Focus on Seed Programs
The Pakistan Seed Industry

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Introduction

Pakistan is located between 24° and 37°N latitude and 61° and 75°E longitude; and it is bordered by Afghanistan and Iran in the west and China and India in the east. The total area of the country is 79.6 million ha comprising four major administrative provinces, Punjab, Sindh, Balochistan and Northwest Frontier Province (NWFP).

Pakistan has a continental type of climate characterized by extreme variations in temperature and rainfall. There are two main growing seasons, summer (*kharif*) and winter (*rabi*). The monsoon rain is from July to September whereas some winter rain is also received in Balochistan and coastal areas of Karachi. The country is generally arid and suffers from low rainfall.

The Himalayas and Kashmir mountains are the main sources of irrigation water; the largest integrated irrigation network in the world serving 13.8 million ha of contiguous cultivated land fed by the water of Indus River and its tributaries. Agriculture mostly depends on irrigation from canals (70%) and tubewells (27%). The remaining area is irrigated using wells, *kareezes* and tanks.

The population is estimated to be 135 million with an annual growth rate of 2.9%. About 70% of the population live in rural areas and are engaged in agriculture and related activities.

Agriculture is a leading sector of the national economy contributing about 24% to GDP and employing 50% of the labor force. It is the main supplier of raw materials for industry and is the largest source of foreign exchange earnings.

Agricultural Sector Policy

In Pakistan about 58.5 million ha is arable land of which 22 million ha is under cultivation. Table 1 shows land use and farm size distribution, reflecting fragmentation of agricultural land due to traditional inheritance practices.

Table 1. Land use and farm size distribution in 1996/97 (millions)

Land Utilization		Farm Distribution	
Use	ha	Size (ha)	Number
Cultivated area	21.5	Small (<5)	4.1
Cultivable waste	8.9	Medium (5-10)	0.6
Forest area	3.6	Large (> 10)	0.4
Not cultivated	24.4		
Total	58.5		5.1

Source: Agricultural Statistics of Pakistan 1996/97

Cereals (wheat, rice and maize), legumes and cash crops (cotton, sugarcane and tobacco) occupy 56, 7 and 16% of the cropped area, respectively. Oilseeds, vegetables, condiments and fruits occupy the remaining 21% of the cultivated area.

The agricultural sector is in transition from subsistence to a market economy and government policy supports its rapid expansion and development. A comprehensive package had been announced recently including new approaches in research and extension, improvement of irrigation systems, relief prices for key inputs, provision of credits, support prices for various commodities and special promotion for wheat and oilseed crops. The agricultural support program guarantees farmers with minimum commodity prices. These policy measures have been initiated to encourage the development of agriculture and attain food self-sufficiency in the next century.

Background of Seed Sector

Since the establishment of Pakistan in 1947, the organized seed sector passed through various evolutionary phases and has refined over time. Until 1961, seed of new varieties was multiplied and distributed by agricultural extension and occasionally 'progressive' farmers received seed directly from breeders before the variety was released. In 1961, upon the recommendations of the Food and Agriculture Commission, the Government created an autonomous West Pakistan Agricultural Development Corporation (WAPDC) to implement an integrated agricultural development in the province. The organization was entrusted with seed production and distribution as well as other agricultural development related activities. However, because of inefficient marketing the organization failed and dissolved in 1972.

In 1973, the Government of Pakistan formulated a national seed development plan with the assistance of FAO and the World Bank, which made strong recommendations for the participation of the private sector. In 1976, a seed industry project was designed and initiated at a cost of $56 million with the technical and financial assistance of the World Bank.

National Seed Policy and Laws

Seed being a key element in agricultural production, it has been given special attention. The Government attaches high priority to agricultural research, variety development and seed production, distribution, quality control and extension.

The Seed Act (No. XXIX of 1976) provided a regulatory framework for variety registration and seed quality control by setting up the institutional infrastructure which included the National Seed Registration Department (NSRD) and the Federal Seed Certification Department (FSCD), as executive arms of the National Seed Council (NSC). In 1997, these two Departments were amalgamated into the Federal Seed Certification and Registration Department (FSCRD). The National Seed Council (NSC) and the Provincial Seed Councils (PSC) were also established. The necessary infrastructure for the seed sector now exists at both the federal and provincial levels (Fig 1).

