

# Growth, Yield and Components of Yield of different Genotypes of Wheat

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## ABSTRACT

Effect of different genotypes of wheat (*Triticum aestivum* L.) on growth, grain yield and components of yield was investigated during 1997-98 season. The cv. Inqalab-91 gave higher grain yield of 5.70 t ha<sup>-1</sup>, followed by Pasban-90 at 5.63 t ha<sup>-1</sup> over cv. Pak.81 (4.85 t ha<sup>-1</sup>). This was due to higher number of fertile tillers in the former than in the latter as mean grain weight did not vary among different genotypes. The results also emphasize the feasibility of different yield components of wheat.

**Key Words:** Grain yield; Yield components; Growth; Genotypes; Wheat

## INTRODUCTION

Yield of wheat can be increased by two ways, i.e. either by bringing more land area under cultivation or by increasing its yield per unit area. Currently, it is not possible to increase area under wheat due to other competitive rabi crops. The only alternative is to obtain higher yield per unit area by growing new high yielding varieties and better crop management.

The increased grain yield of wheat and other cereals in many countries during the past three to four decades have been associated with increasing use of inputs like fertilizer (by increasing total biological yield) and with new genotypes in which the harvest index is higher. This genetic improvement in yield of wheat varieties is associated with a shorter length of straw and a greater harvest index (Austin *et al.*, 1980). Harvest index is, however, dependent on phenological, physiological and environmental effects. Thus, grain yield is better analysed in terms of a number of components determining yield.

The yield of wheat is affected by genetic, physical and biotic factors. The evaluation of cultivars for yield performance is influenced by soil type, climate and presence of diseases and other harmful agents. The cultivar evaluation trials are carried out to provide a basis for the recommended lists of varieties being released for general cultivation in many countries including Pakistan (Qari *et al.*, 1990; Anonymous, 1996). The objective of such list is to help growers choose cultivars which are most likely to give them the maximum returns under their agro-climatic conditions.

It is now well established that grain yield in wheat should be considered as being made up of various components and that they in turn are influenced by cultivar, husbandry practices and environment acting

through physiological processes (Langer & Dougherty, 1976).

Keeping above facts in view, a field study was conducted to compare the growth, grain yield and components of yield of different genotypes of wheat under agro-ecological conditions of Faisalabad.

## MATERIALS AND METHODS

A field investigation was carried out to determine the comparative growth, yield and components of yield of six genotypes of wheat at the Agronomic Research Area, University of Agriculture, Faisalabad, during 1997-98. Experiment was laid out in RCBD with four replications using the net plot size of 1.20m x 8m. Six varieties i.e. Pak-81, Faisalabad-85, Rohtas-90, Pasban-90, Inqalab-91 and Perwaz-94 were used as treatments in the experiment.

The crop was sown with the help of single row hand drill on 15 November 1997. Row to row distance was 30 cm. A basal dose of fertilizer was applied @ 120-100-100 kg NPK ha<sup>-1</sup> in the form of urea, DAP and K<sub>2</sub>O, respectively at the time of seed bed preparation. All other agronomic practices such as weeding, hand hoeings etc. were kept normal and uniform. Data on different growth parameters, seed yield and components of yield were collected, and analysed statistically using Fisher's analysis of variance technique. LSD test was applied for comparison of treatment means (Steel & Torrie, 1984).

## RESULTS AND DISCUSSION

**Plant height.** Plant growth is generally measured in terms of plant height. The data presented in Table I revealed that plant height was significantly affected among various cultivars. The maximum plant height of

109.1 cm was recorded in cv. Rohtas-90 which was significantly taller than all other varieties. Pak-81, Faisalabad-85, Pasban-90 and Inqalab-91 were, however, at par in plant height. The minimum plant height (78.5 cm) was recorded in cv. Perwaz-94. Overall, average plant height was 88.00 cm in this study (Table I). The differences in plant height among various cultivars are in general, due to their genetic constitution. These results are in line with those of Afzal and Nazir (1986) and Ahmad (1991), who also reported that plant height significantly varied among different genotypes of wheat.

