A REVIEW OF HUNDRED YEARS OF WHEAT RESEARCH AND DEVELOPMENT IN PUNJAB (1911-2010)

L. H. Akhtar, M. Hussain[*], A. H. Tariq[*] and M. Nasim[**]

Agricultural Research Station, Bahawalpur
[*]Regional Agricultural Research Institute (RARI), Bahawalpur
[**]Soil and Water Testing Laboratory, Bahawalpur

ABSTRACT: This paper presents share of agriculture to GDP and workforce and its growth rate. Importance of wheat as food, its contribution towards value added and GDP has been reviewed. Food requirements of Pakistan have been discussed. Area, production and yield per ha during 2006-07 and 2007-08 have been given. Wheat situation in 2009, uses, availability and consumption of wheat has been presented. Support price and quality seed distribution has been discussed. A review of hundred years of wheat research and development in Punjab from 1911 to 2010 and the wheat varieties developed have been tabulated with their name, pedigree and year of release. Constraints being faced by agriculture research and their solutions have been suggested.

Key words: Agriculture, support price, wheat, work force.

INTRODUCTION

Agriculture is the single largest sector, contributing 21 percent to GDP and employing 44 percent of the workforce. Agriculture is the main source of livelihood for 66 percent of the country's population. Growth in the agriculture sector registered a sharp recovery in 2006-07 and grew by 5.0 percent as against the preceding year's growth of 1.6 percent. Major crops posted strong recovery from negative 4.1 percent last year to positive 7.6 percent, mainly due to higher production of wheat and sugarcane. Wheat production of 23.421 million tons is the highest ever in the country's history, registered an increase of 11.7 percent over last year (Anonymous, 2007, 2009).

About 93 % of the food to feed the people of the world comes from plants, two-third of which is contributed by the cereals (wheat, maize, barley, sorghum, and millet). These cereals are the major source of calories and protein for the most of the world. About 80 % of the global cereal production comes from wheat, maize, and rice. Among the cereals, wheat is the largest. Of the two principal types of wheat, 90 % of the world's wheat is bread wheat, which accounts for 94 % of the production. Wheat is grown in 27 countries in the developing world. Pakistan is the 8th largest producer after the Russian Federation, China, the U.S., India, Canada, Australia, and Turkey. Durum wheat is grown in North Africa, the Near and Middle East, Russian Federation, India, Italy, France, the Northern U.S., and some areas of Canada (Stubbs *et al*., 1986).

Wheat is a staple food item of Pakistani people; therefore, it is grown in almost every part of the country. It contributes 13.1 percent to the value added in agriculture and 2.8 percent to GDP (Anonymous, 2009). The wheat share in cereal crops is between 70.7 and 80.0 % in terms of area and production in Punjab and 65.3 and 72.1 % in Pakistan (Anonymous, 2007). Continued reliance on wheat as a mainstay of nutrition necessitates an increase in stability and production (yield ha^{-1}) in order to combat the food shortage. To achieve this goal, various aspects of wheat research and development in the Punjab are presented as under:

Food requirements of Pakistan: An annual population growth rate of 3.1 % faces the government with the challenge of feeding an increasing population. The growth rate of agricultural production is slower than the population growth rate. The population by 2013 and 2023 could be as high as 231 and 315 million, respectively. Food-grain requirements of 37 and 51 million tons are expected during 2013 and 2023, respectively. A yield gap of 72 % has been reported between the potential (6.4 tons ha^{-1}) and the average wheat yield (1.8 tons ha^{-1}) in Pakistan (Anonymous, 1996).

Increased food production continues to be a high priority in the face of continued population increase. More than two-third's of Pakistan's population lives in rural areas and their livelihood continues to revolve around agriculture and allied activities. Like in other developing countries, poverty in Pakistan is largely a rural phenomenon; therefore, development of agriculture will be a principal vehicle for alleviating rural poverty (Anonymous, 2008).

