

**Nutritional diversity in spring wheat with chronological perspective and its association with grain yield**

**Ghulam Mahboob Subhani, Javed Ahmad, Abid Subhani, Makhdoom Hussain and Abid Mahmood**

**Supplementary Table 1** Mean values for yield, protein and minerals of 58 wheat varieties belonging to different groups

Sr. No.	Variety	Grain Yield (kg ha <sup>-1</sup> )	Protein (%)	Zn <sup>2+</sup> (µg g <sup>-1</sup> )	Fe <sup>2+</sup> (µg g <sup>-1</sup> )	Mn <sup>2+</sup> (µg g <sup>-1</sup> )	Cu <sup>2+</sup> (µg g <sup>-1</sup> )	NO <sub>3</sub> <sup>-</sup> (µg g <sup>-1</sup> )	H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> (µg g <sup>-1</sup> )	K <sup>+</sup> (µg g <sup>-1</sup> )
Group 1: Pre-green revolution varieties Local (5)										
1	C-518	2017 zA	11.92 bcd	10.00 wx	44.67 cdefg	21.33 rstuv	3.60 mnopqrs	19067 bcde	2233 mnopqr	4800 efghijk
2	C-217	2053 zA	12.08 bcd	29.33 efghi	46.00 cdef	31.33 klmn	4.67 fghijkl	19333 bcde	2300 lmnopqr	4333 ijklmnop
3	C-271	1715 B	12.56 abcd	56.00 a	52.00 b	46.67 efg	6.00 bcdef	20100 abcde	1933 r	3867 klmnopq
4	C-273	1930 A	11.85 bcd	15.33qrstuv	37.33 ijklm	39.33 hij	6.27 bcd	18967 bcde	2400 jklmnopqr	3467 pq
5	Dirk	2182 z	12.00 bcd	25.00 ijklmn	36.00 klmno	28.67 mnopq	4.80 efghijk	19200 bcde	2133 opqr	4600 ghijklm
Group 2: Green revolution varieties Local (7)										
6	Chanab-70	3436 lmn	11.86 bcd	22.67 jklmno	35.33 klmno	26.67 nmopqrs	4.67 fghijklmnop	19033 bcde	3200 cdef	5467 cdefgh
7	SA-75	2195 z	11.52 bcde	17.67 opqrstu	26.00 tuvw	24.33 opqrstuv	3.30 pqrst	18433 bcde	2767 fghijklm	4333 ijklmnop
8	Punjab-76	2692 wxy	12.40 abcd	9.00 x	28.33 qrstu	23.00 pqrstuv	2.63 t	19833 abcde	2533 ghijklmnopq	3500 opq
9	LU-26	2802 uvw	11.10 def	15.67 qrstu	28.33 qrstu	26.33 nopqrst	4.43 ghijklmnopqrs	17767 ef	2667 fghijklmno	3600 nopq
10	Bulbul	2859 tuvw	6.54 g	34.67 cd	47.33 bcd	46.00 efg	4.33 ghijklmnopqrs	10467 g	2700 fghijklmn	3867 klmnopq
11	Indus-79	3212 opq	12.04 bcd	16.67pqrstu	18.67 x	19.33 uv	3.57 mnopqrst	19267 bcde	2900 fghijk	3800 lmnopq
12	Chanab-79	3232 opq	11.88 bcd	37.33 c	17.00 x	22.33 qrstu	5.17 cdefghijkl	19000 bcde	2367 klmnopqr	3633 mnopq
Group 3: Green revolution varieties CIMMYT (11)										
13	Mexipak	3781 k	11.21 cdef	21.00 lmnop	49.33 bc	48.00 ef	6.53 bc	17933 def	2267 lmnopqr	6867 a
14	Blue silver	2600 xy	11.50 bcde	29.33 efghi	28.67 qrstu	46.00 efgs	3.60 mnopqrst	18400 bcde	2167 nopqr	4200 ijklmnop
15	ARZ	3142 opqrs	12.58 abcd	26.00 hijkl	45.33 cdef	34.00 jklm	4.80 wfghijklmn	20133 abcde	2100 pqr	4467 ijklmno
16	Sandal	2712 wxy	11.44 bcde	26.67 hijk	35.33 klmno	36.00 ijkl	5.13 defghijkl	18300 bcde	2567 ghijklmnopq	6333 abc
17	Lyallpur-73	3067 pqrs	12.60 abcd	14.00 stuvw	42.67 defgh	28.67 mnopq	3.13 rst	20167 abcde	2800 fghijkl	6267 abc

