

Evaluation of Wheat (*Triticum aestivum* L.) Varieties for Their Potential Grain Yield under the Agro-ecological Conditions of D.I.Khan

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Abstract: Ten wheat (*Triticum aestivum* L.) varieties viz., Inqalab-91, Sulaiman-96, Bakhtawar-92, Punjab-96, Pirsabak-91, Daman-98, Sarsabz, Sughat, MH-97 and Dera-98 were compared for different agronomic traits. Daman-98 produced maximum 1000-grain weight and minimum number of fertile tillers m^{-2} . Inqalab-91 showed maximum germination counts m^{-2} , grains per spike, grain yield and harvest index, while maximum number of fertile tillers m^{-2} were observed in Sughat. Inqalab-91 proved to be the best yielding variety for D.I. Khan among all tested varieties and Bakhtawar-92, Pirsabak-91, Sughat, MH-97 and Dera-98 can be grown successfully to obtain better grain yields than the remaining wheat varieties.

Key words: Wheat varieties evaluation, potential grain yield, D. I. Khan

Introduction

Pakistan has over 135 million population which is increasing at the rate of about 3% annually. Wheat requirements are progressively increasing every year due to population explosion and stagnant per hectare yields. About 37% total cropped area is devoted to wheat cultivation in Pakistan and per hectare yield is low when compared to advanced countries like USA, France, China and Russia. New high yielding varieties with tolerance to biotic and abiotic stresses are desperately needed to enhance and stabilize wheat production. Shamsuddin, 1987 and Pianchi *et al.* (1987) also reported that spikes per plant, grains per spike, 1000-grain weight, harvest index, glume weight and biological yield were directly related to grain yield of bread wheat. Variety evolution includes consideration of yield components as Zaheer (1991) suggested that selection for high yield might be effective by simultaneous improvement of yield determinants like plant height, number of tillers per plant, number of grains per spike and seed index and yield could be increased through the selection of plants with more spikelets per spike.

The study was undertaken to test the performance of ten wheat varieties regarding their yield components for obtaining maximum grain yield in D.I. Khan.

Materials and Methods

The research was conducted at the agronomic research area of Faculty of Agriculture, Gomal University, D. I. Khan, during the year 1999-2000. Wheat varieties viz. Inqalab-91, Sulaiman-96, Bakhtawar-92, Punjab-96, Pirsabak-91, Daman-98, Sarsabz, Sughat, MH-97 and Dera-98 were evaluated for their agronomic characteristics under the agro-ecological conditions of D.I. Khan. The experiment was laid out in a Randomized Complete Block Design (RCBD) having 4 replications by using a net plot size of 1.8×4 m². Field area was ploughed twice, firstly, with rotavator and then with cultivator followed by planking to ensure a firm seedbed. Ten wheat varieties were sown in rows 30 cm apart. Crop was sown with the seed rate of 115 kg ha^{-1} . Fertilizers to supply 135 and 55 kg NP ha^{-1} , respectively, were applied in the form of Urea and DAP. All the phosphorus and half of the nitrogen were applied at the time of sowing, while the remaining nitrogen was applied with first and second irrigation. Crop received four irrigations timed appropriately to suit the crop requirements. A weedicide namely "Quatro" at the rate of 750 ml/acre was sprayed before the tillering stage of wheat to control weeds. All agronomic practices were kept uniform for

all treatments. The data were collected on the following parameters:

- Germination counts m^{-2} .
- Plant height (cm) at maturity.
- Number of fertile tillers m^{-2} .
- Number of spikelets per spike.
- Number of grains per spike. 1000-grain weight (g).
- Biological yield (t ha^{-1}).
- Grain yield (t ha^{-1}).
- Straw yield (t ha^{-1}).
- Harvest index (%).

Germination counts m^{-2} were taken from 2 randomly selected unit areas in each plot and average was recorded out. These selected areas were marked and data on other parameters like plant height and fertile tillers m^{-2} were also recorded from these selected areas. 10 spikes were selected from the same selected areas and data on number of spikelets per spike, number of grains per spike and 1000-grain weight were recorded. Crop of each plot was harvested manually and tied into bundles. The biological yield was recorded in kilograms and then converted into t ha^{-1} . Bundles were first dried and then threshed separately. The grain and straw weight of each plot was recorded in kg and then converted into t ha^{-1} . Harvest index of each plot was also calculated. The data collected were analyzed by using the analysis of variance techniques (Steel and Torrie, 1984) and the Duncan's New Multiple range test was used to determine the significance of treatment means (Duncan, 1955).

