PHYSIO-MORPHOLOGICAL AND GRAIN PROTEIN CONTENT OF DIFFERENT WHEAT GENOTYPES UNDER AGRO-ECOLOGICAL CONDITIONS OF HARIPUR

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ABSTRACT: *The research was conducted at the Agriculture Research farm of University of Haripur to study physio-morphological, weed infestation and grain protein content of ten wheat genotypes i.e, Lalma, Shahkar-13, Punjab-11, Pir-sabak-05, Batoor, Fakhre-sarhad, Pir-sabak-08, Sehar-06, Pir-sabak-13 and Faisalabad-08. Wheat varieties Fakhre-sarhad, Pir-sabak-13, Lalma, Pir-sabak-08, Sehar-06 and Faislabad-08 took more and statistically at par days to germination (11 days). Maximum days to heading (123) were taken by variety Fakhre-sarhad.Pir-sabak-08 (268) had a maximum number of tillers. The genotype Punjab-11 had recorded a maximum (26) number of weeds (m^{-2}),while Lalma was infested by minimum number of weeds (8). Pir-sabak-08 had maximum weed fresh weight (31.053g), while Lalma had minimum weeds fresh weight (8.163g).Sehar-06 had maximum (105.21cm) plant height while Pir-sabaq-08 had minimum (87.25cm) plant height. Faisalabad-08 had showed maximum (11.647cm) spike length. Pir-sabaq-08 and Faisalabad-08 had a maximum and equal (53) numbers of grains spike^{-1}. Pir-sabaq-13 had heavier (45g) thousand grains. Maximum days to maturity (190, 189 and 188) were taken by variety Pir-sabaq-08, Sehar-06 and Pir-sabaq-13 respectively. Significantly higher grain yield was recorded in varieties Sehar-06 and Pir-sabaq-13 while Punjab-11 proved less yielding variety. Fakhre-sarhad contained higher (12.95% grain protein content) while Pir-sabaq-13 proved to be of lower quality (10.96%) grain protein content. Wheat varieties Sehar-06 and Pir-Sabaq-08 performed better under the agro-ecological conditions of Haripur.*

INTRODUCTION

Pakistan is an agricultural country and different crops are grown in it. Wheat (*Triticum aestivum* L) is leading crop of country and has central position in agriculture. The contribution of wheat in agriculture is 10 % and its percentage to GDP is 2.1 (GOP, 2014-15). Cultivation of wheat in 2014-15 was9180 thousand hectares having 25.478 million tons production [1].In Khyber Pakhtunkhwa wheat was cultivated on an area of 680.31 hectares with the production of 1251.48 tones [2].

Haripur is the district of Khyber Pukhtunkhwa which is located in Hazara region, with an altitude of 520 m, with relatively high temperature in summer and low temperature in winter. In the district total cultivable area is 68 thousand hectares in which wheat was cultivated on an area of 37.16 thousand hectares with the production of 68.77 thousand tones [2]

Wheat proteins are of special significance and important nutrient for all animals and humans. Wheat has 6 to 20% protein depending on cultivars and conditions of different environment during the growth [3].

Wheat production is constrained by different reasons like improper sowing time, lack of weeds control, nutritional imbalance, low quality seed usage etc. Besides these factors availability of improved, high yielding and early maturing wheat varieties is also one of the main factors of low yield. Wheat is widely adaptive crop and is cultivated under different kind of soil and environmental conditions in Pakistan. The yield of wheat can be increased by two ways first by bringing more area under wheat cultivation and second by developing improved genotypes which can gave high yield in different agro-ecological conditions of a country. Every region has a different set of environmental conditions. Mostly one variety which performs better in one region cannot show same performance in other region because of different conditions. Developing new varieties are very important which give maximum yield and the released varieties need to be checked in different agro-ecological conditions. Therefore, the study in hand was carried out to assess the performance of ten wheat varieties for yield, yield components and grain protein content under agro-ecological conditions of Haripur.