18	Pari-73	3004 rst	12.50 abcd	24.67 ijklmn	18.67 x	28.67 mnopq	3.47 nopqrst	20000 abcde	2267 lmnopqr	4033 ijklmnopq
19	Pothwar-73	3040 qrst	11.27 cdef	34.00 cde	48.00 bc	47.33 efg	6.00bcdef	18033 cdef	3033 defgh	5600 cdef
20	Noori	3259 nop	11.75 bcde	26.00 hijkl	57.67 a	29.33 mnop	9.07 a	18800 bcde	2100 pqr	5733 bcde
21	Pavon	2779 vwx	11.23cdef	18.00 opqrst	35.33 klmno	41.33 ghi	4.20 jklmnopqrs	17967 def	2733 fghijklm	4267 ijklmnopq
22	Wl-711	2963 stuv	12.00 bcd	19.33 opqr	21.33 wx	37.33 ijk	3.73 mnopqrst	19200 bcde	2600 ghijklmnop	6333 abc
23	Bahawalpur-79	3286 mno	13.81 a	13.33 tuvwx	29.00 pqrstu	30.00 lmno	3.27 qrst	22100 a	2900 fghijk	3500 opq
Group 4: Post-green revolution varieties Local (2)										
24	Punjab-81	2999 rstu	12.50 abcd	13.33 Tuvwx	24.00 uvw	25.67 nopqrstu	5.63 bcdefghi	20000 abcde	2267 lmnopqr	3933 jklmnopq
25	Shalimar-88	3564 l	11.44 bcde	19.33 Opqr	30.00 pqrst	20.00 tuv	3.50 mnopqrst	18300 bcde	2267 lmnopqr	3567 nopq
Group 5: Post-green revolution varieties CIMMYT (9)										
26	Pak-81	4066 ij	12.33 abcd	12.67 uvwx	30.00 pqrst	26.67 nopqrs	6.50 bcd	19733 abcde	2767 fghijklm	3767 lmnopq
27	Barani-83	2546 y	12.81 ab	16.67 pqrstu	22.00 vwx	20.00 tuv	4.00 klmnopqrst	20500 abc	3067 defg	3867 klmnopq
28	Kohinoor-83	3073 pqrs	12.83 ab	19.67 nopq	28.00 qrstu	20.33 stuv	3.60 mnopqrst	20533 ab	2500 hijklmnopq	3200 q
29	Punjab-85	3964 jk	11.90 bcd	14.00 stuvwx	29.00 pqrstu	18.67 v	5.43 cdefghij	19033 bcde	2367 klmnopqr	4033 ijklmnopq
30	Faisalabad-85	2955 stuv	12.38 abcd	21.00 lmnop	30.00 pqrst	25.00 nopqrstuv	3.30 pqrst	19800 abcde	2533 ghijklmnopq	3733 lmnopq
31	Sutlej-86	3330 mno	11.96 bcd	13.33 tuvwx	32.67 mnopq	27.33 nopqr	4.03 lkmnopqrs	19133 bcde	3800 ab	3833 klmnopq
32	Chakwal-86	2559 y	12.06 bcd	16.00 pqrstuv	28.67 qrstu	20.00 tuv	4.27 ijklmnopqrs	19300 bcde	2733 fghijklm	3967 ijklmnopq
