader,

As the size of world's population increases, so does the scientific community. At the same time, technological aids develop opening new opportunities. The editorials handling scientific communications follow this trend, and many new ventures have emerged in the field.

Many of these new editorials operate under the Open Access Publishing model, commonly known as "author pays", contrary to the traditional publishing model where the reader covers the cost through his/her subscription fee.

The Open Access Model has grown rapidly because:

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C) Reduces "piracy" problems
D) It is considered more ethical, as the author is asked to endorse his intellectual's ownership to the editorial, and the editorial should profit from the services truly provided, information access control and storage.

Unfortunately, as with any business, ethical misconduct happens, and some editorial may try to deceive authors setting up sites with all sorts of misleading information. These so called predatory editorials scam authors into sending their manuscripts with counterfeit invitations, and frequently, the contributors are not warned of the publications charges, until an invoice is issued. In many of this editorials peer reviewing is offered, but almost anything gets trhough[1].

Very good editorials operating under the "author pays" model do exist, and in fact, some of those editorials have created and published their own ethical guidelines, somehow setting a standard for the industry[2].

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C) We have a recognized set of Editors, and we are trying the get even better in this aspect.

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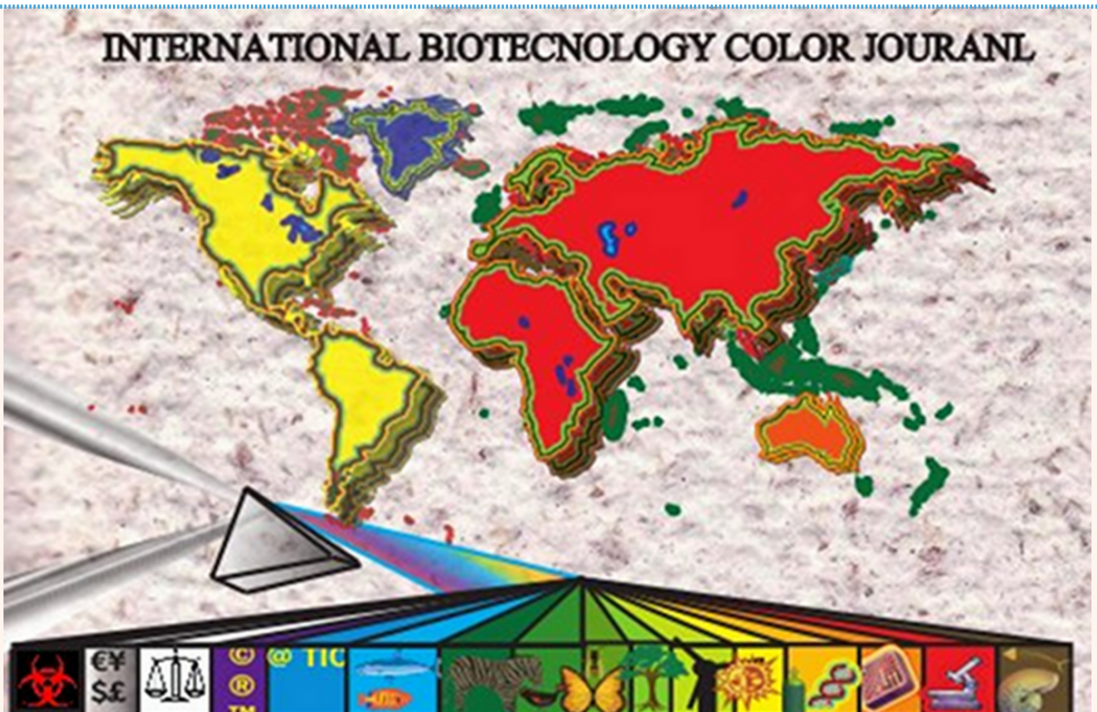
[1]See: Bohannon J (2013) Who's Afraid Of Peer Review? Science 342: 60-5

[2]See: Rodriguez-Sotres R , Plasencia J (2013) International Biotechnology Color Journal Is A Non-Profit Publication With A Genuine Scientific And Academic Interest. International biotechnology color journal 3: 6-11



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Evaluation and selection of bread wheat genotypes grown under different environments