Area, production and yield of wheat: Area and production target of wheat for the year 2008-09 were set at 8.6 million hectares and 25.0 million tons, respectively. Wheat was cultivated on an area of 9.046 million hectares, showing 5.9 percent increase over last year (8.6 million hectares). The size of the wheat crop has been

23.421 million tons–highest wheat production in the country's history, which is 11.7 percent higher than last year. Yield per ha has shown an increasing trend of 5.5% (2585 kg ha^{-1}) (Anonymous, 2009). During the years 2006-08, three new high yielding wheat varieties namely *Sehar-2006, Shafaq-2006, Fareed-2006 ,Mairaj-08, Faislabad-08 and Lasani-08* were released which contributed towards achieving higher production (Anonymous, 2007).

Area and production target of wheat for the year 2007-08 were set at 8.578 million hectares and 24.220 million tons, respectively. Wheat was cultivated on an area of 8414 thousand hectares, showing 1.9 percent decrease over last year's area of 8578 thousand hectares. The size of the wheat crop was provisionally estimated at 21.75 million tons, 6.6 percent less than last year and 9.4 percent less than the target for this year. There are several reasons for the decline in wheat production. Firstly, the area sown under wheat crop declined by 2 percent as a result of delayed start of sugar crushing season and late cotton picking by the growers. Secondly, the higher prices of DAP (Rs. 850 to Rs. 3000 per 40 kg) discouraged farmers to use more phosphoric fertilizer, thus affecting yield of the crop. Thirdly, shortage of irrigation water by 23.3 percent over normal supplies during Rabi season affected wheat crop. Finally, the incidence of severe frost on early sown crop caused damage in some areas of Punjab (Anonymous, 2008).

Wheat situation in 2007-08: The outgoing fiscal year also witnessed the worst ever wheat crisis in the country's history. Pakistan produced a bumper wheat crop of 23.3 million tons. The news about the bumper wheat crop started pouring in April 2007, resulting in a decline in wheat prices. To prevent the wheat price falling before the harvesting of crop, the government allowed exports of 0.5 million ton of wheat in April 2007. Wheat prices started moving upward sharply in the international market sometime during June 2007, touching all time high at over $500 per ton. Prices of wheat in neighbouring countries were also very high compared with the price prevailing in the domestic market. Consequently, the price differential encouraged unscrupulous elements to enter into hoarding and smuggling, causing domestic price to surge at unprecedented level. The government, in its attempt to stabilize wheat prices, took various measures including: banning of export of wheat, imposition of 35 percent regulatory duty on export of wheat to Afghanistan; early release (September 2007) of wheat to flour mills; monitoring and controlling flour prices through Magistrates; beefing up of anti-smuggling measures through the establishment of Federal Food Committee, sale of wheat flour at subsidized rates through the outlets of the Utility Stores Corporation (USC), the State Bank of Pakistan sending instructions to the Commercial Banks for not rolling over the financing facility of wheat given to private sector beyond January 31, 2008, and import of 1.7 million tons of wheat to augment supplies. The wheat produced in 2007-08 will be consumed in 2008-09. To achieve procurement target of 5.0 million tons, the government increased the minimum guaranteed price further from Rs 625 to 925 per 40 kg. The higher prices offered to farmers this year would encourage them to grow more wheat in coming years. This can only be achieved if government changes its emphasis from price to yield enhancement (Anonymous, 2008).

Uses, availability, and consumption of wheat: Wheat is the staple food of the people of Punjab and Pakistan supplying 72 % of the calories and protein in the average diet (CIMMYT, 1989). White and amber colored wheat with high gluten strength is preferred. Wheat is mainly used for *chapati* and *Nan*. Wheat flour is the basis of all breads, biscuits, pastry, and macaroni products. Wheat provides the starch that is used in a wide range of industries from food processing to paper manufacturing and from laundering to oil well drilling (Stubbs *et al*., 1986). The wheat flour is also used to prepare a wide range of sweets, vermicelli, semolina, *jawrey* (hand made small vermicelli), *chillreys*, and *tikreys* (especially in Southern Punjab). About 5-10 % of the wheat harvest (usually low-quality grains) also is used as animal feed (CIMMYT, 1989) needed for an increased demand for poultry, meats, and eggs.

