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YIELD AND QUALITY OF WHEAT AS INFLUENCED BY ENVIRONMENT

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ABSTRACT

Several new promising wheat varieties viz. Pb–81, V–1308, V–5149, V–1302, V–1314, Sakha–8, V–5444 and Blue Silver were tested for yield, protein content, protein harvest and 1000 kernel weight at 8 locations in the irrigated areas of the Punjab. With the exception of protein content, significant differences were revealed due to locations for grain yield, protein harvest and 1000 kernel weight. Significantly higher grain yield (1764 kg/acre) as well as protein harvest (215.34 kg/acre) were obtained at Kasur, while 1000 kernel weight (46.77 gm) were obtained at Sargodha as compared to other test sites. Non-significant differences in varieties for all the traits studied indicated that tested varieties were similar in yield and quality characteristics.

INTRODUCTION

The yield and grain quality characters are reported to be influenced by environmental conditions prevailing during vegetative and reproductive stages (Kent, 1975). The environmental conditions not only reflect upon the grain and protein harvest but also affect the nutritional and technical quality of the produce as reported by Ullah *et al*. (1980).

The studies conducted by Campbell and Lafever (1980) revealed that in many seasons, climatic conditions were more limiting than the fertility of the soil, but some varities gave stable yield responses over the years the more than 12 locations. On the other hand, Liang *et al.* (1966) reported a significant variety and location interaction for wheat and barley over 3 years. Army and Hason (1960)concluded from their studies that high temperature adversely influenced the yield of some of the wheat varieties in the plains of Montana after heading. This points to the development of varieties which are stable over a wide range of climate. High temperature during ripening has also been said to

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be harmful to wheat quality (Finley and Fryer, 1958).

Johnson (1978) reported that some varieties gave considerably higher grain yield and protein content under different climates. He further stated that lysine content in whole meal of wheat was directly correlated with protein content. Hence the interest in the grain quality factors, i. e. protein content of whole wheat grain is justifiable from the yield and nutritional points of view.

The present study evaluated the performance of new short duration wheat varieties for their yield, protein content, protein harvest and 1000 kernel weight over a range of environment prevailing in the central Punjab and to determine the feasibility of reducing testing sites.

MATERIALS AND METHODS

The testing material was comprised of eight wheat varieties including check. The parentage and pedigree of these varieties are given below:

S. No.	Variety code	Parentage/pedigree
1.	Pb—81	Inia/Son64—P4160 (E)/Son64 Pk. 6841—2a—2a—Oa
2.	V—5149	Cno 's'—LR64xSon64 (Amb) Pk:6149—1b—Ob—ka—8b—8b
3.	V—1302	Bb/LR64—Son64xTob65 Pk:13421—1a—5a—Oa
4.	V—1308	' bxCno 's'—Gallo Pk:15503—19a—Oa
5.	V—1314	(6134—C271) Cno's'—No66 Pk:1/571—47a—Oa
6.	Sakha—8	
7.	V—5444	23584/Nai—319—209
8.	Blue Silver	1154—388—An (Vt. 54—N10BxLR64) 11—18427

The sowing was done from December 4 to 17 during 1979–80 at 8 different locations in Kasur, Lahore, Sheikhupura, Gujranwala, Sialkot, Faisalabad, Jhang and Sargodha Districts in the Punjab. Experiment was laid out following randomised complete block design with four replications and a gross plot

size of 44'x12'. Out of this a net plot size measuring 11'x6' was harvested for final evaluation of yield. The seed was used at the rate of 40 kg/acre and all the varieties received a fertilizer dose of 55 – 40 – 0 kg/acre at planting time. Harvesting was done during the 3rd week of April, 1980.

Samples of 500 gm were drawn from each variety at harvest. The 1000 kernel weight was determined after counting and weighing using a sensitive electronic balance. The protein content was estimated by Kjeltec system II by following the procedure of Mossberg (1969). The data were subjected to statistical analysis according to Snedecor (1962).

RESULTS AND DISCUSSION

The data for grain yield, protein content, protein harvest and 1000 kernel weight are presented in Tables 1, 2, 3 and 4, respectively. The effect of varieties and locations on these traits are discussed below:

GRAIN YIELD

The grain yield was significantly affected by environment (Table 1) and was the highest at Kasur (1764 kg/acre) and the lowest (738kg/acre) at Sargodha. The yield at Gujranwala, Sheikhupura and Faisalabad was found to be similar indicating that this areacould be considered as the same wheat production zone.