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ABSTRACT

A randomized complete block design with three replications was used in Sakrand and Tando Jam, Sindh, Pakistan, to assess the simple correlation, coefficient of determination and regression coefficient of ten commercial wheat genotypes (Mehran-89, Moomal-2002, Anmol-91, Pavon, Maxi-Pak, Abadgar-93, TJ-83, Yecora, Z.A-77 and T.D-1). The characteristics studied were plant height (cm), tillers per plant, spike length (cm), spikelets per spike, grains per spike, seed index (g) and grain yield per plant (g). A highly significant positive correlation was observed between tillers per plant and grain yield per plant (r = 0.57**), and the highest positive regression value (byx=2.01) was recorded between spike length and grain yield per plant in Tando Jam. In the Sakrand environment, the highest positive correlation coefficients were found between tillers per plant and grain yield per plant (r=0.78 **), tillers per plant and seed index (r=0.77 **), spike length and spikelets per spike (r=0.81 **) and spike length and grains per spike (r=0.70 **); the highest positive regression coefficient value (byx=3.67) was recorded between seed index and grain yield per plant.

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Key words: Bread wheat, wheat genotypes, agricultural yield, environmental conditios.

INTRODUCTION

Wheat (Triticum aestivum L.) is the most important food grain for more than one third of the world population. Since earliest times, wheat has played a vital role in the development of civilization; this principal source of food is extensively grown and consumed in Pakistan (Bhatti and Soomro 1996). Wheat breeding programs worldwide have achieved significant genetic gains in yield potential without the aid of physiological selection tools (Rajaram and VanGinkel, 1996). Plant breeders and physiologists generally agree that future success will be realized through a greater integration of interdisciplinary research (Jackson et al., 1996). Thus, an urgent need exists to develop new and more efficient wheat breeding methodologies to complement existing breeding techniques and to identify new traits that will drive higher-yielding grains.

Breeding approaches have become increasingly successful in recent years as knowledge of the behavior of yield components has become available. Recently, efforts have been made to assess the contribution of various characteristics that affect yields and the associations among these characteristics under irrigated conditions. This problem has been approached using correlation analysis, which can be helpful in isolating potential genotypes under different environmental conditions. The genetic variability of yield and its components are important parameters in this respect.

MATERIALS AND METHODS

A field experiment was conducted to analyze the genotype x environment interaction for several economically important traits in bread wheat. Ten commercial wheat varieties (Mehran-89, Moomal-2002, Anmol-91, Pavon, Maxi-Pak, Abadgar-93, TJ-83, Yekora, ZA-77 and TD-1) were grown at two locations (Southern Wheat Research Station, Tando Jam and the Wheat Research Institute, Sakrand, Sindh, Pakistan) during the period 2010-11. The grain was sown in the field with three replicates in a randomized complete block design (RCBD) using a plot size of 1.2 m x 2.5 m (3.0 m^2). The sowing was conducted using a single counter hand-driven drill, and a spacing of 30 cm between rows and 15 cm between plants was maintained. At both locations, ten plants of each genotype in each replication were selected at random and tagged to record the data in the field and in the laboratory as follows: days to 75% flowering, days to 90% maturity, plant height, number of tillers/plant, spike length, number of spikelets/spike, number of grains/spike, seed index and grain yield/plant. A standard fertilizer dose of 134-77 kg N-P /hector was applied as follows: a full dose of phosphorus and a half dose of nitrogen was applied at the time of sowing, and the remaining half of nitrogen was divided into two and used as top dressings at the tillering and earhead emergence stages. Standard cultural practices including the use of herbicides etc. were adopted uniformly in all plots throughout the growing period. Statistical parameters including variances of means, coefficients of determination and regression coefficients were calculated for grain yield/plant at both locations.

Correlation and regression coefficients were determined as described by Snedecor (1956). The significance of correlation coefficients was ascertained using the Fisher “r” table.

RESULTS AND DISCUSSION

An experiment was conducted at the Wheat Research Institute, Sakrand and at the Southern Wheat Research Station, Tando Jam to assess the genotypes that are best suited for each region. The experiments used a Randomized Complete Block Design with three replications to determine the following quantitative traits: plant height, tillers per plant, spike length, spikelets per spike, grains per spike, seed index and grain yield per plant for the following ten commercial cultivars: Mehran-89, Moomal-2002, Anmol-91, Pavon, Maxi Pak, Abadgar-93, TJ-83, Yekora, ZA-77 and TD-1.