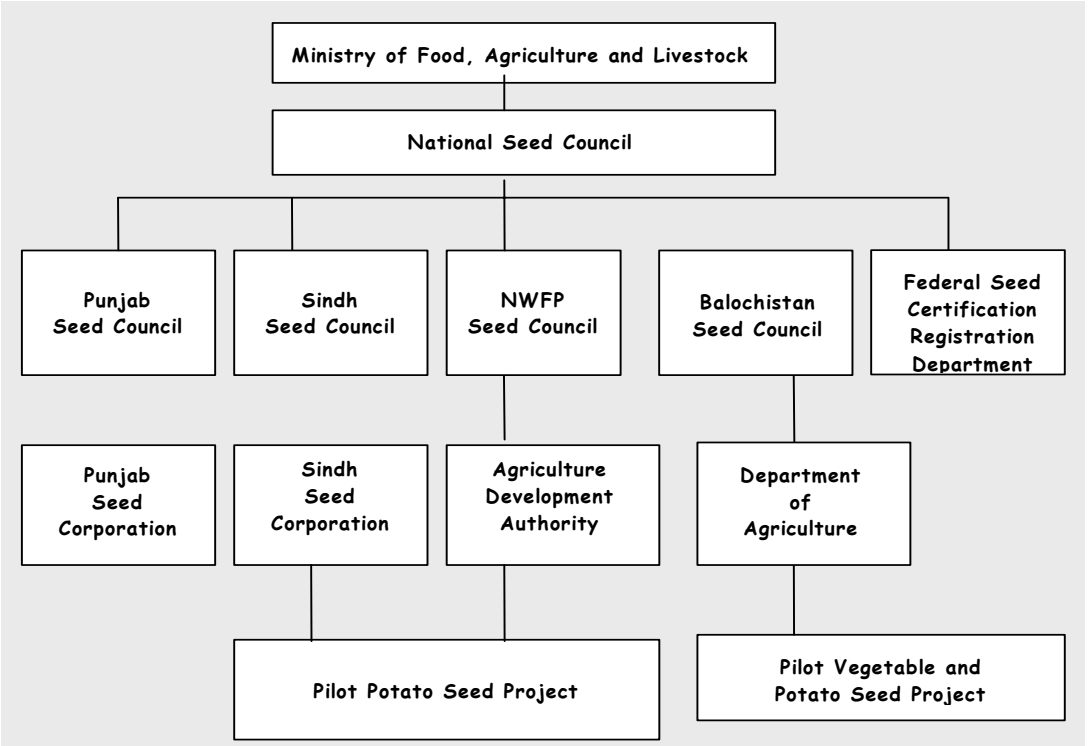

Fig 1. Organizational structure of the public seed sector in Pakistan

The National Seed Council (NSC), chaired by the Federal Minister for Food, Agriculture and Livestock (MFAL) is the supreme body for formulating national policies and regulating the seed sector. It approves and sanction seed standards and regulates inter-provincial movements of seed. The Council represents all institutions concerned with the

development of the seed industry in Pakistan. The Provincial Seed councils have been entrusted to approve crop varieties for seed production and make arrangements for seed multiplication, processing and marketing in the respective provinces.

The Government also encourages the participation of the private sector and enacted the *'Truth-in-Labeling (Seeds) Rules, 1991'* which allows marketing of seed by declaring and correct labeling of quality attributes and related information. Moreover, the seed business was declared as a '*seed industry'* in 1994 providing concessions and privileges given to other sectors. The policy has encouraged the development of the private sector and several companies have been granted permission to produce and market seed in the country. The free market economic policy adopted by the government also promotes privatization.

The new policy defines the roles of agricultural research, private sector and NGOs and a legal framework to prevent adulteration of inputs. In addition, the following incentives have been proposed to develop the seed sector:

- import of seed plants and seed testing equipment will be exempt from customs duty and sales tax up to the year 2000. Modernisation of existing seed plants will enjoy the same concessions as new plants
- income tax holiday will be allowed to the seed industry up to the year 2000
- seed will be treated as an agricultural commodity to ensure cash credit limits similar to those for other agricultural commodities
- all seed transported from one district to another will be exempt from provincial and municipal taxes
- long-term lease of state land to enable private sector to establish seed production units and processing plants
- allow private sector free import of inbred lines to encourage local seed production

For more information on the seed policy in Pakistan, please refer to *Seed Info No.17* published in July 1999.

The National Seed Council has recently approved the 'Rules for Certification of Fruit Plants' to improve the quality of nursery stocks for fruit tree crops. The rules will provide legal support and hel develop the necessary infrastructure for production and distribution of true to type, good quality and disease free fruit plants.

Agricultural Research and Crop Improvement

Pakistan has an extensive agricultural research and variety development program carried out by 13 multidisciplinary and 14 mono-commodity research institutes and four agricultural universities. The agricultural research institutes are located throughout the provinces with a large number of substations and satellite stations covering almost all economic crops and related disciplines. These research institutes have specific mandates to develop varieties suitable to their regions.

At the national level, agricultural research is coordinated and funded by the Pakistan Agricultural Research Council (PARC) and Pakistan Central Cotton Committee (PCCC). The organization of variety development and release is as shown in Fig 2.

PARC has seven major research establishments in Pakistan conducting research according to the agro-ecological needs of various regions. Please click on the links below for ***details of research work*** undertaken at these establishments:

1. National Agricultural Research Centre (NARC), Islamabad

2. Tropical Agricultural Research Centre (TARC), Karachi
3. Arid Zone Research Centre (AZRC), Quetta
4. National Tea Research Institute (NTRI), Mansehra
5. Sugarcane Research Institute (SRI), Thatta
6. Himalayan Agricultural Research Institute (HARI), Kaghan
7. Karakoram Agricultural Research Institute for Northern Areas, (KARINA), Gilgit

Besides, PARC has Coastal Area Research Station, Karachi; Federal Pesticide Research Lab, Multan; and PARC-Integrated Pest Management Labortory, Multan, Agricultural Economics Research Units (AERUs) are functioning in all the provinces and Azad Jammu and Kashmir. PARC has its Liaison Offices in Lahore, Karachi, Peshawar and Quetta and its research units in Rice Research Institute, Kala Shah Kaku, Lahore and Dokri, Sindh.

The agricultural research institutes maintain close collaboration with international agricultural research centers such as CIMMYT, CIAT, ICARDA, ICRISAT, IITA and IRRI to widen the genetic base of existing materials and to strengthen the national plant breeding programs.

Variety Development

Crop variety development remains the domain of the public sector. Provincial and federal research institutes developed a substantial number of crop varieties through conventional plant breeding. The Pakistan Atomic Energy Commission (PAEC) uses mutation breeding to develop grain legumes, rice and cotton varieties. Ssignificant achievements have been made in plant breeding particularly, for crops such as wheat, rice and cotton.

The privatization policy of the government encourages private sector plant breeding. Mmultinational seed companies have started introducing, testing and submitting their hybrid varieties of maize, sorghum, sunflower and sudax for registration and release.

In the near future, a recently established National Institute of Biotechnology and Genetic Engineering is expected to contribute in the release of genetically modified crop varieties for use by farmers.

