

# Food Technology Research

## DETAILS OF EXPERIMENTS AND SALIENT FINDINGS / ACHIEVEMENTS

### RESEARCH ACTIVITIES

#### Technological Value of Commercial Wheat Varieties Grown in Pakistan

Twenty-two wheat varieties received from various provincial agricultural research institutes of Faisalabad, Pirsabak and Tandojam were evaluated for quality parameters. The 1000-kernel weight ranged from 30.6 ('Pari-73', Faisalabad) to 43.9 ('Blue Silver', Tandojam). The grain size varied from small to medium and in general most of the commercial varieties had medium size grains (Table 1). The high alpha-amylase activity of varieties from Faisalabad was evident from the low falling number values (62-165), indicating some damage due to rain at harvest. Conversely, all the varieties from Pirsabak and Tandojam except 'Barani-83' had low alpha-amylase activity. The dry gluten content ranged between 7.4 and 13.3. The protein content ( $N \times 5.7$ ) range was 11.2-13.9, 11.7-13.2 and 11.7-14.3 percent in white flour of varieties grown at Faisalabad, Pirsabak and Tandojam, respectively. The ash content varied from 1.4 to 2.0 and 1.5 to 2.1 percent in varieties grown at Faisalabad and Tandojam, respectively. The flour samples from Faisalabad gave a range of 55.4-58.4 percent of water absorption. The dough development time ranged from 1.5 to 4.0 minutes while the stability was 1.5 to 5.3 minutes. Thus, 'Pari-73' and 'Lyp-73' can be grouped in medium strong to strong category. The samples from Pirsabak gave a range of 60.0-61.0 percent of water absorption, 5.5-8.5 minutes of dough development time and 6.5-10.0 minutes of stability. The water absorption, dough development time and stability of samples from Tandojam were 59.8-65.7 percent, 2.8-6.5 minutes and 3.8-8.0

minutes, respectively. They indicated a weak gluten behaviour except for two varieties i.e., 'Pak-81' and 'C-273' which can be grouped under medium strong to strong gluten behaviour class.

#### Protein and Mineral Contents of the Flour, Bran and Chapatees of Some Pakistani Wheat Varieties

The protein, ash and mineral contents of the flour, bran and chapatees of nine commercial wheat varieties were determined. These varieties were 'Faisalabad-85', 'Pirsabak-85', 'Sind-81', 'Faisalabad-83', 'Tandojam-83', 'Pari-73', 'Sarhad-82', 'Zarghoon' and 'Zamindar', received from Wheat Programme, NARC.

The protein contents of bran (12.7-17.4 percent) and chapatees (12.6-16.5 percent) made from respective flours were somewhat higher than the protein content of the flours (12.4-15.8 percent) from these varieties (Table 2). This mean content of ash, K, Ca, P, Zn, Mn and Cu of the bran of these varieties was significantly higher than that of the corresponding flour. The process of chapatee preparation resulted in a significant lowering of the ash, K and Zn contents. The mean P content of

chapatee was slightly high of flour. The use of heat in of chapatee preparation possible for the loss of so. The addition of tap water preparation was responsible increase in Fe, Mn and Cu chapatees while compared flour.

#### Effect of Field Sprouting on Quality of Wheat Varieties

Untimely rains during harvesting and threshing period led to field sprouting of wheat brought about increase in amylase activity along with chemical changes in the present study, the effect of sprouting on the quality of commercial wheat varieties at NARC was studied on samples collected before and after rains. The test weight for varieties collected before rains varied from 30.6 ('Pari-73') to 38.5 ('Faisalabad-85') to 43.9 ('Pirsabak-85') for samples collected after rains. The 1000 kernel weight of these varieties harvested after rains varied from 28.2 to 44.0 ('Faisalabad-85') to 30.0 ('Sarsabz') to 42

