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Pirsabak-04, A New Wheat Variety for Normal and Late Cultivation in the North West Frontier Province of Pakistan

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Abstract: Wheat variety Pirsabak-04, having parentage KAUZ/STAR, was first evaluated at CCRI Pirsabak in 2000-01 in the Elite Spring Wheat Yield Trial (ESWYT). The trial had 50 lines including the local check variety Fakhre Sarhad and was obtained from the CIMMYT Mexico. The line at serial No. 22 in the ESWYT was selected along with other high yielding and disease resistant lines and was again tested under B-VI trial at CCRI in 2001-02. The B-VI trial was comprised of 20 entries including checks varieties Fakhre-Sarhad and Bakhtawar-92. High yielding and disease resistant lines in B-VI trial were further tested under microplot trial at different locations such as CCRI Pirsabak, Mardan and the Agricultural Research Station Mingora (Swat) in the NWFP during 2002-03. The line showed good performance in microplot trials and was again tested in the CCRI ELITE trials at CCRI during 2003-04. The line gave high yield and showed resistance to leaf and yellow rusts in National Uniform Wheat Yield Trial (NUWYT) during 2004-05. The results of ESWYT, B-VI, microplots, CCRI ELITE and NUWYT trials from 2000-01 to 2004-05 confirmed the superiority of the line for higher yield and disease resistance. Because of its higher yield and resistance to yellow rust and leaf rust, this line was approved as a new variety by the Provincial Seed Council for cultivation in NWFP under irrigated conditions. It has been named as Pirsabak-04 and is recommended for both normal and late sowing. In late sowing, it can be grown from 25th November to 31st December.

Key words: Wheat (*Triticum aestivum* L.), variety, high yield, disease resistance, NWFP

INTRODUCTION

The North West Frontier Province (NWFP) of Pakistan comprises of several agro-ecological zones having different climatic conditions and wheat is sown throughout the province. In hilly areas such as upper Swat, Hazara and Chitral, neither true spring wheat nor winter or facultative types of wheat give high yields. In plain areas, such as Swabi, Mardan and Peshawar, spring wheat is grown but the common wheat diseases especially the yellow rust severely affects the yield of prevailing varieties. To overcome the twin problems of poor winter hardiness in mountainous area and disease susceptibility in plain areas, wheat program at the Cereal Crops Research Institute (CCRI) Pirsabak has concentrated on CIMMYT lines/strains derived from spring and winter crosses.

The broad genetic make-up of the CIMMYT material has made it possible for researchers to select lines adapted to the climatic and edaphic conditions of many countries (Anonymous, 1979, 1980; Borlaug, 1965). In Pakistan, outstanding wheat varieties such as Mexipak-65, Pak-81, Sarhad-82, Pirsabak-85 and Khyber-87 were

introduced and selected from CIMMYT material for general cultivation in NWFP (Mohammad *et al.*, 1992a; b; 1990a; b). These varieties revolutionized the wheat cultivation not only in NWFP but also in the neighboring countries like Afghanistan and Iran as well. Recently Saleem-2000 and Haider-2000 have been selected from the introduced CIMMYT material and are superior cultivars of the NWFP (Subhan *et al.*, 2004a, b). The present variety, named as Pirsabak-04, was also selected from the genetic material obtained from CIMMYT Mexico. The variety gave high yield and showed resistance to yellow and leaf rusts in various tests. It will increase the yield of farmers and will bridge the gap between wheat production and consumption in NWFP.

MATERIALS AND METHODS

The first cross was made at CIMMYT between KAUZ and STAR and the line was received at CCRI, Pirsabak for testing in ESWYT trial. The ESWYT trial, comprised of 50 white grain high yielding lines, was planted at CCRI, Pirsabak in 2000-01 in a Randomized Complete Block Design with four replications

Table 1: Grain yield (kg ha⁻¹) and disease reaction of wheat lines selected from Elite Spring Wheat Yield Trial (ESWYT) at CCRI, Pirsabak during 2000-01