Although the production of wheat is rising over the years, however, when viewed in relation to per capita availability, its performance has been dismal at best. In other words, wheat production has been rising, on an average, in relation to the size of population, but exhibited a fluctuating trend along the per capita availability of 126.77 kg (Anonymous, 2010). During the last 10 years (2001-2009), per capita per anum availability of wheat has been from 114.92 to 126.77 (Anonymous, 2010) as against per capita par anum consumption of 97.98 kg.

Distribution of improved seed: It is generally accepted that high quality seed is the most effective input for improving productivity. The Punjab Seed Corporation (PSC) was established in 1976 as a part of a project with World Bank. PSC produces, procures, and distributes seed of various crops in the Punjab. The certified wheat seed availability was 250760 and 229520 tons on Pakistan and Punjab basis, respectively, during 2008-09 (Anonymous, 2010).

WHEAT RESEARCH AND DEVELOPMENT

FIRST PHASE (1911-44): The Punjab Department of Agriculture and Punjab Agricultural College and Research Institute (PAC & RI) at Lyallpur (now Faisalabad) were established in 1905 and 1906, respectively. As a result of the efforts of the Punjab

Agricultural Research Board and research scientists, three varieties of wheat, T9, T11, and 8A were released in 1911, 1913, and 1919, respectively. C228 and C250 were released as sister lines. A complete list of 9 important varieties released upto 1944 is given in Table 1.

Table 1 Wheat varieties released in Punjab from 1911 to 1944

Varieties	Parentage	Research Institute/Station	Year of release
T9	Selection from landraces	Punjab Agricultural College and Research Institute, Lyallpur	1911
T11	-do-	-do-	1913
8A	-do-	-do-	1919
9D	-do-	-do-	1932
C518	T9 x 8A	-do-	1933
C591	T9 x 8B	-do-	1934
C228	Hard Federation x 9D	-do-	1941
C217	C516 x C591	-do-	1944
C250	Hard Federation x 9D	-do-	1944

Source: CIMMYT (1989) and Director Wheat, Faisalabad.

Second Phase (**1947-1980):** The two tall bread wheat varieties C271 and C273 were released during 1957 for commercial cultivation. Because of their low yield potential, a gain of only 125 kg ha^{-1} was achieved (2,400 to 2,525 kg/ha) in 40 years (Khan, 1987). A team of scientists visited Mexico for training in 1961-63. A medium to hard, white grain line was selected from segregating generations of the cross 8156 (Penjamo/Gabo) and brought to Pakistan. This line had the preferred color and high-gluten strength needed to make good chapati. The line also had a higher yield and was resistant to rust and powdery mildew. After yield testing, it was released in the name of Mexipak for general cultivation in 1965. This variety launched the Green Revolution in the Pakistan. In 1970, the semi dwarf variety Chenab-70 was released as a result of a cross between C271 and a Mexican genotype. This variety possessed excellent grain quality and was resistant to a new race of rusts that were virulent on Mexipak, and had 10-15 % more yield potential than Mexipak. Barani-70 was released for the Barani conditions in 1970, whereas SA-42 and Blue Silver (Sonalika) were released as short-season varieties during 1971. In 1972-73, the commercial varieties Chenab-70, Mexipak, Barani-70, and SA-42 became susceptible to rust. By that time, newer varieties, Blue Silver, Lyallpur-73, Sandal-73, and Pari-73, had been released but seed availability was not enough to meet the nation's requirement. List of 23 released varieties from 1957 to 1980 is given in Table 2.