**Number of fertile tillers (m<sup>-2</sup>).** Final grain yield of wheat is mainly a function of the number of spikes bearing tillers (fertile tillers) per unit area at harvest. Fertile tillers per unit area (m<sup>-2</sup>) significantly varied among various cultivars (Table I). The highest number of fertile tillers at 540 m<sup>-2</sup> was observed in Perwaz-94 which differed significantly from Rohtas-90 (413), Pasban-90 (389) and Inqalab-91 (409). The genotypes Pak-81, Rohtas-90, Pasban-90 and Inqalab-91 produced statistically same number of fertile tillers per unit area

cultivars of wheat have been found to produce more grains per spikelet than old tall varieties probably due to more favourable distribution of assimilate to the ear. Generally, new semi dwarf cultivars partition more DM to the ears and less to the stem, and this is reflected in more fertile florets and grains per spikelet than in general standard cultivars. Many workers reported a range of grain number varying from 40 to 59 grains per spike among different genotypes of wheat (Hussain *et al.*, 1997; Jabbar *et al.*, 1999).

**1000-grain weight.** No significant differences in 1000-grain weight were found among different cultivars (Table I). The grain weight varied from 44.7 to 50.5 g/1000-grain for various genotypes. Overall, mean grain weight was 47.8/1000-grains in this study. These results are similar with the findings of Afzal and Nazir (1986) and Sharar *et al.* (1989). Hussain *et al.* (1997) reported mean grain weight at 38-51 g/1000 grains among various genotypes.

**Harvest index.** The ability of a cultivar to partition the dry matter into economic (grain) yield is indicated by its

**Table I. Effect of different genotypes of wheat on grain yield and components of yield**

Genotypes	Plant height (cm)	Fertile tiller (m <sup>-2</sup> )	Grains per spike	1000-grain weight (g)	Harvest index (%)	Total dry matter (t ha <sup>-1</sup> )	Grain yield (t ha <sup>-1</sup> )
Pak-81	87.5 b	343 b	48.9 a	44.7 <sup>NS</sup>	0.47 ab	10.3 d	4.85 bc
Faisalabad-85	85.2 bc	439 b	43.0 b	48.8	0.49 a	11.3 bc	5.58 a
Rahotas-90	109.1 a	413 b	45.8 a	45.6	0.47 ab	11.6 bc	5.50 ab
Pasban-90	86.0 bc	389 b	46.3 a	50.2	0.46 ab	12.3 b	5.63 a
Inqalab-91	81.2 bc	409 b	46.8 a	50.5	0.42 bc	13.5 a	5.70 a
Perwaz-94	78.5 c	540 a	35.1 c	47.0	0.41 c	11.0 cd	4.52 c
LSD 5%	7.1	109	5.7	-	0.05	1.0	0.66
Mean	88.0	447.37	44.3	47.8	0.45	11.7	5.30

Any two means sharing different letters differ significantly by LSD test at 5% level

(m<sup>-2</sup>). The minimum number of fertile tillers at 343 m<sup>-2</sup> was given by cv. Pak-81. Overall, average number of fertile tillers was 447 m<sup>-2</sup> in this study, which are slightly less than the number of tillers (506) reported by Hussain *et al.* (1997) among various genotypes.

**Number of grains per spike.** Number of grains per spike is an important yield contributing factor of wheat which is significantly influenced by the prevailing growing conditions and genetic potential of a cultivar. The maximum number of grains per spike (48.96) was produced by cv. Pak-81 which differed significantly from cv Faisalabad-85 and Perwaz-94 which produced the minimum (43,35) grains per spike (Table I). Similarly, Pasban-90 and Inqalab-91 were also at par in the number of grains with each other. The mean number of grains per spike was at 44.3 in this study (Table I). The difference in grain number per spike were probably due to the variation in their genetic potential. New

harvest index (HI) significantly varied among various genotypes (Table I). The cv. Pak.81 and Pasban-90 were, however, superior in HI than Perwaz, but statistically at par with cv. Inqalab-91. The cv. Perwaz significantly gave the lowest (0.41) HI than other genotypes except cv. Inqalab-91 where both genotypes were at par in HI. The average HI values of 41-49% are similar to those (41-47%) for different genotypes of wheat under Faisalabad conditions, reported by others (Ahmad, 1991; Hussain *et al.*, 1997).