Table 1. *Grain yield as influenced by locations and varieties*

Variety	Yield (kg/ac)	Location	Yield (kgfac)
Blue Silver	1371	Kasur	1764* a
V – 5149	1244	Faisalabad	1501 b
V – 5444	1244	Sheikhupura	1433 b
V – 1314	1217	Gujranwala	1403 b
Pb – 81	1193	Jhang	1143 c
V – 1308	1178	Lahore	1055 c
V – 1302	1140	Sialkot	812 d
Sakha – 8	1127	Sargodha	738 d

*Means having the same letters are not significantly different.

Non-significant difference in yield of varieties showed that all the new varieties fell in the same yield group.

PROTEIN CONTENT

The protein content was neither affected by environment (locations) nor by varieties (Table 2).

Table 2. *Protein content as influenced by locations and varieties*

Variety	Protein content (%)	Location	Protein content (%)
V – 1308	11.38	Kasur	12.64
V – 5444	11.07	Faisalabad	12.17
Sakha – 8	10.91	Jhang	11.27
Pb – 81	10.87	Sheikhupura	11.12
Blue Silver	10.72	Gujranwala	10.88
V – 5149	10.70	Lahore	10.09
V – 1314	10.45	Sialkot	9.60
V – 1302	9.56	Sargodha	9.49

PROTEIN HARVEST

The protein harvest was found to be significantly affected by environment but not by varieties (Table 3).

Table 3. *Protein harvest as influenced by harvesting and varieties*

Varieties	Protein harvest (kg/ac)	Location	Protein harvest (kg/ac)
Blue Silver	153.70	Kasur	215.34* a
V – 5444	141.56	Faisalabad	182.53 b
V – 1302	139.57	Sheikhupura	157.30 c
V – 5149	137.02	Gujranwala	151.19 cd
Pb – 81	132.15	Jhang	129.08 de
V – 1308	131.50	Lahore	106.30 e
Sakha – 8	125.97	Sialkot	79.14 f
V – 1314	104.17	Sargodha	68.50 f

*Means having the same letters are not significantly different.

The protein harvest at different locations followed the same pattern as grain yield. This was due to the fact that non-significant differences in yield were observed in protein content of wheat planted at different sites.

1000 KERNEL WEIGHT

Kernel weight is an indicator of grain size. It was found to be significantly affected by environment. However, there has been no evidence of this trait being influenced by tested genotypes (Table 4).

Table 4. *1000 kernel weight as influenced by locations and verieties*

Variety	1000 kernel weight (gm)	Location	1000 kernel weight (gm)
Blue Silver	47.91	Sargodha	46.77* a
V–5444	47.01	Lahore	42.15 b
V–5149	40.04	Faisalabad	41.58 bc
Pb–81	39.50	Sialkot	40.79 bc
V–1302	30.09	Gujranwala	40.52 bc
V–1308	38.02	Jhang	40.04 bc
V–1314	36.52	Sheikhupura	38.26 cd
Sakha–8	35.63	Kasur	35.10 e

*Means having the same letters are not significantly different.

Significantly higher kernel weight was observed at Sargodha, followed by Lahore as compared to other sites in different districts. It is interesting to note that although grain yield was the highest but grain weight was the lowest at Kasur and reverse was the situation in case of Sargodha. The higher grain yield at Kasur, therefore seems to be due to other important yields components such as number of grains/spike and heads/unit area.

REFERENCES

Army, T. J. and W. D. Hason. 1960. Moisture and temperature influence on spring wheat production in the plains area of Montana, U.S.A. Prod. Res. 34 : 1-25.

Campbell, I. G. H. and N. Lafever., 1980. Effects of locations and years upon relative yields in the soft winter wheat region. Crop. Sci. 20 : 23-27.

Finely, K. E. and H. O. Fryer. 1958. Effect of loaf volume of high temperature during the fruiting period of wheat. Agron. J. 50 : 28-34.

Johnson, V. A. 1978. Breeding for improved nutritional quality of winter wheat. Proc. Second FAO/SIDA Seminar on field food crops in Africa and Near East held at Lahore, Pakistan.

Kent, N. L. 1975. Technology of Cereals with Special Reference to Wheat. Pergamon Press, Oxford,

Liang, G. H. L., E. G. Heyne and T. L. Walter. 1966. Estimates of variety x environmental interactions in yield tests of three small grain and their significance on breeding programme. Crop Sci. 6 : 135-139.

Mossberg, R. 1969. Evaluation of protein quantity and quality by dye binding capacity. A tool in plant breeding for improved plant protein. IAEA/FAO/STI/Pub. 212, Vienna, PP 151-161.

Snedecor, G. W. 1962. Statistical Methods, Iowa State University Press, Iowa, U.S.A.

Ullah, M., F.M. Anjum and S. Khan 1980. Effect of locality on quality characteristics of various triticale cultivars. Pak. Agri. 3 (3) : 26-29.