Table 2 List of wheat varieties released in the Punjab between 1957-80

Varieties	Parentage	Research Institute/Station	Year of Release
C271	C230/IP165	Punjab Agricultural College and Research Institute, Lyallpur	1957
C273	C209/C591	-do-	1957
Dirk	Ford/Dondee	-do-	1958
Mexipak	PJ62"S"-GB-55	AARI, Faisalabad	1965
Chenab 70	C271-WT(E)//SON 64	-do-	1970
Barani 70	PIT-GB/C271	-do-	1970
SA 42	C271-LR64/SON 64	-do-	1971
Blue Silver	II-54-388-AN(YT.54-N 10B/LR 64)	RARI, Bahawalpur	1971
LYP-73	BB-NOR 67	AARI, Faisalabad	1973
Sandal 73	CNO//SN64/KL.REND/3/8156	-do-	1973
Pothowar	114B-35/NAD 63	-do-	1973
Pari 73	CNO'S'//SON/KL.REND/M.PAK	-do-	1973
Yecora	CNO'S'//SON-KL.REND/8156	-do-	1973
ARZ	MAYO54E-LR 64/TAC'S'//LR 64/TZPP-Y54	-do-	1973
SA75	(NAI60-CB151/S.948)M.PAK	-do-	1975
Nuri-70	CNO'S'//SON64/KLRE/3/8156	-do-	1975
Punjab-76	(NA160-CB151XS.948)M.PAK	-do-	1976
Pavon	VCM//CNO'S'-7C/KAL-BB	-do-	1976
LU26	BLS-KHUSHAL 69	University of Agriculture, Faisalabad	1976
WL711	S308-CHR/KAL	AARI, Faisalabad	1978
Chenab-79	PB-76/CHB 70	-do-	1979
BWP-79	CNO'S'-LR64(R)//SON 64/SON(AMBER)	RARI, Bahawalpur	1979
INDUS-79	BB/15.13.5//SON64	AARI, Faisalabad	1980

Source: CIMMYT (1989) and Director Wheat, Faisalabad

Third Phase (1981-2008): Since 1981, forty high-yielding and disease resistant wheat varieties possessing good quality and tolerance to various biotic and abiotic stresses have been released. The detail of their names, pedigree and year of release is summarized in Table 3.