Variety Evaluation

Breeding lines are tested in micro-variety trials at research station and sub-stations and then evaluated for adaptability in out-station zonal variety trials. Such trials are conducted at government farms and in collaboration with 'progressive' farmers in the proposed area of adaptation. When a breeder considers the variety has sufficient merit, he submits it to PARC (PCCC for cotton) and FSCRD for further testing.

Variety registration and release require testing for Distinctness, Uniformity and Stability (DUS) and Value for Cultivation and Use (VCU) which are conducted simultaneously.

VCU Testing

PARC is responsible for evaluation of agronomic value of all crop varieties (except cotton) in National Coordinated Variety Trials (NCVT) spread throughout the country. The PCCC is responsible for evaluation of cotton varieties only. These trials determine the suitability, adaptability and disease response of the variety. At provincial level, the agriculture departments carry out evaluation at adaptive agricultural research farms, extension farms and on the farms of 'progressive' farmers. The seed corporations also test the pre-released varieties in collaboration with breeders.

After 2 years of testing the Variety Evaluation Committee (VEC) of PARC and PCCC informs the breeder, provincial governments and Federal Seed Registration Committee (FSRC) about the suitability, adaptability and disease responses of the candidate varieties.

DUS Testing

The DUS testing is conducted by the FSCRD and the candidate variety is critically examined in comparison with existing commercial varieties to establish distinctness. Morphological and phenological data are recorded at various growth stages compared with the control varieties. After two years of testing the Department submits its report to FSRC.

Variety Release

The Variety Evaluation Committee (VEC) and the Federal Seed Certification and Registration Department (FSCRD) submit their reports to the Federal Seed Registration Committee (FSRC). This examines both DUS and VCU data and recommends to the PSC and NSC for confirmation of registration and release.

Provincial Seed Councils: The PSC, having wider representation from research, registration/certification agency, seed producers and farmers, approve and release varieties for general cultivation within the provincial territories. In case of difference of opinion, the matter is referred to the NSC through FSRC.

National Seed Council: The National Seed Council approves variety registration and release at national level; and only then varieties are notified by the federal government. Such notification provides eligibility of varieties for commercial seed production and certification.

The total number of varieties registered and released since 1947 is given in Table 2.

Variety Maintenance

After the release of a variety, the originating institute has the responsibility for maintenance and production of Breeders Nucleus Seed (BNS) which will be multiplied to Pre-basic Seed. Breeders collaborate with FSCRD to produce the Pre-basic Seed which will be further multiplied to Basic Seed by public sector corporations. In the future it is envisaged that the private sector will also be involved in producing Basic Seed to overcome seed shortage.

Table 2. Number of crop varieties released from 1947 to 2002 in Pakistan

Crop	Number of varieties			Estimated cost/variety (Rs m)
	Public	Private	Total	
Wheat	78	-	78	2.7
Rice	29	-	29	-
Barley and Oats	11	-	11	-
Pulses	41	-	41	-
Oilseeds	38	5	43	-
Maize[1] & millet	22	2	24	2.8
Potato	11	-	11	-
Vegetable	32	-	32	-
Fodder and forage	11	1	12	2.3
Cotton	61		61	6.8
Sugarcane	22	-	22	-
Total	356	8	364	-

Plant Breeders' Rights

The Government supports the public breeding program to ensure the availability of better varieties and quality seed for the benefits of farmers. Pakistan has a vigorous breeding program which until recently, was entirely dominated by the public sector. However, with the emergence of the private sector, and its linkage to international trade, the seed market is expanding rapidly. Multinational seed companies may require legal protection to introduce and market their varieties. Pakistan is a signatory to the WTO and TRPS agreements and obliged to provide

minimum level of protection either by patents o an effective *sui generis* system or by any combination thereof under section 27(3b) of TRIPS agreement. The FSCRD initiated the draft of 'Plant Breeder's Right Act; in accordance with 1978 and 1991 UPOV convention. The draft PBR Act has been accepted in principle by the MoAFL and is awaiting clearance from the Government.