33	Rawal-87	2690 wxy	12.71 abc	20.33 mnopq	27.00 rstuv	24.00 opqrstuv	3.83 lmnopqrst	20333 abcd	2600 ghijklmnop	3567 nopq
34	Punjanad-88	3482 lm	12.85 ab	14.33rstuvw	25.67 tuvw	20.67 stuv	3.07 st	20567 ab	2133 opqr	4533 hijklmn
Group 6: Recently discontinued varieties Local (6)										
35	Inqalab-91	4578 b	11.27 cdef	19.67 nopq	36.67 jklmn	22.67 qrstuv	3.73 mnopqrst	18033 cdef	2700 fghijklmn	3867 klmnopq
36	Punjab-96	4139 ghij	11.48 bcde	37.33 c	44.67 cdefg	58.00 bc	4.60 ghijklmnopq	18367 bcde	2933 fghij	6667 ab
37	Kohistan-97	4316 cdefg	11.38 bcde	32.00 defg	36.67 jklmn	48.67 def	5.80 bcdefg	18200 bcde	3733 abc	5867 bcd
38	Iqbal-2000	4017 ij	11.56 bcde	32.00 defg	32.67 mnopq	60.67 bc	7.00 b	18500 bcde	3033 defgh	5533 cdefg
39	SH-2002	4081 hij	11.38 bcde	35.33 cd	41.33 fghij	41.33 ghi	4.80 efg hijklmn	18200 bcde	3033 defgh	5733 bcde
40	AS-2002	4099 hij	12.38 abcd	29.33 efghi	38.00 hijkl	68.33 a	5.67 bcdefgh	19800 abcde	2867 fghijk	4667 fghijkl
Group 7: Recently discontinued varieties CIMMYT (7)										
41	Rohtas -90	4476 bc	12.08 bcd	11.00 vwx	32.33 mnopq	20.33 stuv	4.23 jklmnopqrs	19333 bcde	2267 lmnopqr	3700 lmnopq
42	Pasban-90	4455 bcd	12.13 bcd	17.67 opqrstu	31.67 nopqr	21.00 rwtuv	3.60 mnopqrst	19400 bcde	3500 bcde	3700 lmnopq
43	Kohsar-95	3172 opqr	11.27 cdef	34.00 cde	35.33 klmno	44.00 fgh	6.07 bcde	18033 cdef	3900 ab	4867 efghio
44	Chakwal-97	3248 nop	11.75 bcde	49.33 b	40.00 ghijk	59.33 bc	6.53 bc	18800 bcde	3567 abcd	4667 fghijkl
45	Zarlashta-99	3483 lm	12.54 abcd	19.33 opqr	49.33 bc	28.67 mnopq	4.60 ghijklmnopq	20067 abcde	2033 qr	4867 efghij
46	Margalla-99	3298mno	11.81 bcde	30.67 defgh	45.33 cdef	50.00 def	4.87 efg hijklm	18900 bcde	2933 fghij	5867 bcd
47	Wafaq-2001	3314 mno	11.69 bcde	27.33 ghij	36.67 jklmn	60.00 bc	4.73 efg hijklmno	18700 bcde	2967 efghi	5467 cdefgh