Table 3 A list of wheat varieties released in the Punjab from 1981 to 2008

Varieties	Parentage	Research Institute/Station	Year of Release
Punjab-81	INIA/SON 64-P.4160(E)//SON 64	WRI, Faisalabad	1981
Pak-81	KVZ/BUHO//KAL/BB	-do-	1981
Barani-83	BB-GALLO/GTO-7C//BB-CNO	-do-	1983
Kohinoor-83	OREF1 158-FDL/MEXFEN'S'-TIBA63)C0C75	-do-	1983
FSD-83	FURY/KAL-BB	-do-	1983
FSD-85	MAYA-MONCHO'S'/KVZ-TRM	-do-	1985
PB-85	KVZ-TRM/PTM-ANA	-do-	1985
WDK-85	GUIL'S'/SNIPE'S'//GDO VZ449 (durum wheat)	-do-	1985
Sutlej-86	CMT/YR//MON'S'	RARI, Bahawalpur	1986
Chakwal-86	FORLANI-ACCICO 10/ANA 75	WRI, Faisalabad	1986
Rawal-87	MAYA-MONCHO'S'/KVZ-TRM	Agri. Research Station, Rawalpindi	1987
Shalimar-88	PB81-HD2182/PB81	WRI, Faisalabad	1988
Punjnad-88	K.4500*2/BJY	RARI, Bahawalpur	1988
Rohtas-90	INIA66/A.DISTT//INIA66/3/GEN81	WRI, Faisalabad	1990
Pasban-90	INIA66/A.DISTT//INIA66/3/GEN81	WRI, Faisalabad	1990
Inqlab-91	WL711/CROW'S'	WRI, Faisalabad	1991
Parwaz-94	(V.5648)CNO'S'/LR64//SON64/3/SON/4/PRL'S'	WRI, Faisalabad	1994
Shahkar-95	WL711//F3.71/TRM	WRI, Faisalabad	1996
Punjab-96	SA42/3/CC/INIA//BB/INIA/4/CNO/HD832	WRI, Faisalabad	1996
MH-97	ATTILA	WRI, Faisalabad	1997
Kohistan-97	V-1562//CHRC'S'/HORK/3/KUFRA-1/4/CARP'S'/BJY	WRI, Faisalabad	1997
Derawar-97	MLT'S'=ORE F1 158/FDI/KAL/BB/3/NAC	RARI, Bahawalpur	1998
BWP-97	SASONO-KOMOGI/NORIN/BOW'S'	RARI, Bahawalpur	1998
BWP-2000	AU/UP301//GLL/Sx/3/PEW'S'/4/MAT'S'/MAYA'S'//PEW'S'	RARI, Bahawalpur	2000
Punjnad-1	Pb-85 x NKT	RARI, Bahawalpur	2001
Iqbal-2000	BURGUS/SORT-12-13//KAL/BB/3/PAK-81	WRI, Faisalabad	2000
Uqab-2000	CROW'S'/NAC//BOW'S'	WRI, Faisalabad	2000
Chenab-2000	CBRD	WRI, Faisalabad	2000
Ufaq-2000	V.84/33/V.83150	ABRI, Faisalabad	2000
Bhakkar-02	P-20102/PIMA//SKA/3/TTR'S'/BOW'S'	AZRI, Bhakkar	2002
SH-2002	INQLAB-91/FINK'S	WRI, Faisalabad	2002
AS-2002	KHP/D-31708//CM-74-A-370/CIANO79/RL-6043/4*NAC	WRI, Faisalabad	2002
Manthar-03	KAUZ/ALTAR-84//AOS	RARI, Bahawalpur	2003
Sehr-06	CHILL/2*STAR/4/BOW/CROW//BUC/PVN/3/	WRI, Faisalabad	2006
Fareed-06	PTS/3/TOB/LFN//BB/HD832-5//ON/5/4-V/ALD'S'//HPO'S'	RARI, Bahawalpur	2006
Shafaq-06	LU-26/HD-2179//2*INQ-91	WRI, Faisalabad	2006
Chakwal-50	ATTILA/3/HUI/CARC//CHEN/CNTO/4/ATTILA	BARI, Chakwal	2008
Mairaj-08	SPARROW / INIA // V.7394 / WL 711//3/ BAU'S'	RARI, Bahawalpur	2008
Lasani-08	LUAN/KOH-97	WRI, Faisalabad	2008
Faisalabad-08	PBW62/2*PASTOR	WRI, Faisalabad	2008

Source: Economic Botanist, RARI, Bahawalpur and Director Wheat, Faisalabad

The role of the Ayub Agricultural Research Institute, Faisalabad: The Ayub Agricultural Research Institute, Faisalabad (AARI) was established during the year 1962 and is headed by a Director-General Agriculture (Research). The AARI has been the most productive crop science and research establishment in the province of Punjab. The institute has contributed materially to the transformation of agriculture, the green revolution and the improvement of the living standard of the people. AARI has 63 monocrop/single discipline research institutes/stations, about 37 substations, and 104 research farms for a total area of 13,033 acres (5274.38 ha)

throughout Punjab. AARI has 1,064 scientists in grades 17-20 and approximately 2715 supporting and 1075 administrative staff (Personal communication with DGA (R), AARI, Faisalabad office). Approximately 60-70 scientists are engaged in wheat research throughout Punjab. Institute scientists also conduct research on soil fertility, soil chemistry, food technology, agronomy, plant breeding and genetics, plant protection, agricultural economics, pulses, sugarcane, tobacco, vegetables, cotton, oilseed, post-harvest technology of fruits and vegetables, and agricultural biotechnology.