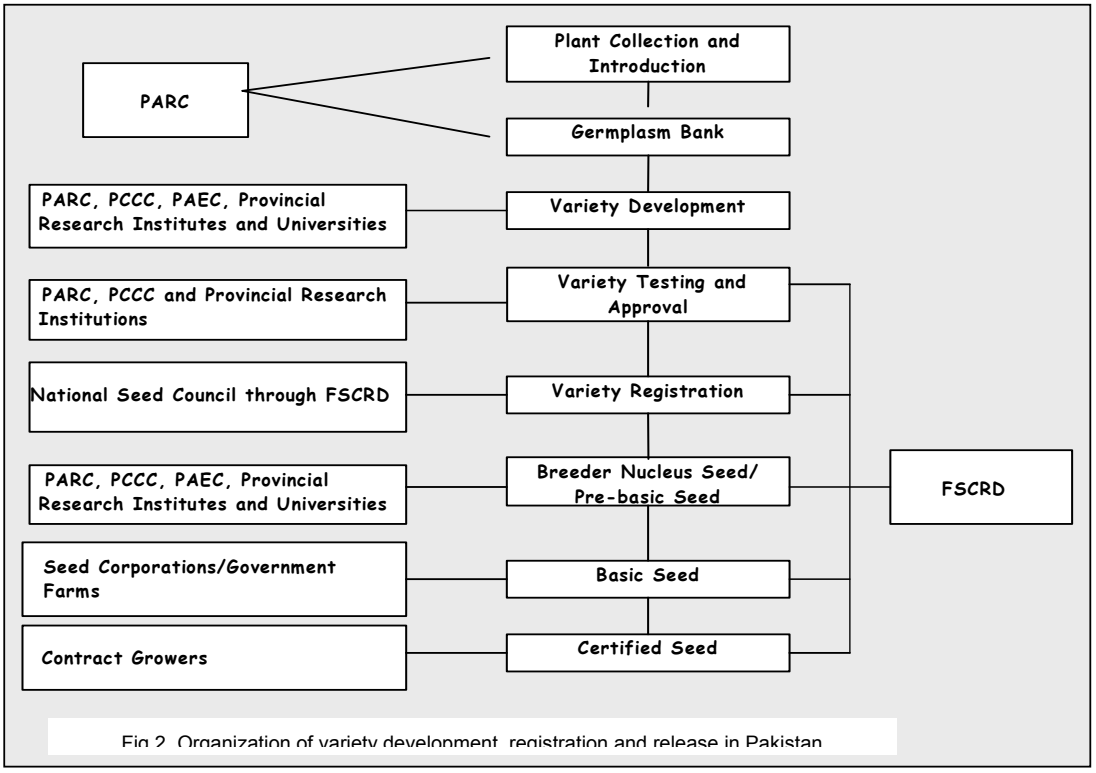

Fig 2. Organization of variety development, registration and release in Pakistan

Seed Production

An assured supply of quality seed needs strong partnership of public and private sector. In Pakistan, seed production is carried out both by the public and private sectors (Fig 3). The formal sector is expected to supply 100%, 33% and 20%, respectively of the seed requirement for cotton, maize and cereals. However, in practice more than 90% of the cereal seed need and almost the entire requirements of legumes, oilseeds and fodder crops are met from other sources, mainly the informal sector. The seed sector is now open for the private sector to play an active role and there is a great opportunity for private investment in the seed business.

Despite the availability of many varieties, Pakistan has not been able to produce enough quantity of seed for the farming community, except for cotton. An estimated seed requirement, seed production and distribution is given in Table 3.

Public Sector

In Punjab and Sindh, the two parastatal seed corporations are responsible for seed production and supply. The Agriculture Development Authority (ADA) in NWFP and the Department of Agriculture (DA) in Balochistan are responsible for managing seed supply in these two provinces. The public sector mainly concentrates on production of high-volume low-cost seed of crops like wheat, rice and cotton varieties coming from the public research. According to the potential seed market, the project launched in 1976 aimed to supply 103,000 tonnes of quality seed of various crops. In the 1997/98 season the public sector was able to supply only 10.6% seeds of wheat, 33.4% of cotton, 2.9% of rice and 4.8% of maize.

Private Sector

The active participation of the formal private sector started in 1991 when many seed companies were established producing different crop seed including legumes and vegetables. At present 242 national and 4 multinational seed companies have been registered and granted permission to produce and market seed. There is no restriction on the private sector to sell seed of any crop which offers favorable commercial opportunities. They are also allowed to import and export seed.

National Seed Companies

National seed companies produce only seed of public sector varieties of wheat, rice and cotton and obtain Basic Seed from public seed corporations. However, amendments to the Seed Act 1976 are being proposed to grant permission to private sector to produce Basic Seed if authorized by the provincial governments. The national seed companies may also produce seed of introduced varieties.

Multinational Seed Companies

There are four multinational seed companies in the country and some others are exploring opportunities for seed business. Multinational seed companies primarily import and distribute seed of maize, sunflower, fodder and sudax hybrids. A limited effort is made to encourage local production through certain incentives in order to curtail continuous dependence on bulk import. Having seen the potential of the seed market, the multinational companies have also started seed production of self-pollinated crops like wheat, rice, legumes and cotton.

Informal Sector

The informal sector is the major seed supplier in the country where more than 90% of the seed comes from farmers (or other sources like commission agents, retailers and shopkeepers). The informal sector provides approximately 23% of vegetable seed, 45% of cotton, 90% of wheat, rice and maize and almost 99% of the legumes. The sector invites the attention of policy makers, donors and scientific community to revolutionize agricultural production through provision of infrastructure, financial incentives and improved marketing.