---

Group 8: Present varieties Local (7)										
48	Auqab-2000	4204 efghi	11.17 def	26.67 hijk	42.00 efghi	51.33 de	4.53 ghijklmnopq	17867 def	2733 fghijklm	4867 efghij
49	Shafaq-2006	4174 fghi	11.58 bcde	18.67 opqrs	36.67 jklmn	67.33 a	4.47 ghijklmnopqr	18533 bcde	3000 efghi	4133 ijklmnopq
50	Fareed-2006	4060 ij	6.94 g	22.00 klmno	38.67 hijkl	54.67 cd	4.60 ghijklmnopq	11100 g	3800 ab	3833 klmnopq
51	Lasani-2008	4386 bcde	9.79 f	34.67 cd	32.00 nopqr	60.67 bc	3.87 lmnopqrst	15667 f	3033 ddefg	5600 cdef
52	AARI 2011	4363 cdef	11.44 bcde	19.33 opqr	26.33 stuvw	20.00 tuv	3.50 mnopqrst	18300 bcde	2467 ijklmnopqr	3567 nopq
53	Punjab-11	4264 defgh	11.27 cdef	19.00 opqrs	34.00 lmnop	23.67 opqrstuv	3.40 opqrst	18033 cdef	2700 fghijklmn	3867 klmnopq
54	Millat-11	4126 ghij	11.27 cdef	19.67 nopq	36.00 klmno	23.33 pqrstuv	3.57 mnopqrst	18033 cdef	2700 fghijklmn	3867 klmnopq
Group 9: Present varieties CIMMYT (4)										
55	GA-2002	3282 no	11.54 bcde	28.67 fghi	36.00 klmno	64.00 ab	4.60 ghijklmnopq	18467 bcde	2800 fghijkl	4933 defghi
56	Seher-2006	4948 a	11.19 cdef	32.00 defg	35.33 klmno	50.67 de	5.27 cdefghijk	17900 def	3167 def	4333 ijklmnop
57	Chakwal-50	3559 l	12.17 bcd	18.67 opqrs	46.67 cde	62.67 ab	5.27 cdefghijk	19467 bcde	3033 defgh	6267 abc
58	FSD-2008	4581 b	10.29 ef	33.33 cdef	31.33 opqes	59.33 bc	3.87 lmnopqrst	15667 f	4067 a	5867 bcd
	LSD (0.05)	197.27	1.54	5.27	5.15	6.60	1.39	2472	558.1	997.4

---

**Supplementary Table 2** List of wheat varieties used in the study, their year of release and parentage

S. No.	Variety	Year	Parentage
Group 1: Pre-green revolution varieties Local (5)			
1	C-518	1933	T9 x 8A
2	C-217	1940	C516 x C591
3	C-271	1957	C230 x IP165
4	C-273	1957	C209 x C591
5	Dirk	1958	FORD/DONDEE
Group 2: Green revolution varieties Local (7)			
6	Chanab-70	1970	C271-WT(E) x SON64
7	SA-75	1975	(NAI60-CB151 x S.948) M.PAK
8	Punjab-76	1976	(NAI60-CB151 x S.948) M.PAK
9	LU-26	1977	BLS-KHUSHAL 69
10	Bulbul	1977	OI/FROND/3/MZ//MXP
11	Indus-79	1979	BB/15 13 5/SON 64
12	Chanab-79	1979	PB-76 x CHB 70
Group 3: Green revolution varieties CIMMYT (11)			
13	Mexipak	1965	PJ62 'S'-GB-55
14	Blue silver	1971	II-54-388-AN(YT.54-N 10 B x LR 64)
15	ARZ	1973	MAYO54E-LR 64 x TAC 'S'/LR 64 x TZPP-Y54
16	Sandal	1973	CNO//SN64/KL.REND/3/8156
17	Lyalpur-73	1973	BB-NOR 67
18	Pari-73	1973	CNO 'S' x SON-KL.REND/M.PAK
19	Pothwar-73	1973	144/3-35 x NAD 63
20	Noori	1975	CNO//SN64/KL.REND/3/8156
21	Pavon	1978	VCM x CNO 'S'-7C/KAL-BB
22	W1-711	1978	S308-CHR/KAL
23	Bahawalpur-79	1979	CNO 'S'-LR64(R) x SON 64/SON (AMBER)
Group 4: Post-green revolution varieties Local (2)			
24	Punjab-81	1981	INIA/SON64-P.4160(E) x SON64
25	Shalimar-88	1988	PB.81-HD2182 x PB.81
Group 5: Post-green revolution varieties CIMMYT (9)			
26	Pak-81 <sup>a</sup>	1981	KVZ/BUHO//KAL/BB
27	Barani-83	1983	BB-GALLO/GTO-7C x BB-CNO
28	Kohinoor 83 <sup>a</sup>	1983	(OREF <sub>1</sub> .158-FDL x MEXIFEN 'S'-TIBA63) COC75
29	Punjab-85 <sup>a</sup>	1985	KVZ-TRM x PTM-ANA
30	Faisalabad-85 <sup>a</sup>	1985	MAYA-MONCHO 'S' x KVZ-TRM
31	Sutlej-86	1986	CMT/YR//MON 'S'
32	Chakwal-86	1986	FORLANI-ACCICO10 x ANA75
33	Rawal-87 <sup>a</sup>	1987	MAYA-MONCHO 'S'/KVZ-TRM
34	Punjad 88	1988	K.4500*2/BJY
Group 6: Recently discontinued varieties Local (6)			
35	Inqalab-91	1991	WL711/CROW 'S'
36	Punjab-96	1996	SA42/3/CC/INIA/BB/INIA/4/CNO / HD832
37	Kohistan-97	1997	V-1562//CHRC 'S'/HORK / 3 / KUFRA-1/4/CARP 'S' /BJY
38	Iqbal-2000 <sup>a</sup>	2000	BURGUS/SORT-12-13 //KAL/ BB /3/ PAK81
39	SH-2002	2002	INQ.91/FINK 'S'