Entry No.	Cross	YR	LR	Grain yield
1	FAKHRE SARHAD (CHECK)	TR	TR	4583
2	PBW 343	--	--	5425
5	PARWAZ-94	--	--	5325
7	PUNJAB-96	--	--	5275
8	KAUZ/3/SAPI/TEAL/ /HUI	--	--	5300
9	KAUZ/3/SAPI/TEAL/ /HUI	--	--	5300
10	-DO-	--	--	5300
13	KAUZ/ /ALTAR 84/ADS/3/KAUZ	--	--	4900
14	IRENA/WEAVER	--	--	5100
15	IRENA/WEAVER	--	--	5100
16	PFAU/ WEAVER	--	--	4900
19	ATTILA/3/HUI/CARC/CHEN/ CHTO/4/ATTILA	--	--	6100
20	STAR/KAUZ/STAR	--	--	4875
22	KAUZ/STAR	--	--	5750
23	OASIS/STAR/2*BORL 95	--	--	4800
27	OASIS/STAR/ /3*STAR	--	--	5500
29	WEAVER/WL3926/ /SW 89.3064	--	--	5000
33	CHIL/ESDA/3/HE1/3*CNO 79/ /2*SERI	--	--	5050
42	2V879.C8.11/G110/ /V979/3/STAR/4/STAR	--	--	4900
43	DVERD-2/AE.SQUARROSA(214)/ /2*BCN	--	--	4850
47	OASIS/SKAUZ/ /4*BCN	--	--	4900
49	UPER SERI # 1	--	--	4750
	LSD 5%			722.4
	CV%			7.4
	Increase in yield of entry No. 22 over check Fakhre Sarhad			32.0%

YR, Yellow Rust; LR, Leaf Rust

Table 2: Grain yield (kg ha⁻¹) of selected entries in B-VI (Normal) planted at CCRI Pirsabak, during 2001-02

Entry No.	Cross	Grain yield	Origin 2000-01
1	STAR/KAUZ/STAR	5600	ESWYT # 20
2	KAUZ/STAR	6000	22
3	OASIS/STAR/ /3*STAR	5133	27
4	WEAVER/WL3926/ /SW 89.3064	5133	29
5	CHIL/ESDA/3/HE1/3*CNO 79/ /2*SERI	5733	33
7	DVERD-2/AE.SQUARROSA(214)/ /2*BCN	5600	43
8	OASIS/SKAUZ/ /4*BCN	6067	47
13	CMT/CDC/ /PLO/3/SAKER	5467	RWYT # 09
14	TEVEE'S'/KARAWAN'S''	5467	13
15	KASYON/GFNARO.81/ /TEVFE-1	6200	19
16	TEVEE'S'/KARAWAN'S''	5667	21
17	-DO-	6000	22
19	CHECK-1 (FAKHRE SARHAD)	5533	
20	CHECK-2 (BAKHTAWAR-92)	6267	
	LSD 5%	858.1	
	CV%	9.67	
	Yield increase of entry No. 2 over Check F. Sarhad	8.44%	

ESWYT, Elite Spring Wheat Yield Trial; RWYT, Regional Wheat Yield Trial

(Gomez and Gomez, 1983). Each plot consisted of six rows spaced 25 cm apart and 5 m in length. Out of the 50 entries, 21 were selected on the basis of high yield and disease resistance for further testing (Table 1).

On the basis of high yielding performance and disease resistance, the line (KAUZ/STAR, CMBW 90Y3058-74M-015Y-015M-1Y-0B) along with other selected lines was advanced to B-VI test (Advance Screening trial) to compare it with other high yielding lines in 2001-02, (Table 2). B-VI test had 20 lines and was planted in a Randomized Complete Block Design with three replications at CCRI, Pirsabak. The line was further

advanced to the Microplot (short) trial on the basis of its over all performance especially the yield and disease resistance and was planted during 2002-03 at three locations namely the CCRI, Pirsabak, Mardan and ARS Mingora (Swat) (Table 3) in NWFP. The trials were sown in Randomized Complete Block design. Each entry was sown in plot having six rows of 5 m length and 25 cm apart. Planting was done after 25th of November because of its placement in short duration trial.

Again on the basis of high yield and disease resistance, the line was planted in Elite yield trial to verify and confirm its performance at CCRI during 2003-04

Table 3: Average grain yield (kg ha⁻¹) of selected entries in Microplot (Short) planted at three different locations in NWFP, during 2002-03

Entry No.	Cross	CCRI	Mardan	Swat	Average
1	KHYBER-87//K/KIBOKO	3780	2500	1966	3082
11	CHAM6//WYONA (WR*H2)PF/ 2/2	2733	2767	3232	2911
15	NL 1496	3267	1867	4032	3055
22	OPATA/RAYON//KAUZ	3787	2033	3534	3118
27	SW89.3064*2/BORL95	3553	2100	3366	3006
28	OASIS//SKAUZ//4*BCN	3533	2167	3832	3177
31	PVN//CAR422/ANA/3/BAV92	3247	2300	3234	2927
40	KAUZ/STAR	3687	1667	4000	3118
49	FAKHRE SARHAD (Check-1)	3213	1967	3550	2910
50	SALEEM-2000 (Check-2)	4466	1767	2534	2922
	% yield increase over Fakhre Sarhad (check-1)				7.15%
	% yield increase over Saleem-2000 (check-2)				6.71%