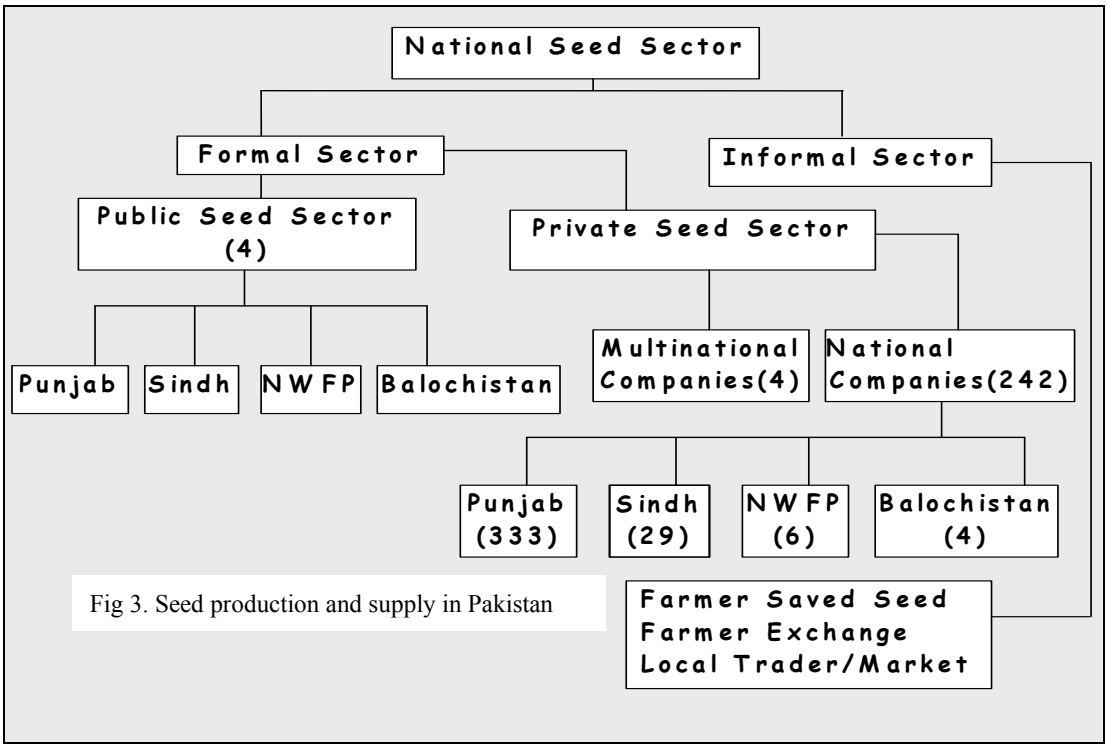

Fig 3. Seed production and supply in Pakistan

Seed Processing

The seed processing capacity of both the public and private sector is concentrated in Punjab and Sindh compared to the other two provinces. The public sector has five seed processing plants in Punjab (3), Sindh (1), Balochistan (1) and 3 mobile seed cleaning units in NWFP. The four seed plants installed in Punjab and Sindh have a combined capacity of 103,000 tonnes per year for crops such as wheat, rice, maize and cotton (Table 4).

The multinational and some national seed companies have established seed processing plants, mainly for cereals and cotton. The private sector companies have 17 seed plants all in Punjab with a combined processing capacity of 65,840 tonnes. Moreover, about 30 seed companies have also installed small machines manufactured locally for cleaning wheat and cotton seed.

Table 3. Estimated seed requirement, procurement and distribution from 1993/94-1997/98 (tonnes)

Crop	Year	Estimated seed requirement	Procurement		Distribution	
			Quantity	%	Quantity	%
Wheat	1993-94	725182	71979	9.9	56045	7.7
	1994-95	733545	98003	13.4	77697	10.6
	1995-96	733545	91868	12.5	85383	11.6
	1996-97	739000	92218	12.5	77023	10.4
	1997-98	739000	85640	11.6	78544	10.6
Rice	1993-94	43922	3311	7.5	2170	4.9
	1994-95	43498	3388	7.8	2662	6.1
	1995-96	49000	3708	7.6	3517	7.2
	1996-97	43000	2534	5.9	1751	4.1
	1997-98	60200	2301	3.8	1734	2.9

Maize†	1993-94	35896	1861	5.2	1631	4.5
	1994-95	35580	2201	6.2	2201	6.2
	1995-96	34920	1173	3.4	2032	5.8
	1996-97	35000	568	1.6	2011	5.7
	1997-98	35000	1731	4.9	1674	4.8
Sunflower†	1993-94	410	271	66.0	271	66.0
	1994-95	525	359	68.4	359	68.4
	1995-96	808	586	72.5	586	72.5
	1996-97	1750	807	46.1	807	46.1
	1997-98	1000	585	58.5	571	57.1
Cotton	1993-94	67806	29595	43.6	26499	39.1
	1994-95	58298	32565	55.9	28453	48.8
	1995-96	66000	39864	60.4	31295	47.4
	1996-97	66000	34292	51.6	26635	40.4
	1997-98	67000	27928	41.7	23128	34.5
Others†‡	1993-94	221984	14768	6.7	14768	6.7
	1994-95	231510	6984	3.0	6963	3.0
	1995-96	209366	7893	3.8	7893	3.8
	1996-97	204370	11175	5.5	11175	5.5
	1997-98	266306	12262	4.6	12269	4.6

† Includes imported seed of maize, sunflower, vegetables, potato, fodder and forages
‡ Includes soybean, safflower, rape, mustard, vegetables, potato, fodder and forages

Table 4. Available annual seed processing capacity in the public seed sector (tonnes)

Corporation	Location	Wheat	Cotton	Rice	Maize	Others	Total
Punjab Seed Corporation	Khanewal	17100	12000	-	-	150	29250
	Sahiwal	17100	-	1410	2620	150	21280
	R.Y.Khan	17100	16000	-	-	150	33250
Sindh Seed Corporation	Sakrand	9400	8500	1100	-	300	19300
Agriculture Department, NWFP						4,800	4,800
Agriculture Department, Balochistan						6.400	6,400
	Total	60700	36500	2510	2620	11950	114280

Seed Marketing

The Government no longer controls seed prices in the market and various companies price seed differently based upon their own specific production and procurement circumstances. The public sector pays a premium for contract growers and
follows a comprehensive accounting system to include all costs incurred on to the procurement price to determine the sale price for seed.

The private sector prices are invariably higher than the public sector and every company has a different price for the same crop seed. Imported seed is much more expensive than that produced locally. For example, hybrid maize and sunflower seed

imported by multinational companies are sold at around 4-5 times the price of locally produced open-pollinated varieties.

The provincial seed corporations are responsible for marketing and distribution of seed to farmers through their own seed depots, seed dealers and other public sector organizations. In total they have over 2000 outlets for seed distribution throughout the country (Table 5). However, in Balochistan, seed is sold directly to the farmers by agricultural extension services, agricultural research institutes and 19 sales points established by the Department of Agriculture.

The emerging private sector markets their seed using its own outlets and through private dealers who sell agrochemcials and other inputs.