40	AS 2002	2002	KHP/D31708//CM74A370/3/CIAN079/4/RL6043/*4NAC
Group 7: Recently discontinued varieties CIMMYT (7)			
41	Rohtas -90	1990	INIA66/A.DISTT//INIA66/3/GEN 81
42	Pasban-90	1990	INIA66/A.DISTT//INIA66/3/GEN81
43	Kohsar-95	1995	PSN/BOW
44	Chakwal-97	1997	BUC 'S'/FCT 'S'
45	Zarlashta-99	1999	URES/BOW 'S'
46	Margalla -99	1999	OPATA/BOW 'S'
47	Wafaq 2001	2001	OPATA/RAYON//KAUZ
Group 8: Present varieties Local (7)			
48	Auqab-2000	2000	CROW 'S'/ NAC// BOW'S'
49	Shafaq-2006	2006	LU 26/HD2179//2*INQ-91
50	Fareed-06	2006	PT'S/3/TOB/LFN//BB/4/BB/HD-832-5 //ON/5/G-V//ALD 'S'//HPO
51	Lasani-2008	2008	LUAN/KOHISTAN.97
52	AARI 2011	2011	SHALIMAR88 / 90A204 // MH.97
53	Punjab-11	2011	AMSEL/ATTILA//INQ.91/PEW 'S'
54	Millat-11	2011	CHENAB.2000/INQ.91
Group 9: Present varieties CIMMYT (4)			
55	GA-2002	2002	DWL 5023/SNB//SNB
56	Seher-2006	2006	CHIL/2*STAR/4/BOW/CROW//BUC/PVN /3/ 2*VEE#10
57	Chakwal-50	2008	ATTILA/3/HUI/CARC//CHEN/CHTO/4/ATTILA
58	FSD-2008	2008	PBW65/2*PASTOR

a = 1B/1R translocation present in these varieties.

**Supplementary Table 3** Mean minimum, maximum temperature and rainfall during cropping season 2011-12

Month	Mean Temperature (°C)		Rainfall (mm)
	Minimum	Maximum	
October, 2011	18.1	33.6	0.0
November, 2011	13.6	29.2	0.0
December, 2011	4.8	23.1	0.0
January, 2012	4.1	19.5	3.2
February, 2012	5.6	21.0	6.3
March, 2012	12.9	28.1	1.8
April, 2012	19.8	33.4	35.4
May, 2012	24.3	39.7	0.1
Total			46.8