Since the establishment of AARI, a number of high-yielding, disease-resistant wheat varieties have been developed (Table 2 & 3). The following institutes are entrusted with wheat research program: Wheat Research Institute, Faisalabad; Barani Agricultural Research Institute, Chakwal; Regional Agricultural Research Institute, Bahawalpur; Soil Salinity Research Institute, Pindi Bhattian; and Agricultural Biotechnology Research Institute, Faisalabad

Wheat Research Institute, Faisalabad (WRI): The WRI is the main wheat research point in Punjab with about 30 research scientists headed by a Director. Scientists conduct research on bread wheat, durum wheat, barley, and Triticale. A very good crossing block has been maintained at the WRI for future use in the breeding program. As a result of the devoted and continuous research efforts of the Research Scientists of WRI, a number of excellent wheat varieties have been released for general cultivation. Inqlab-91 had been the most popular variety planted over a vast area throughout Pakistan but has become susceptible to rust diseases and its cultivation is banned by Government of the Punjab. The WRI released the durum wheat Wadhanak-85 in collaboration with ICARDA (ICARDA, 2000) and a variety of barely Jau-86 for general cultivation. WRI with an area of 27.92 ha has no substation. Two more varieties of barley namely Jau-87 and Haider-93 were also developed by WRI. Twelve wheat varieties developed after 2000 are listed in table 3.

It is a multicrop institute working on wheat, pulses, oilseeds, fodder, plant pathology and entomology, research at BARI is aimed at breeding crop varieties for the Barani areas of Punjab. Varieties of wheat developed at BARI for Barani area are listed in Table 3. BARI has three stations and three substations located at Attock, Fateh Jang, Piplan and Noshehra (Soon Valley).

Barani Agricultural Research Institute, Chakwal (BARI): BARI has 55 research scientists at its strength. The disciplinewise detail of researchers is given as under:

Regional Agricultural Research Institute, Bahawalpur (RARI): A multicrop Institute, RARI has 30 research staff headed by the Director Agriculture (Research) was established as Agricultural Research Station at Khanpur during 1950 and was upgraded to Regional Agricultural Research Institute during the year 1987. RARI has no substation. Wheat research is conducted by the Economic Botany Section. As a result of the untiring efforts of the researchers at RARI, several excellent wheat varieties have been approved and released for general cultivation in southern Punjab (Tables 2 & 3). RARI has cultivated area of 56 ha. The newly approved wheat varieties are expected to replace the existing wheat varieties in southern Punjab because of their high-yield potential, more productive tillers per unit area, and disease, salinity and lodging resistance.

Discipline	No. of Researchers	Discipline	No. of Researchers
Plant Breeding and Genetics	22	Entomology	2
Soil Chemistry	4	Agricultural Economics	2
Agronomy	7	Agricultural Engineering	2
Pathology	3	Technology	2
Horticulture	5	Statistics	1

Soil Salinity Research Institute, Pindi Bhattian (SSRI): It was established in 1982-83. A considerable increase in the waterlogged/saline/sodic areas in the province has necessitated the start of research to develop and test wheat material for resistance/tolerance to salinity and sodicity. The scientists at SSRI are struggling hard to develop wheat varieties that are resistant/tolerant to these stress conditions. Some new lines of wheat resistant to salinity namely S-12, S-13, S-27 and S-32 have been developed through selection from the wheat material received from CIMMYT.

Agricultural Biotechnology Research Institute, Faisalabad (ABRI): It was established in 1985. ABRI is conducting research on various aspects of wheat tissue culture to exploit the potential of somaclonal variation for the improvement of wheat and its future use in the development of new wheat varieties. Genetically engineered wheat seed resistant to pests and weeds will increase the present yields by 25 % in countries like Pakistan as soon as it is released (Kidwai, 1992). One variety of wheat namely Ufaq-2002 has been developed by this institute. Now, this institute develops new material of wheat through biotechnological means and hand over it to Wheat Research Institute for further evaluation and approval of varieties.

Arid Zone Research Institute, Bhakkar (AZRI): A multicrop institute headed by a director, AZRI has six scientists. The AZRI was established in 1991-92 to carry out research for Arid Zones of Bhakkar, Mianwali,

Khushab, Layyah, and Muzaffar Garh. Sufficient advanced material of various crops has been developed. A high yielding variety Bhakkar-2002 was developed by this institute (Table 3) and one advanced strain of wheat TW0107 is being tested in the National Uniform Yield Trial (NUYT) (Table 4).