Table 1. Technological value of some commercial wheat varieties

Variety	1000-kernel		Flour			Protein (% db) (White flour)	Ash (% db) (Whole flour)	Water absorption (%)	Dough development time (min.)	Stability (min)
	weight (g)	Grain size	yield % (14% mb)	Falling number (sec)	Gluten dry (%)					
Source: Wheat Research Institute, Faisalabad, Punjab										
Blue Silver'	33.1	Small	67.5	165	8.8	12.2	2.0	58.0	2.3	3.0
Arif-73'	30.6	Small	69.3	81	8.8	12.7	1.8	56.9	2.0	5.3
Phinoor-83'	32.4	Small	76.4	78	7.7	11.2	1.8	55.4	3.5	3.0
Arif-81'	39.3	Medium	75.6	65	8.5	12.6	1.8	56.2	3.0	3.0
Faisalabad-83'	39.5	Medium	71.9	62	7.8	11.3	1.8	58.5	1.5	2.3
Arif-81'	30.1	Small	75.3	121	8.8	12.8	1.7	57.9	1.8	3.0
Arif-73'	34.7	Small	80.2	69	9.9	13.9	1.7	56.8	4.0	5.0
Faisalabad-85'	41.9	Medium	71.5	71	8.2	11.9	1.5	57.4	2.5	1.5
Punjab-85'	40.1	Medium	72.5	62	7.4	11.2	1.7	56.6	2.5	2.5
Arif-83'	42.6	Medium	76.3	69	8.7	13.2	1.7	56.7	2.0	3.6
Punjab-81'	42.5	Medium	68.8	62	7.8	11.6	1.4	57.6	1.5	1.5
Source: Cereal Crops Research Institute, Pirsabak, NWFP										
Arif-83'	37.9	Medium	75.1	206	10.5	11.9	—	61.0	5.5	10.0
Arif-81'	32.9	Small	70.5	373	9.3	12.1	—	60.0	7.3	8.5
Arif-73'	39.4	Medium	73.1	311	9.4	11.7	—	60.0	7.0	8.8
Pirsabak-85'	39.4	Medium	71.5	368	8.9	12.2	—	60.8	8.5	6.5
Arif-12'	39.1	Medium	72.3	273	10.3	13.2	—	60.6	7.0	6.6
Source: Agricultural Research Institute, Tandojam, Sind										
Arif-591'	42.6	Medium	71.4	304	12.2	14.1	2.1	65.7	3.5	4.5
Benab-70'	42.0	Medium	74.1	363	10.9	12.1	1.7	59.8	3.5	3.8
Blue Silver'	43.9	Medium	76.2	449	10.8	11.7	1.7	62.4	2.8	4.3
Arif-81'	39.2	Medium	74.4	298	11.0	13.5	2.0	61.0	6.5	8.0
Arif-Pak'	36.3	Medium	73.7	461	11.0	12.0	1.7	61.6	3.3	4.0
Arif-273'	43.2	Medium	75.6	510	13.3	14.3	1.5	65.0	4.0	5.0

Table 2. Protein and mineral content of flour, bran and chapatees of some Pakistani wheat varieties

Material	Protein	Ash	Mineral Elements (mg/100 g d.b)							
			K	Ca	P	Fe	Zn	Mn	Cu	
Flour	Mean	14.1	1.4	454.8	89.4	264.7	5.9	5.2	5.4	0.7
	Range	12.4-15.8	1.2-1.5	389.7-586.4	70.0-111.1	195.4-332.0	4.7-6.7	4.0-6.0	4.5-5.9	0.5-1.0
	S.E.	0.473	0.036	23.83	4.299	12.33	0.205	0.18	0.186	0.055
	C.V.	10.048	7.932	15.72	14.424	13.97	10.496	10.7	10.35	23.69
Bran	Mean	14.6	2.7	647.3	171.2	499.2	9.5	7.1	13.0	1.1
	Range	12.7-17.4	2.4-3.2	566.2-710.0	117.6-216.6	418.2-577.7	7.3-11.5	6.2-8.2	10.6-15.0	0.7-1.6
	S.E.	0.51	0.096	17.12	9.98	21.84	0.43	0.21	0.52	0.09
	C.V.	10.49	10.852	7.48	17.46	13.13	13.66	8.90	11.95	24.16
Chapatee	Mean	14.4	0.9	322.5	86.0	270.4	8.6	4.8	7.4	1.5
	Range	12.6-16.5	0.6-1.1	248.9-363.4	67.5-98.6	204.0-318.0	7.7-10.7	4.45-5.3	6.7-8.2	1.2-2.1
	S.E.	0.45	0.05	11.65	3.20	10.53	0.29	0.11	0.21	0.10
	C.V.	9.52	18.18	10.84	11.18	11.68	10.15	7.13	8.48	19.91

Silver') for sample collected after rains. The alpha-amylase activity of the damaged samples increased in most of the varieties as evident by low falling number values. Softening of gluten presumably due to increase in proteolytic activity in rain damaged grains was observed. The dry gluten content of all the varieties except 'Faisalabad-83' collected after rains was significantly lower (4.8-8.4 percent) than samples collected before rains (7.7-11.6 percent). The protein content (N x 5.7) of the samples collected after rains was consistently lower (7.8-13.2) than those of the samples collected before rains (11.8-15.9) except for variety 'Faisalabad-83'. The ash content of the samples of these varieties harvested before and after rains was almost uniform. Kernel sprouting was significantly higher in the wheat samples collected after rains. The water absorption and dough

development time decreased in most of the varieties due to sprouting. The dough development time varied from 2.5 to 6.8 for samples collected before rains to 1.8-4.5 minutes for samples collected after rains. The stability was significantly reduced in most of the samples collected after rains except in 'Faisalabad-85' and 'Sarsabz'. The doughs exhibited a sticky nature with poor handling and baking characteristics.