The analysis of variance presented in Table 1 shows that genotypes are highly significant ($P<0.01$) for all the studied characteristics. The effect of location over yielding was highly significant ($P<0.01$) for spikelets per spike, grains per spike, and seed index; moderately significant ($P<0.05$) for tillers per plant and spike length; and non-significant for plant height and grain yield per plant. The interaction of location with genotype was highly significant at the 0.01 level for tillers per plant, grains per spike and grain yield per plant; significant at the 0.05 level for spike length and seed index; and non-significant for plant height and spikelets per spike.

The mean performances of the genotypes are presented in Table 1 and reveal that the tallest plant (98.02 cm) and the longest spike (12.16 cm) was produced by Pavon, maximum tillers (13.20) were produced by TD-1, the maximum number of spikelets per spike (22.66) was produced by Yekora, the maximum number of grains per spike (73.46) was produced by Maxi Pak, the maximum seed index (3.72 g) was produced by Abadgar-93 and that the variety TD-1 out-yielded all other tested varieties, producing 15.33 grams of grain yield per plant at the Tando Jam site.

The mean performances of the genotypes are presented in Table 1 and reveal that the tallest plant (98.00) was produced by Abadgar-93; maximum tillers, seed index and grain yield per plant (13.27, 4.33 g and 16.06 g, respectively) were produced by TD-1; the longest spike (12.55 cm) was produced by Pavon; the maximum number of spikelets per spike (23.06) was produced by Yekora; and the maximum number of grains per spike (79.33) was produced by Maxi Pak at the Sakrand site.

Table 1. Average performance of the ten genotypes for the observed characteristics of *Triticum aestivum* L. (Tando Jam & Sakrand).

Genotypes		Plant Height		Tillers / Plant		Spike Length		Spikelets/ Spike		Grains / Spike		Seed Index		Grains Yield/Plant	
		Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand
Mehran-89		97.25 gh	95.55 h	5.46 ab	6.63 h	11.10fg	11.06ef	22.06f	21.46 ef	58.13 cd	52.33abc	3.65 hi	3.17 hi	14.84 hi	10.02 e
Moomal-2002		97.22 gh	93.58f	5.80abc	6.33 g	10.83f	11.03e	20.06ab	19.53c	66.0i	59.93ef	3.08c	3.78ef	9.99cd	10.35f
Anmol-91		93.52ef	93.78fg	7.73 h	5.57ab	10.4ab	9.95a	20.26abc	18.06ab	61.26e	49.76ab	3.21f	3.79 g	10.23e	7.02a
Pavon		98.02 h	95.38 hi	5.90e	6.30 f	12.16ig	12.55 ghi	21.73de	21.53 g	63.56 h	64.43 h	3.28 g	3.62d	10.89 g	12.43 gh
Maxi-Pak		87.38cd	88.03 c	5.83abcd	5.67abc	10.52d	11.83 g	21.53de	21.46ef	73.46ig	79.33 hi	3.12cd	3.45a	10.76f	12.25 g
Abadgar-93		95.77 g	98.0 i	4.80 a	5.90 d	10.58e	10.76d	20.80d	20.33e	50.56a	53.83a-d	3.72j	3.95 h	5.76a	8.91c
TJ-83		85.72 c	88.75 cd	6.26f	4.67 a	11.20fgh	10.72abc	20.80d	19.60cd	62.86 g	59.26ef	2.87ab	3.46ab	8.62c	7.93ab
Yekora		69.45ab	68.03 a	8.30 hi	6.90 i	11.33i	12.32 gh	22.26 g	23.06i	62.16ef	59.93ef	2.80a	3.55c	14.17 h	13.06i
Z.A-77		93.25 e	90.02 e	6.56fg	6.10 e	9.52a	10.72abc	21.73de	21.73 h	52.0ab	56.20e	3.17e	3.77e	6.10ab	9.46d
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SOV	DF	Mean Squares													
Location	1	5.83 ns		0.96 *		1.302 *		5.165 **		116.5 **		4.12 **		0.09 ns	
Replication	2	12.63		0.052		1.25		0.433		16.09		0.0075		0.1125	
Genotypes	9	720.44 **		32.54 **		3.111 **		9.97 **		351.77 **		0.45 **		45.55 **	
Interaction GxL	9	7.72 ns		1.97 **		0.67 *		1.027 ns		62.001 **		0.06 *		10.27 **	
Pooled Error	36	12.12		0.24		0.32		0.63		13.01		0.025		0.65	