**Total dry matter.** Total dry matter (TDM) yield was found significantly different among various genotypes of wheat (Table I). The cv. Inqalab-91 produced the highest TDM at 13.5 t ha<sup>-1</sup> which was followed by cv. Pasban-90 (12.3 t ha<sup>-1</sup>), Rohtas-90 (11.6 t ha<sup>-1</sup>) and Faisalabad-85 (11.3 t ha<sup>-1</sup>). Both cv. Pak.81 and Perwaz-94 produced the lowest TDM than all other genotypes. Overall, average TDM was 11.7 t ha<sup>-1</sup> which compares

favourably with the values of 9.5 to 15.0 t ha<sup>-1</sup>, reported by others (Razzaq *et al.*, 1986; Hussain *et al.*, 1997).

**Grain yield.** Grain yield is a function of interplay of various yield components such as number of fertile tillers per unit area, number of grains per spike and 1000-grain weight. It is evident from the Table I that there were significant differences among various wheat cultivars regarding grain yield per hectare. The cv. Inqalab-91 produced maximum grain yield of 5.70 t/ha followed by Pasban-90 (5.63 t) which were at par statistically with each other. The higher grain yield in Inqalab-91 or Faisalabad-85 over Pak-81 or Parwaz-94 may be attributed to their higher number of grains spike<sup>-1</sup>. The mean grain weight was also higher in these cultivars over Pak-81 or Parwaz-94 although the differences in mean grain weight did not reach at statistical significance. Yield variation can be associated with changes in any one of these components. The yield components tend to compensate as ear population and grain set are inversely related. The minimum grain yield of 4.52 t ha<sup>-1</sup> was given by cv. Perwaz-94 which was statistically at par with cv. Pak-81 (4.85 t). The genotypes Pak-81 and Rohtas-90 were also superior in grain yield than cv. Perwaz-94 (Table I). Overall, average grain yield was 5.30 t/ha in this experiment (Table I). Many workers have reported similar yield level among different genotypes of wheat (Afzal & Nazir, 1986; Hussain *et al.*, 1997), working under agro-ecological conditions of Faisalabad.

## CONCLUSION

Wheat cv. Inqalab-91 proved to be the best yielder than all other genotypes under Faisalabad conditions.

## REFERENCES

- Afzal, M. and M.S. Nazir, 1986. Response of two semi dwarf wheat varieties to sowing dates. *J. Agric. Res.*, 24: 110-14.
- Ahmad, Z., 1991. Effect of irrigation and cultivar on the growth and yield of wheat. M.Sc.(Hons.) Agri. Thesis, Univ. Agri., Faisalabad, Pakistan.
- Anonymous, 1996. Annual Report. Ayub Agricultural Research Institute, Faisalabad, Pakistan.
- Austin, R.B., J. Bingham, R.D. Blackwell, L.T. Evens, M.A. Ford, C.L. Morgan and R.D. Taylor, 1980. Genetic improvement in winter wheat yields since 1900 and associated physiological changes. *J. Agric. Sci. Camb.*, 94: 675-89.
- Hussain, A., M. Maqsood, A. Ahmad, A. Wajid and Z. Ahmad, 1997. Effect of irrigation during various development stages on components of yield and harvest index of different wheat cultivars. *Pakistan J. Agric. Sci.*, 34: 104-7.
- Jabbar, A., M. Saeed and A. Gaffar, 1999. Agro-chemical weed management in wheat. *Pakistan J. Agric. Sci.*, 36: 33-8.
- Langer, R.H.M. and C.T. Dougherty, 1976. Physiology of grain yield in wheat. *In: Perspectives in Experimental Biology*, Sunderland, N. (ed.), Volume 2, Botany. Oxford. Pergamon Press, pp: 59-67.
- Qari, N.S., N.A. Khan and M.A. Bajwa, 1990. Comparison of wheat cultivars for stability in yield performance. *Pakistan J. Agri. Res.*, 11: 73-6.
- Razzaq, A., B.R. Khan, P.R. Hobbs and N.I. Hashmi, 1986. Comparison of morphological and physiological parameters of wheat cultivars under rainfed conditions. *Pakistan J. Agric. Res.*, 7: 148-58.
- Sharar, M.S., M. Yaqub and M. Ayub, 1989. Growth and yield of five wheat genotypes as influenced by different irrigation frequencies. *Pakistan Sci. Ind. Res.*, 2: 344-5.
- Steel, R.G.D. and J. H. Torrie, 1984. Principles and Procedures of Statistics. McGraw Hill Book Co. Inc., Singapore, pp: 172-7.

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