MATERIAL AND METHODS

Field experiment on the physio-morphological and grain protein content of different wheat genotypes under agro-ecological conditions of Haripur was performed at Agriculture Research farm of University of Haripur during 2014-15. Ten wheat varieties (Lalma, Shahkar-013, Punjab-011, Pir-sabaq-05, Batoor, Fakhre-sarhad, Pir-sabaq-08, Sehar-06, Pir-sabaq-13, and Faisalabad-08) were tested. The experiment was laid out in a randomized complete block design (RCBD) with 3 replications. The sub-plot size of 1.5×8 m ($9m^2$) was sown to each variety with row to row distance of 30 cm. There were six rows of wheat seeded at the required seed rate of 120 kg ha^{-1}. All the sub-plots were supplied with the recommended fertilizer dose of 150:120:90 kg ha^{-1} N: P: K, respectively. The phosphorous, potassium and half dose of the nitrogen were applied during the seed bed preparation in form of SSP, MOP and Urea, respectively. The remaining half nitrogen was applied with first irrigation. Irrigation was applied as per the requirement of the crop. All other cultural practices were kept uniform for all the treatments. Soil physio-chemical analysis was done before the crop sowing and presented in Table 1.

Table 1: **The physico chemical analysis of experimental site**

Soil Texture	pH value	Ec	Organic matter (%)	N (%)	P (ppm)	K (ppm)	Ca^+	Mg^+	Hco3	Cl
Silty clay loam	7.85	1.19	0.55	0.064	8.71	74.00	5.25	0.75	5.80	0.12

RESULTS AND DISCUSSION

The physio-morphological characteristics and grain protein content of ten wheat genotypes were investigated under agro-ecological conditions of Haripur during the year 2014-15.

Days to germination, days to heading & number of tillers (m^{-2})

Statistical analysis of data showed significant differences for days to germination (table-2). Days to germination of genotypes ranged from 10 to 11. The genotype Fakhre-sarhad, Pir-sabaq-13, Lalma, Pir-sabaq-08, Sehar-06 and Faislabad-08 took more and statistically at par days to germination (11 days) while Batoor, Pir-sabaq-05, Punjab-11 and Shahkar-13 (10 days) took minimum and statistically similar days to germination. Sattar *et al*., also found similar results [4].Days to heading has been significantly affected in various wheat varieties and is shown in table-2. Maximum days to heading (123) were taken by variety Fakhre-sarhad followed by Lalma, Batoor and Pir-sabaq-08 (118 each) while Punjab-11 took minimum days to heading (113). . Irfaq *et al*., also found the similar results [5].Highly significant differences were found in the no. tillers as shown in table-2. Statistical data revealed that the genotype Pir-sabaq-08 had a maximum number of tillers (268). Sehar-06, Pir-sabaq-13 and Faisalabad-08 also produced maximum and statistically at par number of tillers (267, 246 and 244 respectively). Punjab-11 had a minimum number of tillers (216). Rests of the varieties were statistically similar with Punjab-11. My findings are in conformity with the findings of Rahaman *et al*., [6].

Table-2: Days to germination, days to heading and number of tillers (m^{-2}) as recorded in various wheat varieties

Varieties	Days to germination	Days to heading	No of tillers m^{-2}
Lalma	11ab	118b	232bc
Shahkar-13	10b	116c	235bc
Punjab-13	10b	113e	216c
Pir-sabaq-05	10b	116c	231bc
Batoor	10b	118b	239bc
Fakhre-sarhad	11a	123a	230bc
Pir-sabaq-08	11ab	118b	268a
Sehar-06	11ab	114d	267a
Pir-sabaq-13	11a	116c	246ab
Faisalabad-08	11ab	116c	244ab
Critical value for comparison:	0.7233	0.8980	23.852

Table-3: No of weeds (m^{-2}), weeds fresh biomass (g) and weeds dry biomass (g) as recorded in various wheat varieties

Varieties	No of weeds (m^2)	Weeds fresh biomass (g)	Weeds dry biomass (g)
Lalma	8c	8.16Ns	1.65b
Shahkar-13	22ab	29.07	4.65ab
Punjab-11	26a	29.34	8.02a
Pir-sabaq-05	18abc	16.90	3.16b
Batoor	18abc	16.82	1.84b
Fakhre-sarhad	12bc	15.55	1.95b
Pir-sabaq-08	21ab	18.05	3.51b
Sehar-06	14abc	12.57	1.80b
Pir-sabaq-13	12bc	12.42	1.67b
Faisalabad-08	24ab	18.57	2.38b
Critical value for comparison:	12.050	23.510	4.0730

Number of weeds (m^{-2}), weeds fresh biomass (g)&weeds dry biomass (g)