Highly significant values of interaction between genotype and environment were recorded in the wheat varieties Mehran-89, Moomal-2002, Anmol-91, Pavon, Maxi-Pak, Abadgar-93, TJ-83, Yekora, Z.A-77 and T.D-1. These findings are consistent with results reported by Mondal and Khajuria (2002), Budak et al. (2003), Reynolds et al. (2004), Baric and Pecina (2004 b), and Yong et al. (2004). The named authors all studied genotype (G) x environment (E) interactions in wheat; the results obtained were broadly similar to those found here. The results for Abadgar-93 found here are consistent with the findings recorded by Sial et al. (2003), who studied environments (E), genotypes (G), and GxE interactions in terms of grain yield and observed that E and GxE interactions were highly significant. Our results showed that Mehran-89, Anmol-91, TJ-83, and Yekora performed better at the Tando Jam site whereas Moomal-2002, Pavon, Maxi-Pak, Abadgar-93, Z.A-77 and T.D-1 performed better at the Sakrand location. The performance of the genotypes reveals an interaction between genotype and environment.

Correlation and regression coefficient

The phenotypic correlation for yield and the characteristics contributing to yield are presented in Tables 2 and 3.

Plant height

Plant height exhibited a positive but non-significant correlation (r=0.04) with spike length, spikelets per spike (r=0.15) and seed index (r=0.046) at the Tando Jam site and negative but non-significant correlations (r=-0.06, r=-0.04 and r=-0.16, respectively) at the Sakrand site. On the other hand, plant height exhibited negative, non-significant correlations with tillers per plant (r=-0.80) and grains per spike (r=-0.03) at the Tando Jam site and negative, non-significant correlations with tillers per plant (r=-0.66) and grains per spike (r=0.17) at the Sakrand site.

Plant height exhibited a negative but non-significant correlation with grain yield per plant (r=-0.54). The coefficient of determination (r^2=0.29) for this correlation suggests that 29% of the variation in grain yield per plant is due to plant height under Tando Jam conditions; for every centimeter of increase in plant height, grain yield decreases by 0.15 grams (Table 2). At Sakrand (Table 3), plant height exhibited a negative but non-significant correlation with grain yield per plant (-0.71). The coefficient of determination for this correlation explains that

50% of the variation in grain yield is due to plant height (r^2 = 0.50), and the regression coefficient (b=-0.17) reveals that for every centimeter of plant height increase, grain yield decreases by 0.17 grams.

For these character combinations, the results found by the author in this investigation are completely consistent with the variation in grain yield per plant was due to the tillers per plant under Tando Jam conditions; for every increase of one tiller per plant, grain yield increased by 0.80 grams (Table 2). In contrast, at the Sakrand sit (Table 3), tillers per plant exhibited a positive but highly significant correlation with grain yield per plant (0.78). The coefficient of determination explains that 60% of the

Table 2. Simple correlations between the yields and yield-contributing characteristics of *Triticum aestivum* L. (Tando Jam & Sakrand).

Characters	Plant Height		Tillers / Plant		Spike Length		Spikelets/ Spike		Grains / Spike		Seed Index	
	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand
Plant height	1.00	1.00										
Tillers / plant	-0.80 ns	-0.66 ns	1.00	1.00								
Spike length	0.04 ns	-0.06 ns	-0.18 ns	-0.27 ns	1.00	1.00						
Spikelets/ spike	0.15 ns	-0.04 ns	-0.50 ns	-0.36 ns	0.28 ns	0.81 **	1.00	1.00				
Grains/ spike	-0.03 ns	0.17 ns	- 0.13 ns	-0.52 ns	0.37 ns	0.70 **	0.07 ns	0.54 *	1.00	1.00		
Seed index	0.046 ns	-0.16 ns	0.004 ns	0.77 **	-0.02 ns	-0.59 ns	-0.03	-0.50 ns	-0.08 ns	-0.80 ns	1.00	1.00
Grain yield/plant	-0.54 ns	-0.71 ns	0.57 **	0.78 **	0.37 ns	0.34 ns	0.02 ns	0.14 ns	0.28 ns	0.04 ns	0.006 ns	0.31 ns

results reported by Deswal et al. (1996), Ehdaie et al. (2001), Mittal and Sethi (2001), Singh et al. (2002), and Altinbas et al. (2004). The authors of the previously mentioned studies studied correlation coefficients and regression among these characteristics in wheat and reported that plant height was negatively correlated with wheat grain yield per plant at the different locations studied under various environments.