Results and Discussion

Germination counts m^{-2} : Data in Table 1 revealed that there were significant differences in germination counts m^{-2} among different wheat varieties. Inqalab-91 produced the highest number of seedlings m^{-2} (266.60), which differed significantly from Punjab-96 (166.60) and Daman-98 (145.80). Sulaiman-96, Bakhtawar-92, Pirsabak-91, Sarsabz, Sughat, MH-97 and Dera-98 were however, statistically similar with each other in number of seedling m^{-2} and statistically at par with Inqalab-91. The minimum number of seedlings m^{-2} was produced by Daman-98. Variation in germination counts per unit area might be due to genetic variation in germination capability from variety to variety.

Plant height (cm) at maturity: The maximum plant height (116.10 cm) was observed in Sulaiman-96, which was significantly taller than all other varieties except Sarsabz however, statistically similar in plant height. Bakhtawar-92,

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(110.90 cm) (Table 1). Sarsabz, Daman-98 and Dera-98 were, MH-97 and Inqalab-91 were also very much close in plant height with one another. The differences in plant height among various varieties were in general, due to their genetic constitution. These results are in consonance with the results of Khan *et al.* (1992) and Muhammad *et al.* (1999).

Number of fertile tillers m^{-2} : Maximum number of fertile tillers m^{-2} (462.00) was produced by Sughat, which differed significantly from various varieties. Inqalab-91, Sughat, MH-97 and Dera-98 were, however, statistically similar in producing fertile tillers m^{-2} (Table 1). Inqalab-91, Pirsabak-91, Sulaiman-96, Bakhtawar-92 and Sarsabz proved to be intermediate varieties in producing fertile tillers m^{-2} . The minimum number of fertile tillers m^{-2} (239.00) was produced by Daman-98, which also has low seedling emergence potential. These results are in conformity with the findings of Ghanem *et al.* (1994), who also observed significant differences in number of fertile tillers per unit area among different varieties.

Number of spikelets per spike: Maximum number of spikelets per spike (22.30) was produced by Punjab-96, while the minimum number of spikelets per spike (18.20) was produced by MH-97 (Table 1). Inqalab-91, Bakhtawar-92, Pirsabak-91, Daman-98, Sarsabz and Sughat were statistically at par with the production of the number of spikelets per spike. These results agreed with those of Adnan and Bhutta (1994) and Tahir *et al.* (1995), who all reported that number of spikelets per spike differed significantly in various genotypes of wheat

Number of grains per spike: The results pertaining to number of grains per spike presented in Table 2 revealed that Inqalab-91 produced the maximum number of grains per spike (74.40), which differed significantly from all other varieties except Bakhtawar-92 (69.70) and Daman-98 (68.22). All varieties produced number of grains per spike above 50. The minimum number of grains per spike was recorded in Sulaiman-96 (51.05). The differences in number of grains per spike were probably due to variation in genetic potential from variety to variety. Shahzad *et al.* (1998) and Muhammad *et al.* (1999) also observed significant differences in grains per spike among different varieties.

1000-grain weight (g): Maximum 1000-grain weight (51.01 g) was observed in Daman-98, which differed significantly from all other varieties (Table 2) except Sulaiman-96 (47.05 g). However, Sulaiman-96, Punjab-96 and Pirsabak-91 were statistically at par with each other regarding their 1000-grain weight. All other varieties showed non-significant differences in 1000-grain weight among themselves. The minimum 1000-grain weight of 37.22 g was recorded in MH-97. Muhammad *et al.* (1999) also reported similar results.

Biological yield ($t ha^{-1}$): It is evident from the data (shown in Table 3) that no significant differences were found among different varieties for their biological yield. The average biological yield varied from 11.98 $t ha^{-1}$ to 14.06 $t ha^{-1}$ among various varieties. Although there were no significant differences but Pirsabak-91, Punjab-96, Sarsabz and Dera-98 were higher in the biological yield as compared to others. Razzaq *et al.* (1986) also observed non-significant differences in the biological yield among various cultivars.

Grain yield ($t ha^{-1}$): Inqalab-91 produced the maximum grain yield (6.80 $t ha^{-1}$) which differed significantly from Sulaiman-96, Daman-98, Punjab-96 and Sarsabz (Table 3). All other

Table 1: Germination counts m^{-2} , plant height at maturity and fertile tillers m^{-2} of different wheat varieties.