There were significant differences between varieties of wheat regarding presence of weeds (m^{-2}) (table-3). The genotype Punjab-1the 1 had a maximum (26) number of weeds (m^{-2}). Varieties Shahkar-13, Pir-sabaq-05, Batoor, Pir-sabaq-08, Sehar-06 and Faisalabad-08 recorded statistically at par number weeds with that of Punjab-11. Lalma was infested by minimum number of weeds [8]. The statistical analysis showed that there were non-significant differences found in the data for weeds fresh biomass as shown in table-3. Maximum (29.34g) weeds fresh biomass was recorded in variety Punjab-11while minimum (8.16g) was recorded in Lalma. The statistical analysis revealed significant

differences among wheat varieties regarding weeds dry biomass (g) (table-3). The weeds dry biomass ranged from 1.65g to 8.02g. Punjab-11 had maximum (8.02g) weeds dry biomass followed by Shahkar-13 (4.65g). Pir-sabaq-08, Pir-sabaq-05, Faislabad-08, Fakhre-sarhad, Batoor Sehar-06 and Pir-sabaq-13 recorded statistically similar weeds dry biomass with that of Lalma. Lalma had minimum (1.65g) weeds dry weight. Hammad *et al*., 2010 supported my findings [7].

Plant height (cm), spike length (cm)&grain Spike^{-1}

There were significant differences for plant height among all wheat varieties (Table-4). Sehar-06 (105.21cm) had maximum plant height followed by Faisalabad-08, Batoor and Pir-sabaq-05 (105.01cm, 100.28cm and 100.09cm respectively) while minimum plant height was found in the variety Pir-sabaq-08 (87.25cm). The varieties Pir-sabaak-05, Lalma, Fakhre-sarhad, Punjab-11, Pir-sabaq-13 and Shahkar-13 had a height of 105.01cm, 100.28cm, 100.09cm, 97.41cm, 94.61 cm, 94.50 cm, 89.81cm and 87.79 cm respectively. Abbas *et al*.,2014 reported similar results [8]. Table-4 showed that the length of all the wheat spikes had significant variations. The variety Faisalabad-08 (11.64cm) had maximum spike length followed by Pir-sabaq-13, Fakhre-sarhad, Pir-sabaq-08 and Sehar-6 (11.29cm, 11.18cm, 10.96cm and 10.90cm respectively). Pir-sabaq-05 (9.42) had minimum spike length. Punjab-11,Batoor, Shahkar-13 and Lalma recorded statistically at par spike length of 10.66cm, 10.49cm, 9.91cm and 9.82cm respectively. These findings are in line with those of Tanveer *et al*., [9]. ANOVA showed that there were significant differences in grains spike^{-1} among the genotypes (Table-4). Pir-sabaq-08 and Faisalabad-08 had a maximum and statistically similar (53) number of grains spike^{-1} followed by Fakhre-sarhad (50). Pir-sabaq-05 (34) had a minimum number of grains. The varieties Sehar-06, Batoor, Shahkar-13, Punjab-11 Lalma and Pir-sabaq-13 contained statistically equal number of grains spike^{-1} 45, 44, 43, 43, 42 and 39 respectively. These results are supported by Sultana *et al*., 2013 who also found similar results (10).

Table-4.: Plant height (cm), spike length (cm) and grain spike^{-1} as recorded in various wheat varieties

Varieties	Plant height (cm)	Spike length (cm)	Grain spike^{-1}
Lalma	97.41b	9.82cd	42c
Shahkar-13	87.79d	9.91cd	43bc
Punjab-11	94.50bc	10.66bc	43bc
Pir-sabaq-05	100.09ab	9.42d	34d
Batoor	100.28ab	10.49bc	44bc
Fakhre-sarhad	94.61bc	11.18ab	50ab
Pir-sabaq-08	87.25d	10.96ab	53a
Sehar-06	105.21a	10.90ab	45bc
Pir-sabaq-13	89.81cd	11.29ab	39cd
Faisalabad-08	105.01a	11.64a	53a
Critical value for comparison:	6.5024	0.9669	7.0116

1000 grain weight (g), days to maturity & biological yield (kg ha^{-1})