Table 4: Grain yield (kg ha⁻¹) performance of selected lines in Elite (CCRI) Trial planted at CCRI Pirsabak, during 2003-04

Entry No.	Cross	Grain yield	Origin 2002-03
1	IAS63/ALD*S,,//GLEN/3/SNB*S,,/PIMA//C306	6200	MPT (Normal)-7
2	VENAC*S,,/FLORKWA-1	5700	8
3	CHAM6//WYONA (WR*H2)PF/ 2/2	5034	11
4	SHI#4414/CROW*S,,/CONDOR	4840	12
5	ZARZOVK//PRL*S,,/PEW*S,,	5146	14
6	NL 1496	5520	15
7	V92118=OPAK	5354	16
8	URES/JUN//KAUZ	5906	17
9	KAUZ//KAUZ/STAR	6414	20
10	OPATA/RAYON//KAUZ	5700	22
11	OASIS/5*ANGRA	5586	29
12	PBN/YACO/3/KAUZ*2/TRAP//KAUZ/	5440	32
13	KAUZ//ALTAR84/ALDS/3/KAUZ	5960	35
14	IRENA/WEAVER	6226	36
15	ATTILA/3/HUI/CARC//CHEN/CHTO/ 4/ATTIL	6586	38
16	CHIL/ASDA/3/HFI/3*CNO79//2*CERI	5960	43
17	SW89.3064*2/BORL95	5414	MPT (Short)-27
18	OASIS//SKAUZ//4*BCN	6686	28
19	PVN//CAR422/ANA/3/BAV92	5294	31
20	KAUZ/STAR	5840	40
21	LYLPURE73/PFAU	5674	MPT (Rainfed)-2
22	IAS63/ALD*S,,//GLEN/3/MORIS/PR-55	6014	3
23	SHI#4414/CROW*S,,/PREW	5466	6
24	BOW/MOR/BAU	5760	8
25	VORONA//KAUZ//KAUZ	6254	9
26	ATTILA/3/HV1/CARC//CHIN/ CHT10/4/ATTILA	5386	10
27	SERI//ATTILA	6120	15
28	Saleem 2000	5614	Check variety
	% yield increase over check (Saleem-2000)	4.04%	

(Table 4). The entry was planted at 25 cm spacing in 6 rows of 5 m length. Fertilizer was applied at the rate of 120-90 NP in all the trials throughout the duration of the line testing from 2000-04. For yield determinations, four rows of 5 m length were harvested in all tests conducted for the selection of this line. All other cultural practices were kept the same during the study period of this line in all trials and locations.

Seed of this line was sent for National Uniform Wheat Yield Trial (NUWYT) to the Wheat Coordinator NARC, Islamabad for normal and late sowing during 2004-05. In NUWYT, it was included as PR-84.

Statistical analyses were conducted according to the standard procedure by using M-State program in computer.

RESULTS AND DISCUSSION

The results of ESWYT trial during 2000-01 shows the yield advantage of entry No. 22 (later on named as Pirsabak 04) over the local check, Fakhre Sarhad (Table 1). Pirsabak 04 gave 5750 kg ha⁻¹ grain yield while Fakhre sarhad gave 4583 kg ha⁻¹ (32% lower than that of Pirsabak 04). It showed resistance (TR) (Peterson, 1948) to yellow and leaf rust also. Most of the varieties released in Pakistan have been selected from international nurseries/trials like the ESWYT etc., which were introduced from CIMMYT/ICARDA (Anonymous, 1980; Mohammad *et al.*, 1992a; b; Subhan *et al.*, 2004a). Pirsabak 04 (entry No. 22 in ESWYT) was also selected on the basis of higher yield and disease resistance during

Table 5: Average grain yield (kg ha⁻¹) of PR-84 in normal and late National Uniform Wheat Yield Trial (NUWYT) at four different locations of NWFP during 2004-05