Table 5. Public sector seed marketing network in Pakistan

Organization	Dealers	Cooperative Banks	Sale Points	Others	Total
Punjab Seed Corporation	1750	30	15	206	2001
Sindh Seed Corporation	75	-	7	-	82
Agricultural Development Authority (NWFP)	-	-	53	-	53
Agriculture Department (Balochistan)	-	-	19	-	19
Total	1825	30	94	206	2155

The role of public and private sector in seed marketing and distribution for 1999/00 crop seasons is shown in Table 6. The multinational seed companies altogether distributed 2100 tonnes of wheat, 551tonnes of cotton, 227 tonnes of maize, 526 tonnes of sunflower and 8 tonnes of fodders. Monsanto distributed 3596 tonnes (67.06%) followed by Pioneer Seed at 1330 tonnes (28.8%) of various crop seeds

Table 6. Share of public and private sector seed distribution in 1999/00 crop season

Crop	Province	Estimated seed requirement	Quantity distributed			Share of public and private sector	
			Public	Private	% of total requirement	Public	Private
Wheat	Punjab	61,800	57,107	37,855	15.37	60.12	39.88
	Sindh	114400	3753	1181	4.31	76.10	23.90
	NWFP	80600	5930	32	7.39	100	-
	Balochistan	31300	460	61	1.66	88.55	11.45

		844300	67,250	39,129	12.59	63.22	36.78
Cotton	Punjab	46000	3715	27237	67.28	11.99	88.01
	Sindh	16000	721	989	10.69	22.78	31.21
	PCGA			1458	9.11	-	46.01
		62,000	4436	29684	55.03	13	87
Rice	Punjab	31813	1236	2242	10.93	32.52	67.48
	Sindh	25564	330	138	1.83	70.49	29.51
	NWFP	1324	7	-	0.53	100	-
	Balochistan	2924	-	-	-	-	-
		61,625	1573	2380	6.41	39.79	60.21
Maize	Punjab	13437	316	2327	19.25	11.96	88.04
	NWFP	21301	234	24	1.11	90.70	9.30
		34,738	550	2351	8.35	18.96	81.04
	Pakistan	1,002,663	73,809	73,544	14.70	50.09	49.91

Seed Quality Control and Certification

The Federal Seed Certification and Registration Department (FSCRD) is the main organisation responsible for seed quality control, certification and law enforcement. The Department is attached to the Ministry of Food, Agriculture and Livestock (MFAL) and performs its regulatory functions through 17 laboratories located in various parts of the country. The FSCRD has 283 staff (83 officers and 200 technical and supporting staff) with a budget of 24 million Pakistani Rupees in 1998/99.
All seed quality control activities have been enforced under the legal framework of the Seed Act, 1976. However, the '*Truth-in-Labeling (Seed) Rules, 1991'* were also introduced under the same Seed Act to encourage the emerging private sector. Seed certification is compulsory for the notified crop varieties. For production of Certified Seed only varieties registered and approved either by the National Seed Council or Provincial Seed Councils are accepted.

Four classes of seed are recognized in the system: Pre-basic, Basic, Certified and Approved Seed (Fig 4). The quality of all these classes is controlled by the FSCRD. Seed quality control is mainly based on crop inspection and laboratory testing to ensure that the seed meets minimum standards laid down in the regulations. Any person intending to produce Certified Seed applies to FSCRD for certification. All Pre-basic and Basic Seed classes are subjected to pre-control while 10% of Certified Seed lots are tested in post control.

The FSCRD plays a key role in maintaining quality at all stages of seed production. During 1997/98, 116,000 ha with an expected yield of 222,000 tonnes of various crop seed were made available for inspection by seed producers. From this quantity about 199,000 tonnes of seed was made available for testing and certification (Table 7).

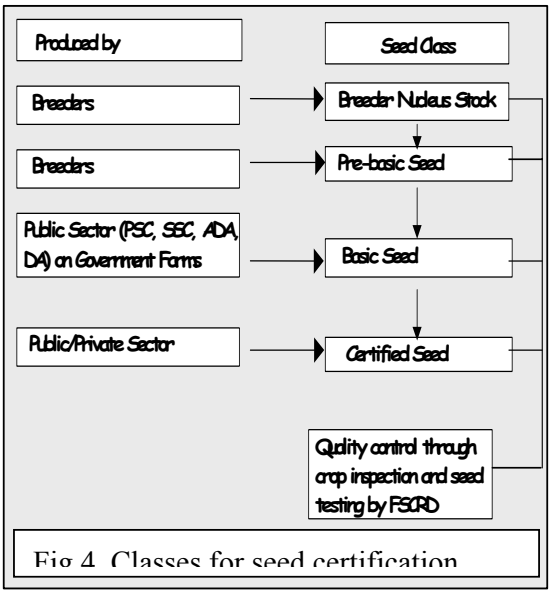

Fig 4. Classes for seed certification

The seed inspectors also monitor the quality of seed in the market and enforce the Seed Act. All seed lots are checked while in store at least one month before sale, so that seed lots damaged during storage are excluded from sale. Seed samples are drawn from the stores and checked in the laboratory. If the results do not coincide with the label on the seed containers, *'challans'* are made and submitted to the court. From 1994/95 to 1997/98 about 391 cases were submitted to court of which 259 cases were accepted resulting in fines.

As a result of active seed quality control, certification and law enforcement, the availability of quality seed has increased to 11% during 1995/96 to 1997/98 (Table 3). Quality seed production has attracted international agencies like FAO and USAID to export seed from Pakistan. The FSCRD central laboratory has been accredited by ISTA and is authorized to issue International Seed Lot Certificates for seed export consignments.

Seed Health Program

Since 1981, seed health testing became part of the quality assurance program in Pakistan. With the assistance of FAO/DANIDA, a Seed Health Certification Project was launched in 1986 and later a Central Seed Health Laboratory was established at the headquarters of the FSCRD in Islamabad. In 1994/95, Pakistan developed collaboration with the Seed Unit of ICARDA where 15 professional staff both from public and private sector was trained in legume seed health testing.

Every year thousands of hectares are inspected to assess seed-borne diseases in the field. About 3,000 and 5,000 seed samples have been tested for bacterial and fungal seed-borne diseases, respectively. The FSCRD is now able to use *ELISA* serological techniques for testing an average of 5000 potato leaves samples per year for detection of viral diseases and thereby able to save millions of rupees in foreign exchange. The Department has recently initiated horticultural crop certification for the first time in the country.