Statistical analysis of data showed that there were significant differences found among all wheat varieties (table-5). Pir-sabaq-13 (45g) and also Pir-sabaq-05 (43g) had maximum and statistically at par thousand grain weight while Batoor had minimum thousand grain weight (35g). Lalma, Sehar-06, Faisalabad-08, Shahkar-13, Punjab-11, Pir-sabaq-08 and Fakhre-sarhad had statistically equal thousand grain weight of 42, 42, 40, 39, 38, 38 and 37 respectively. The findings of Al Musa *et al*., 2012are in line with my results [11].The data regarding days to maturity were significantly affected among wheat varieties as shown in table-5. Maximum and statistically similar days to maturity (190, 189 and 188) were taken by variety Pir-sabaq-08, Sehar-06 and Pir-sabaq-13 respectively while Punjab-11 and Shahkar-13 took minimum days to heading (155 and 156). The statistical analysis also showed that the genotypes Faisalabad-08, Pir-sabaq-05, Batoor and Lalma took statistically at par days to matuity 163, 158, 158 and 157 respectively. My results are supported by Inamullah *et al*., 2007 who also found significant differences [12]. Differences found in biological yield were

Table-5: 1000 grain weight (g), days to maturity and biological yield (kg ha^{-1}) as recorded in various wheat varieties

Varieties	1000 grain weight (g)	Days to maturity	Biological yield (kg ha^{-1})
Lalma	42.00bc	157.00de	10333d
Shahkar-13	39.33cd	156.33e	11000cd
Punjab-11	38.66d	155.00e	10000d
Pir-sabaq-05	43.33ab	158.67d	11500bcd
Batoor	35.33e	158.67d	11333bcd
Fakhre-sarhad	37.33de	166.00b	13000abc
Pir-sabaq-08	38.00de	190.67a	12833abc
Sehar-06	42.00bc	189.67a	14000a
Pir-sabaq-13	45.33a	188.67a	13333ab
Faisalabad-08	40.00cd	163.67c	13433ab
Critical value for comparison:	3.3227	2.3085	2151.3

significant between all the genotypes (table-5). The varieties Sehar-6, Faislalbad-08 and Pir-sabaq-13 (14000, 13433 and 13333kh ha^{-1}) produced maximum biological yield and statistically at par with each other while Punjab-11 and Lalma (10000 and 10333kg ha^{-1}) had a minimum but statistically equal biological yield. The findings of Laghari *et al*., 2012 supported my findings [13].

Grain yield (kg ha^{-1})&grain protein content (%)

Grain yield and grain protein content are the most important parameters both from quantitative and qualitative point of view. There were significant differences found for data regarding grain yield (table-6). Sehar-06 and Pir-sabaq-08 had maximum (5266 and 5226kg ha^{-1}) grain yield while Punjab-11 produced minimum (3103.3kg ha^{-1}) grain yields followed byPir-sabaq-13 and Faisalabad-08 which recorded statistically at par yield with each other (4720 and 4433.3kg ha^{-1}) respectively. Baig *et al*., 2008 also found similar results [14].The data revealed that Fakhre-sarhad had a maximum (12.95%) protein content followd by Lalma and Pir-sabaq-05 (12.68% and 12.61%) while Pir-sabaq-13 had minimum(10.96%) protein content. Faisalabad-08, Pir sabak-08, Sehar-06, Shahkar-13, Punjab-11 and Batoor contained protein content of 12.41%, 12.25%, 12.09%, 11.76%, 11.33% and 11.27% respectively. Gulzar *et al*., 2010 supported similar kind of results [15].

Table-6: Grain yield (kg ha^{-1}) and protein content (%) as recorded in various wheat varieties

Varieties	Grain yield (kg ha^{-1})	Protein content (%)
Lalma	3533.3d	12.68
Shahkar-13	3260.0de	11.76
Punjab-11	3103.3e	11.33
Pir-sabaq-05	3953.3c	12.61
Batoor	3966.7c	11.27
Fakhre-sarhad	4060.0c	12.95
Pir-sabaq-08	5226.7a	12.25
Sehar-06	5266.7a	12.09
Pir-sabaq-13	4720.0b	10.96
Faisalabad-08	4433.3b	12.41

Critical value for comparison: 304.55

CONCLUSION

It is concluded thatSehar-06 and Pir-sabaq-08 produced more number of tillers and grain-yield as compared to other varieties in the trial. These were found to contain relatively more protein, which showed its high quality.

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