NUWYT No.	Line/Variety	Source	Normal	Late
1	V-01078	AARI-Faisalabad	4276a	2946b
2	99B4012	RARI-Bahawalpur	4275a	2922b
3	Wafaq-2002	NARC-Islamabad	3697bcdefg	2453de
4	RWM-9818	NIA-Tandojam	3846bcd	2014hi
5	V-00125	AARI-Faisalabad	3586cdefgh	2732bc
6	DIAMOND	WRI-Sakrand	3733bcdef	2244gh
7	PR-84	CCRI-Pirsabak	4085ab	2513cde
8	TW 0135	AZRI-Bhakkar	3155hij	1858i
9	V-00055	AARI-Faisalabad	3500defghi	2394defg
10	99B2278	RARI-Bahawalpur	3368efghij	2507cdef
11	KT-7	BARS-Kohat	2798k	1892i
12	V-01180	AARI-Faisalabad	3137hijk	1998hi
13	DN-47	ARI-DI Khan	3953abc	2921b
14	V-9021	Univ. Agric. F.abad	3556cdefgh	2436defg
15	CT-00062	NIFA-Peshawar	3847bcd	2628cd
16	7-03	NIA Tandojam	3754bcde	2894b
17	PR-86	CCRI-Pirsabak	3435defghij	2192gh
18	V-02129	AARI-Faisalabad	4079ab	3308a
19	V-002493	RARI-Bahawalpur	3543cdefgh	2494cdef
20	Local Check		4073ab	2252fgh
		CV%	16.5	14.8
		LSD value (0.05)		
		Variety	417	255

Table 6: Response of PR-84 as compared with other lines showing desirable and acceptable Relative and Resistance Index (RRI) in National Uniform Wheat Yield Trial (NUWYT) during 2004-05*

Candidate line	Yellow rust	Leaf rust
V-01078	6	7
V-02192	6	6
PR-84	5	8
K7-4	5	5

*Table 6 adopted from Anonymous *et al.* (2005)

2000-01 in ESWYT trial and was advanced to the advance yield trial B-VI (normal), where it was planted as entry No. 2 during 2001-02 at CCRI Pirsabak. In B-VI trial, this line (entry No. 2) produced 6000 kg ha⁻¹ grain yield while the local check No. 1 Fakhre Sarhad produced 5533 kg ha⁻¹ grain yield (Table 2). Thus, the yield of this line was 8.44% higher than the local check-1 Fakhre Sarhad. It was also not significantly different from the grain yield of local check-2 Bakhtawar-92. Pirsabak 04 (entry No. 2) was again selected on the basis of higher yield in B-VI trial during 2001-02 and was advanced to Microplot (short) trial where it was sown as entry No. 40 at three different locations (CCRI Pirsabak, Mardan and ARS Mingora Swat) of NWFP during 2002-03. In Microplot (short), the average grain yield (average of the three locations) of Pirsabak-04 (entry No. 40) was 3118 kg ha⁻¹ while those of Fakhre Sarhad (local check-1) and Saleem-2000 (local check-2) were 2910 and 2922 kg ha⁻¹, respectively (Table 3). This shows that the yield of this line was 7.15 and 6.71% higher than our local check varieties Fakhre Sarhad and Saleem-2000, respectively.

On the basis of higher yield in Microplot (short), Pirsabak-04 (entry No. 40) was included in the Elite yield trial of the CCRI Pirsabak where it was planted as entry No. 20 during 2003-04. Pirsabak-04 (entry No. 20) gave 5840 kg ha⁻¹ grain yield in the Elite yield trial while the local check variety Saleem-2000 gave 5614 kg ha⁻¹ grain yield, 4.04% lower than that of entry No. 20 (Table 4).

The line was included in the National Uniform Wheat Yield Trial (NUWYT) as PR-84 for normal and late sowing during 2004-05. During 2004-05, the average yield of four different locations in NWFP showed that PR-84 ranked third among the 20 entries with 4085 kg ha⁻¹ grain yield and this yield was not significantly different from the top two high yielding entries in normal sowing (Table 5). Similarly, in late sowing PR-84 ranked eighth among the 20 entries with 2513 kg ha⁻¹ grain yield (Table 5).

Disease reaction data (Relative Resistance Index RRI) (Loegering, 1959; Hussain, 1997) recorded on PR-84 at 12 different locations in Pakistan (Sindh 3, Punjab 4, NWFP 3, Baluchistan 1 and Islamabad 1) (Anonymous, 2005) are given in Table 6. PR-84 recorded an acceptable RRI of 5 for yellow rust and a desirable RRI of 8 for leaf rust (Anonymous, 2005).

Because of its high yielding performance and resistance to the most killing diseases i.e., the yellow and leaf rusts, this line (PR-84) having the parentage and pedigree of KAUZ/STAR; CMBW 90Y3058-74M-015Y-015M-1Y-0B, was approved by the Provincial Seed Council for general cultivation in NWFP. It was named as Pirsabak 04. It is recommended both for normal and late

sowing in all the four agro-ecological zones of NWFP (Subhan *et al.*, 2004c).

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