Varieties	Germination counts m^2	Plant height at maturity (cm)	Fertile tillers m^2
Inqalab-91	266.60 a*	94.49 e*	374.50 abc*
Sulaiman-96	246.10 ab	116.10 a	367.80 bc
Bakhtawar-92	233.80 abc	95.01 e	345.30 bc
Punjab-96	166.60 cd	97.18 de	290.00 cd
Pirsabak-91	198.10 abcd	101.10 cde	358.00 bc
Daman-98	145.80 d	108.40 bc	239.00 d
Sarsabz	219.10 abc	110.90 ab	323.80bcd
Sughat	264.50 a	97.81 de	462.00 a
MH-97	211.50 abcd	94.91 e	421.00 ab
Dera-98	223.90 abc	104.10 bcd	407.50 ab

* Means not sharing a letter in common differ significantly at 1% level of probability.

Table 2: Spikelets per spike, grains per spike and 1000-grain weight of different wheat varieties.

Varieties	Spikelets Per spike	Grains per spike	1000-grain weight
Inqalab-91	21.75 ab*	74.40 a*	38.67 de*
Sulaiman-96	19.40 cde	51.05 d	47.05 ab
Bakhtawar-92	21.35 ab	69.70 ab	39.68 cde
Punjab-96	22.30 a	60.92 bc	45.77 b
Pirsabak-91	21.23 ab	63.45 bc	42.85 bcd
Daman-98	20.92 abc	68.22 ab	51.05 a
Sarsabz	21.33 ab	63.30 bc	38.35 de
Sughat	20.08 bcd	56.85 cd	38.31 de
MH-97	18.20 e	55.10 cd	37.22 e
Dera-98	19.10 de	57.85 cd	39.97 cde

* Means not sharing a letter in common differ significantly at 1% level of probability.

Table 3: Biological yield, grain yield, straw yield and harvest index (%) of different wheat varieties

Varieties	Biological yield ($t ha^{-1}$)	Grain yield ($t ha^{-1}$)	Straw yield ($t ha^{-1}$)	Harvest index (%)
Inqalab-91	13.89 ns	6.80 a*	7.08 abc*	51.01 a*
Sulaiman-96	13.89	5.88 bc	8.01 abc	42.59 bc
Bakhtawar-92	13.71	6.27 ab	7.45 abc	45.80 ab
Punjab-96	14.06	5.70 bc	8.26 abc	41.81 bc
Pirsabak-91	14.06	6.44 ab	7.62 abc	45.84 ab
Daman-98	11.98	5.81 bc	6.16 c	48.71 ab
Sarsabz	14.06	5.33 c	8.73 a	38.22 c
Sughat	12.84	6.56 ab	6.28 bc	51.08 a
MH-97	13.54	5.97 abc	7.57 abc	44.61 abc
Dera-98	14.06	6.25 ab	7.81 abc	44.44 abc

* Means not sharing a letter in common differ significantly at 1% level of probability. ns: Non significant.

varieties were statistically at par with each other regarding the grain yield. Sarsabz produced the minimum grain yield (5.33 $t ha^{-1}$). The higher grain yield in Inqalab-91 and Bakhtawar-92 may be attributed to having more numbers of ears per unit area and the highest number of grains per spike over other varieties. Pirsabak-91 proved to be the third best variety regarding the grain yield because of higher ear population, grains per spike and 1000-grain weight as compared to other varieties. Tahir *et al.* (1995) and Muhammad *et al.* (1999) also observed significant differences in the grain yield among different varieties.

Straw yield ($t ha^{-1}$): Variety Sarsabz having straw yield of 8.73 $t ha^{-1}$ was followed by Punjab-96 (8.26 $t ha^{-1}$) (Table 3), statistically at par with each other regarding straw yield. The minimum straw yield (6.16 $t ha^{-1}$) was produced by Daman-98. These results are in conformity with the findings of Sharar *et al.* (1986).

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Harvest Index (%): The ability of a variety to convert the total dry matter into economic yield is indicated by its harvest index value. Higher the harvest index value, greater is the physiological potential for converting the total dry matter into grain yield. Table 3 showed that Sughat and Inqalab-91 gave the maximum harvest index of 51.08% and 51.01%, respectively, followed by Daman-98 (48.71%). The minimum harvest index value (38.22%) was recorded in Sarsabz. Pirsabak-91, Bakhtawar-92, MH-97 and Dera-98 were also better in harvest index value.

The wheat variety Inqalab-91 proved to be the best variety regarding its grain yield. As far as, harvest index of these varieties is concerned, Inqalab-91 and Sughat were found to be the most efficient varieties in converting assimilates into the grain yield.

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