Tolerance limits for important seed-borne diseases of major crops have been established. This will help in reducing the use of fungicide for management of seed-borne diseases and the availability of healthy seed to farmers.

Table 7. Area inspected (ha) and quantity of seed (tonnes) tested by FSCD in 1996/97 and 1997/98†

Year	Crop	Area inspected	Estimated yield	Area accepted	Quantity tested	Quantity accepted
1996/97	Wheat	53507	143331	41461	109795	98930
	Cotton	64026	67662	46632	47939	28558
	Rice	3891	7278	2164	7094	6248
	Maize	583	933	583	2042	1907
	Barley	0.4	1	0.4	-	-
	Chickpea	674	420	521	147	48
	Mung bean	179	290	173	32	32
	Lentil	0.8	1	0.8	-	-
	Oilseeds	528	647	447	563	445
	Vegetables	3	9	3	4	3
	Cotton	1305	18008	935	283	257
	Total	124,697	238,580	92,920	167,899	136,428
1997/98	Wheat	68064	180473	56065	123950	81503
	Cotton	57507	62636	44268	68307	38335
	Rice	4443	7202	2274	4362	3088
	Chickpea	2650	1175	1798	465	412
	Maize	609	1683	576	590	542
	Oilseeds	927	837	698	323	269
	Pulses	171	123	119	72	72
	Vegetables	4	64	4	2	1
	Potato	737	8219	357	2069	1879
	Total	135,112	262,412	106,159	200,140	126,101

Note: †Figures are rounded to whole numbers for clarity

International Seed Trade

At present, Pakistan is spending billions of Rupees to import seed of maize, oilseeds vegetables, potatoes, forages, and flowers. The FSCRD is authorized to regulate the quality of the seed imported and exported. Under the '*Truth-in-Labeling (Seeds) Rules, 1991',* any body can import and export seed subject to the following requirements:

- All imported seed shall bear a label with the following information: (a) crop/species; (b) variety; (c) quantity; (d) lot number; (e) % purity; (f) % germination; (g) % other seeds; (h) month/ year of production; (i) date of expiry
- Seed import is allowed only of those varieties which are approved in the National Register for seed and crop production in Pakistan
- Seed lots up to 10kg may be imported for experimental use upon approval of the Ministry
- The importer shall inform the FSCRD of the probable date of arrival of the shipment and notify FSCRD for drawing samples for testing
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To safeguard the interest of seed industry and farmers, the FSCRD has successfully monitored the quality of seed by enforcing the Seed Act 1976 and '*Truth-in-Labeling (Seeds) Rules, 1991'* of seed imported from other countries (Table 8). This provides a

check against the entry of virulent pathogens and ensures the availability of quality seed for those crops in which local seed production does not exist.

Some modest efforts have been made to export seed to neighboring countries. During the last ten years (1987 to 1998) about 29,075 tonnes of seed was exported from Pakistan. There is a need to explore seed export markets in Asia and Africa.

Table 8. Quantity of seed imported and tested in 1996/97 and 1997/98

Year	Station	Quantity (tonnes)		Value (million Rupees)	
		Tested	< Standard	Imported	Rejected
1996/97	Lahore	2376.8	61.7	178.6	3.1
	Karachi	6887.6	0.1	400.7	-
	Total	9264.4	61.8	579.3	3.1
1997/98	Lahore	2799.7	85.5	307.5	3.3
	Karachi	7793.9	595.6	425.8	0.3
	Total	10593.6	681.1	733.3	3.6

National Seed Associations

There are six seed trade associations in the country, *viz.*: Chamber of Private Seed Industry, Seed Companies Association of Pakistan (SCAP), All Sindh Private Seed Companies Organization (ASPSCO), Seed Associations of Pakistan (SAP), Association Seed Companies of Pakistan (ASCOP) and All Pakistan Seed Merchants and Seed Dealers Association (APSMTA APSMTA).

The SCAP is an association of multinational seed companies i.e. Monsanto, Du Pont, ICI and Syngenta; and primarily interested to increase their share in the seed sector. The CPSI is an exclusive association of national seed companies and has 85 members. ASCOP is established by the private seed companies in Sahiwal, Okara and Pakpattan districts. The All Pakistan Seed Merchants and Seed Dealers Association (APSMTA) operates on national level and looks after the interest of vegetable seed dealers. Efforts are also under way to organize seed growers associations at various levels in different parts of the country.

The Pakistan Society of Seed Technologists (PAKSSET) was established to provide a forum for professionals and all others involved in the seed sector in Pakistan. PAKSSET works for the development of seed technology and advancement of the profession in the country.

Research and Training

The seed industry in Pakistan is at a crossroads and requires sound scientific support and linkages with agricultural research and academic institutions throughout the country.

Seed Research

Seed research related to germination and crop establishment in variable planting conditions as well as during harvesting and post harvest management is limited. To date there is little research on seed technology and no postgraduate program in any agricultural university, except some work on seed pathology at FSCRD. However, a seed research laboratory has been recently established at National Agricultural Research Center as part of the Plant Genetic Resources Program.

Training

FSCRD has a mandate to develop training strategies for the seed industry. The Department organized one international and 8 national seminars and training courses. More than 100 professional staff both from public and private sector has been trained in Pakistan. About 300 seed technologists are now engaged directly or indirectly in the seed industry. FSCRD is the leading institution in producing more than 100 scientific papers, training manuals, proceedings and books. For example, in the 1990s about 20 books/proceedings and manuals were published by FSCRD mostly on technical guidelines and regulatory issues related to seeds.