Tillers per plant

A positive but non-significant correlations (r=0.004) was observed between tillers per plant and seed index at the Tando Jam site but a highly significant and positive (r=0.77**) correlation was observed at the Sakrand site. Tillers per plant exhibited a negative but non-significant correlation (r=-0.18) with spike length, (r=-0.50) spikelets per spike and (r=-0.13) grains per spike at the Tando Jam site; the corresponding figures for the Sakrand site were (r=-0.27), (r=-0.36) and (r=-0.52), respectively.

Tillers per plant exhibited a positive but highly significant correlation with grain yield per plant (r=0.57). The coefficient of determination (r^2=0.32) explains that 32% of the variation in grain yield was due to tillers per plant (r^2=0.60), and the regression coefficient (b=0.90) revealed that grain yield increased by 0.90 grams for every 1-tiller per plant increase.

Deswal et al. (1996), Ibrahim (2004), Yadaw and Choudhary (2004), and Safeer-ul-Hassan et al. (2005) studied the correlations and regressions among the number of tillers per plant, spike length, spikelets per spike, grains per spike and seed index with grain yield per plant for various genotypes of wheat under various environments; the results are similar to those found in the present research work. Madariya et al. (2002) observed a positive but highly significant correlation between tillers per plant and grain yield per plant under various environmental conditions for wheat and recorded similar results.

Spike length

Spike length exhibited a positive but non-significant correlation with spikelets per spike (r=0.28) and grains per spike (r=0.37) at the Tando Jam site and exhibited a highly significant and positive correlations (r=0.81**) and (r=0.70**), respectively, at the Sakrand site. Table 2 shows that there was a negative but non-significant correlation (r=-0.02) between spike length and seed index at the Tando Jam site, whereas a value of r=-0.59 was found for the Sakrand site.

Spike length exhibited a positive but non-significant correlation with grain yield per plant (r=0.37). The coefficient of determination (r^2=0.13) explains that 13% of the variation in grain yield per plant was due to spike length under Tando Jam conditions and that every increase of one centimeter in spike length produces 2.01 grams of grain yield increase. In contrast, under the Sakrand environment, spike length exhibited a positive but non-significant correlation (0.34) with gain yield per plant. The coefficient of determination exhibited that 11% of the variation in grain yield was due to spike length (r^2=0.11), and the regression coefficient (b=1.22) revealed that every increase of one centimeter in spike length produces 1.22 grams of grain yield increase.

Gupta et al. (2002), Singh et al. (2002a), Najeeb et al. (2004) and Deshtaki et al. (2004) studied the correlations and regressions among the number of tillers per plant, spike length, spikelets per spike, grains per spike and seed index with grain yield per plant for various genotypes of wheat under various environments and reported results that are similar to those found in the present research work.

Table 3. Correlations, coefficients of determination and regression coefficients for the yields and yield components of Triticum aestivum L. (Tando Jam and Sakrand).

Characters	Correlation (r)		Coefficient of determination (r^2)		Regression (byx)	
	Tando Jam	Sakrand	Tando Jam	Sakrand	Tando Jam	Sakrand
Plant height	-0.54	-0.71	0.29	0.50	-0.15	-0.17
Tillers per plant	0.57	0.78	0.32	0.60	0.80	0.90
Spike length	0.37	0.34	0.13	0.11	2.01	1.22
Spikelets / spike	0.02	0.14	0.0004	0.019	0.30	0.30
Grains / spike	0.28	0.04	0.07	0.0016	0.15	0.02
Seed index	0.006	0.31	0.00003	0.09	0.02	3.67

Spikelets per spike

Spikelets per spike exhibited a positive but non-significant correlation with grains per spike (r=0.07) at the Tando Jam site but a significant positive correlation (r=0.54*) at the Sakrand site. A negative but non-significant correlation (r=-0.03) was observed between spikelets per spike and seed index at Tando Jam site, whereas a value of r=-0.50 was found for the Sakrand site.