University Of Agriculture, Faisalabad (UAF): The university was established during 1906 as West Pakistan Agricultural University, Lyallpur. It was re-designated as University of Agriculture, Faisalabad during 1962. It has developed rapidly during the last six decades. UAF has an experimental area of 850 ha and the largest number (303) of Ph.D. scientists (86 from Foreign countries and 217 from local universities). Besides teaching and training high-level manpower, the Department of Plant Breeding and Genetics is trying to evolve wheat varieties. LU-26 had been a popular wheat variety developed at UAF (Table 2).

Prospective wheat varieties: At present, 30 new promising wheat strains (11 for rainfed areas and 19 for irrigated areas) of various wheat breeding institutes of Punjab with high-yield potential and other good agronomic traits are in the pipeline. These lines are being tested in the NUYT as a prerequisite of approval for a new variety. Prospective strains of various institutes of Punjab included in NUYT in 2008-09 are listed in Table 4.

Line	Parentage	Institute
	FOR RAINFED AREAS	
NR-358	PFAU/Weaver*2//Kiritati	NARC, Islamabad
PR-98	CMH84.3379/CMH78.578//Milan	CCRI, Pirsabak
NR-360	PFAU/Seri. 1B//AMAD/3/W axwing	NARC, Islamabad
SN-151	Kambara-1	ARS, Sarai Naurang, Bannu
04FJS35	PASTOR//HXL7573/2*BAU	BARS, Fatehjang
AZRC-2008-1	Tracha,s//CMH76-252/pvn,s	AZRC, Quetta
PR-99	Hamam-4/Star “S”/Liz	CCRI, Pirsabak
KT-4	ALTAR84/AE.SQUARROSA219//SER	BARS, KOHAT
V-05003	Karvan2/4/Burgus/Sort12-13//Kal/BB/3/Pak81	WRI, Faisalabad
NRL-0320	FRET2	NIFA, Peshawar
5C011	Skauz/BAV92	BARI, Chakwal
	FOR IRRIGATED AREAS	
DN-62	SW89.518/Kauz	ARI, D. I. Khan
V-04178	SH88/90A-204//MH97	WRI,AARI, Faisalabad
SM-07018	Shalimar-88/Atilla//MH97	NIFA, Peshawar
22-03	Snb (s’)//Kea (s’)/Snb (s’)	NIA, Tandojam
B-07/Bkhtwr	LFN/1158.57//Prl/3/Hahn/4/Kauz	WRI, Sakrand
V-05082	Chenab2000/INQ.91	WRI, AARI, Faisalabad
PR-90	CNDO/R143//Ente/Mexi-213/	CCRI, Pirsabak
ZAS70	Inqalab 91 *2/Tukuru	NWFP Agri. University, Peshawar
33010	KT/Bage//Fnu/3/CH-86	RARI, BWP
AUP-4008	Gen*2//Buc/FIK/3/Buchin	NWFP Agric. University Peshawar
NIA-8/7	SHA4/Weaver//Skauz*2/SRMA	NIA, Tandojam
V-05066	Amsel/Attila//INQ.91/Pew,S’	WRI, AARI, Faisalabad
CT-03457	Attila *2/Yaco	NIFA, Peshawar
66284	INQ.91/CB-271(Ethopia)	RARI, BWP
SD-4085/3	Sarsabz/Sunco *2	NIA, Tandojam
NR-356	Oasis/Skauz//4 * BC/3/2* Pastor	NARC, Islamabad
9268	7012/PBW-222	Univ. of Agriculture, Faisalabad
V-05BT006	Maya/Mon ‘S//Hork/Fsd85	WRI/Biotech, Faisalabad
V-04022	INQ.91/3/Crow/Nac//Bow’S’	WRI, AARI, Faisalabad

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