Although the national seed sector has developed diverse expertise further training is required in the following areas:

- Modern techniques for variety identification
- Implementation of Plant Breeders' Rights
- Quality assurance in large private seed enterprises
- Serological tests for virus and bacterial diseases
- Database development and management skills
- Degree course in biotechnology

Future Seed Sector Strategy

The availability of quality seed plays an important role in enhancing the productivity of agriculture. The existing seed production and supply system is inadequate to meet the national requirements and so far reached only 11%. Although, the seed program for major crops is progressing, in case of minor crops it is far behind.

The Government plans to increase seed supply of major crops to 20% for cereals and 100% for cotton by the year 2000. The target is set for 30% for cereals and 100% for cotton in 2010 based on estimated seed requirement. The estimated Certified Seed required for major crops in 2010 will be 326,647 tonnes (Table 9). At this stage, the country could not meet its seed requirement even at the present replacement rate of 20% for cereals and 100% for cotton.

Table 9. Estimated national seed requirement and potential seed market (1000 tonnes) in 2000/01

Crop	National seed required	Seed available				Gap (%)
		Local	Import	Total	%	
Wheat	846.2	161.	-	161.4	19.1	80.9
Cotton	59.3	32.0	-	32.0	54.0	46.0
Gram	38.9	0.23	-	0.2	0.5	99.4
Paddy	50.3	3.82	-	3.8	7.6	92.4
Lentil	1.1	0.00	-	0.001	0.1	99.9
Mung	4.4	0.3	-	0.3	6.9	93.1
Potato	221	0.4	0.83	1.2	0.5	99.5
Maize	26.8	2.1	3.143	5.2	19.5	80.5
Canola	0.7	0.1	0.04	0.1	20.1	79.9
Sunflower	1.3	0.1	0.36	0.5	36.4	63.6
Soybean	0.8	0.1	-	0.1	12.9	87.0
Fodders	14.5	0.04	10.98	11.0	76.1	23.9
Vegetables	5.1	0.2	3.37	3.6	70.34	29.7
Total	1270.4	200.8	18.7	219.4	17.3	82.7

The measures to achieve the targets of the 2010 program are given below:

- Provide incentives for the development of national seed sector
- Reorganize or privatize public seed companies to increase efficiency
- Encourage national private seed companies to establish Basic Seed Production Units
- Introduce PBRs to encourage public and private sector to develop varieties and introduce hybrids
- Encourage seed production of legumes, oilseeds, fodders and forages by public and private sector to substitute massive imports
- Encourage seed potato production by public and private sector to reduce dependence on import
- Encourage local vegetable seed production by private sector by providing

incentives
- Establish a seed corporation in NWFP to increase availability of quality seed
- Establish seed plants and encourage seed production of various crops in rainfed (*barani)* areas
- Strengthen the FSCRD by establishing new laboratories and levying fees for variety registration and seed certification services
- Amend Seeds Act 1976 to encourage the private sector and curb sale of unlabelled seed
- Register all seed importers with FSCRD to ensure import of varieties that are locally tested
- Register seed vendors in the provinces to curb the sale of unlabelled seed.
- Organize the informal sector by forming seed grower's association and provision of small cleaning units and storage facilities
- Increase awareness about seed through demonstrations by the agriculture extension at union council level

International Collaborations

The Pakistan seed industry has enjoyed fruitful collaboration with many international organizations involved in the development of the seed sector.

In mid 1980s, the FAO/DANIDA Regional Seed Improvement Project based in Thailand strengthened seed production and certification activities in Pakistan. The project provided laboratory equipment and training facilities to FSCRD and initiated seed health testing program. A series of national training courses were arranged in maize seed production, seed potato technology, vegetable seed technology, seed pathology and the implementation of the Seed Act. The certification of seed potato was further strengthened with the assistance and cooperation of the Institute of Plant Protection (IPO-DLO), The Netherlands. Collaboration with ICARDA has enabled the FSCRD to start seed certification of legumes.

These facilities and expertise enabled the Central Seed Testing Laboratory in Islamabad to become an accredited member of the ISTA and to issue International Seed Lot Certificates.

Constraints in the Seed Sector

The performance of both public and private seed sector has remained below the desired level (see Table 3). There are constraints which have impeded seed sector development both in the public and private sectors. These can be summarized as follows:

Public Sector
- Available seed processing capacity does not correspond with the targets of seed procurement
- Insufficient storage facilities affect planned seed procurement by the companies
- Inefficient marketing system leading to carry-over stocks which affects next year procurement targets
- Less development of the seed sector in NWFP and Balochistan affecting seed production in these provinces
- Lack of a specific national seed program for vegetables and flowers resulting in large imports

Private Sector
- Inadequate research support for private seed sector
- Limited availability of Pre-basic and Basic Seed from research centers and public seed corporations
- Lack of proper seed storage facilities
- High interest rate on credit from banks
- High local municipality taxes when seed is transferred from one area to another
- Indiscriminate seed imports by unauthorized traders

Recommendations for the Seed Sector

The following measures are recommended for the improvement of the national seed sector in Pakistan.

Public Sector

- Increase present seed processing capacity to meet procurement targets by installing small cleaning units in production areas
- Build appropriate seed storage facilities to maintain the quality of seed offered for sale
- Explore possibilities of licensing seed marketing to the private sector
- Encourage private sector to enter the seed business in North West Frontier Province and Balochistan
- Initiate pilot projects for seed production of vegetables, flowers and fruits

Private Sector

- Allow private sector to establish its own Basic Seed Production Units
- Lease land on long-term basis to the private sector to facilitate research
- Provide loans at low interest by commercial banks to encourage new entrants to the private sector
- Provide soft loans by the commercial banks to build storage facilities
- Remove or reduce local taxes to the level of taxes charged on grain
- Restrict seed imports to registered companies to encourage seed business and improve the quality

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