Spikelets per spike exhibited a positive but non-significant correlation with grain yield per plant (r=0.02). The coefficient of determination (r^2=0.0004) explains that 0.04% of the variation in grain yield per plant was due to the spikelets per spike under Tando Jam conditions and that for every increase of one spikelet per spike, grain yield increases by 0.30 grams (Table 2). In the Sakrand environment (Table 3), spikelets per spike exhibited a positive but non-significant correlation with grain yield per plant (0.14). The coefficient of determination exhibited that 1.9% of the variation in grain yield was due to spikelets per spike (r^2=0.019), and the regression coefficient (b=0.30) revealed that for every one spikelet increase, grain yield increases by 0.30 grams.

Deswal et al. (1996), Gupta et al. (2002), Singh et al. (2002a), Ibrahim (2004), Yadaw and Choudhary (2004), Najeeb et al. (2004), Deshtaki et al. (2004), and Safeer-ul-Hassan et al. (2005) studied the correlations and regressions among the number of tillers per plant, spike length, spikelets per spike, grains per spike and seed index with grain yield per plant for various genotypes of wheat under various environments and reported results that are similar to those found in the present research work.

Grains per spike

Negative but non-significant correlation (r=-0.08) between grains per spike and seed index at Tando Jam site, whereas a value of r=-0.80 was found for the Sakrand site.

Grains per spike exhibited a positive but non-significant correlation with grain yield per plant (r=0.28). The coefficient of determination (r^2=0.07) explains that 7% of the variation in grain yield per plant was due to grains per spike under Tando Jam conditions and that for every increase of one grain per spike, grain yield increases by 0.15 grams (Table 2). In the

Sakrand environment (Table-3), grains per spike exhibited a positive but non-significant correlation with grain yield per plant (0.04). The coefficient of determination explains that 0.16% of the variation in grain yield is due to grains per spike (r^2=0.0016), and the regression coefficient (b=0.02) revealed that for every increase of one grain per spike, grain yield increased by 0.02 grams.

Deswal et al. (1996), Gupta et al. (2002), Singh et al. (2002a), Ibrahim (2004), Yadaw and Choudhary (2004), Najeeb et al. (2004), Deshtaki et al. (2004), and Safeer-ul-Hassan et al. (2005) studied the correlations and regressions among the number of tillers per plant, spike length, spikelets per spike, grains per spike and seed index with grain yield per plant for various genotypes of wheat under various environments and reported results that are similar to those found in the present research work.

Seed index

Seed index exhibited a positive but non-significant correlation with grain yield per plant (r=0.006). The coefficient of determination (r^2=0.00003) explains that 0.003% of the variation in grain yield per plant was due to seed index under Tando Jam conditions and that for every increase of one grain in seed index, grain yield increased by 0.02 grams (Table 2). In the Sakrand environment (Table 3), seed index exhibited a positive but non-significant correlation with grain yield per plant (r=0.31). The coefficient of determination explains that 9% of the variation in grain yield was due to seed index (r^2=0.09), and the regression coefficient (b=3.67) revealed that for every one gram of seed index increase, grain yield increased by 3.67 grams.

Deswal et al. (1996), Gupta et al. (2002), Singh et al. (2002a), Ibrahim (2004), Yadaw and Choudhary (2004), Najeeb et al. (2004), Deshtaki et al. (2004), and Safeer-ul-Hassan et al. (2005) studied the correlations and regressions among the number of tillers per plant, spike length, spikelets per spike, grains per spike and seed index with grain yield per plant for various genotypes of wheat under various environments and reported results that are similar to those found in the present research work.

Conclusion

It is concluded that the variety T.D-1 out-yielded all other varieties at both sites (Tando Jam and Sakrand). The outstanding grain yield produced by T.D-1 demonstrated it is a better genotype. Yekora and Pavon performed better at Tando Jam, whereas Pavon and Maxi-Pak performed better at Sakrand. Hence, these genotypes are recommended for use in cultivation.

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