Differences in alpha-amylase activity due to cultivars is important in breeding wheat varieties resistant to pre-harvest sprout damage. Since pre-harvest sprouting damage is caused by lack of dormancy and a high level of alpha-amylase activity in sprouted kernels, the cultivars that produce kernels, which are dormant and low in enzyme activity, can be used as parents, and this characteristic can be selected in a breeding programme.

### Effect of Pre-harvest Rains on Quality of Wheat Grown in Islamabad District

The effect of rains on quality of two varieties of wheat ('Lyp-73' and 'Pak-81') collected from 11 different locations of Islamabad district was studied (Table 4). The flour yield of the rain-damaged samples was slightly higher (71.7-72.4 percent) when compared to controls (68.8-70.2 percent). The falling number of rain-damaged samples was significantly lower (164-688) as compared to controls (267-410). This indicated the development of high alpha-amylase activity in rain-damaged samples as a result of rain damage. The wheat flour for bread-making produced best results at a falling number between 200 and 300. However, samples with falling number below 200 produced poor quality chapatties. The mean protein and dry gluten content

Table 3. Effect of sprouting on the technological value of commercial wheat varieties

Variety	Time of harvest	Test wt (kg/hl)	1000 kernel wt(g)	Grain size	Sprouted kernels (%)	Flour yield % (14%mb)	Falling number (sec)	Water Abs. (%)	DDT (min)	Stab. (min)	Gluten dry (%)	Protein (% db)
'Lyp-73'	Before rain	70.3	34.5	Small	0	68.9	410	62.4	5.5	5.0	10.3	15.1
	After rain	71.8	36.5	Medium	7.7	71.0	270	55.7	2.3	4.9	6.7	9.8
'Barani-83'	Before rain	74.6	35.8	Medium	0	73.0	367	63.8	6.8	5.8	10.2	14.1
	After rain	68.8	36.3	Medium	17.0	70.9	174	59.4	2.2	4.3	7.4	11.7
'Blue Silver'	Before rain	77.2	43.0	Medium	0	67.1	285	62.6	3.5	3.5	9.8	12.7
	After rain	71.2	42.0	Medium	6.0	69.6	290	60.2	2.8	1.5	8.0	10.4
'Kohinoor-83'	Before rain	70.5	31.4	Small	0	73.1	295	61.8	4.5	6.3	9.8	12.9
	After rain	68.2	33.0	Small	12.0	70.7	278	58.0	4.0	4.8	6.6	10.0
'Faisalabad-83'	Before rain	72.1	33.8	Small	0	70.7	271	62.5	2.8	3.5	7.7	10.2
	After rain	72.5	37.2	Medium	15.5	74.4	284	61.0	2.5	1.2	7.5	10.3
'Pirsabak-85'	Before rain	73.1	38.9	Small	0	76.1	294	64.4	2.5	6.2	9.7	14.3
	After rain	76.4	38.5	Medium	21.5	69.9	176	59.0	3.5	4.3	6.4	9.9
'Faisalabad-85'	Before rain	78.5	44.0	Medium	0	70.1	328	62.6	4.2	3.0	11.6	15.9
	After rain	75.0	40.1	Medium	10.0	69.8	241	59.6	4.0	3.0	7.6	11.5
'Punjab-85'	Before rain	75.3	40.1	Medium	0	72.1	338	61.0	4.5	4.3	9.3	13.2
	After rain	71.4	37.2	Medium	12.0	69.9	288	58.4	4.5	4.0	7.7	11.1
'Sarsabz'	Before rain	75.6	28.2	Small	0	68.2	316	61.9	3.0	3.0	8.8	11.8
	After rain	71.4	30.0	Small	9.0	69.6	203	59.4	4.0	3.8	7.0	9.8
'Pak-81'	Before rain	73.8	35.8	Medium	0	70.2	268	63.5	5.7	4.5	9.4	14.0
	After rain	69.2	37.7	Medium	13.0	68.4	184	57.6	1.8	1.5	4.8	7.8