PN-ABH-010

PRODUCTION AND MARKETING OF WHEAT SEED IN PUNJAB

Pakistan Economic Analysis
Network Project

SPECIAL REPORT SERIES
NO. 7

PN-ABH-010

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Published by the Directorate of Agricultural Policy and Chemonics International Consulting Division for The Economic Analysis Network Project in collaboration with the Ministry of Food, Agriculture, and Cooperatives, Government of Pakistan, and the United States Agency for International Development under the provisions of USAID Contract 394-0491-C-00-5034

Islamabad
May 1988

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1. INTRODUCTION

1.1. The Setting

Wheat is the major staple food crop of Pakistan. In order to meet an ever-increasing demand for food, the government had planned for wheat production to increase at an annual rate of 5.6 percent in the Sixth Five-Year Plan (1983-88). In contrast, the observed average annual growth rate was around 3.5 percent by the end of the year 1985-86. This shortfall forced the government to import about two million tons of wheat during 1985-86. A recent study undertaken by the International Food Policy Research Institute (IFPRI, Hamid, et al., 1987) concluded that future trends in wheat supply would be lower than the trends in wheat demand over the next decade and a half. This signals the need for future wheat production policy to be based on the goal of sustained self sufficiency.

In the past, wheat yields have increased mainly due to the change from traditional varieties to high yielding varieties (HYVs). Since this shift is now almost complete, future yield growth will be dependent on increases in the yields of HYVs (Hamid, et al., 1987). Various studies (NFC, 1983; PARC, 1983; Byrlee, Hobbs, et al., 1986; Sharif, et al., 1986) have concluded that the present per acre wheat yields are significantly below potential. The gap between actual and potential yield levels can be attributed to a number of agronomic, economic and technical factors. Availability and use of good quality seed is one of these.

In the early years of the Green Revolution, Pakistani farmers adopted new semi-dwarf wheat varieties more rapidly than farmers in Iowa, U.S.A., adopted hybrid maize in the 1930s (Lowdermilk, 1972). More recently, however, wheat varietal change in Pakistan appears to be slower than in countries with similar wheat growing environments. For example, the spread of new wheat varieties appears to be faster in the Indian Punjab than in the Pakistani Punjab (Tetlay, et al., 1987b). This can have direct economic effects. In 1977-78, Pakistan suffered serious losses in a rust epidemic, while a record harvest was recorded on the Indian side of the border (Nagarajan, et al., 1984). In the recent past, scientists participating in the sixth and seventh annual Wheat Travelling Seminar (in 1985-86 and 1986-87) estimated losses of over one million tons of wheat attributable to the use of disease prone varieties and mixed seed (PARC, 1986). It is generally felt by the wheat scientists that Pakistan's wheat crop is vulnerable to a rust epidemic. A recent study by Heisey, et al. (1987) concluded that 30 to 50 percent of the area under wheat is still being grown under banned[1] varieties, although area under new recommended varieties appeared to be increasing and area under banned, mixed, or unknown varieties was decreasing. One possible

reason for slow varietal turnover may be the way in which the seed system presently functions.

It is difficult to quantify the contribution of quality seed to crop yields as this is more a function of the interaction of seed with other factors of production, than the effect of seed alone (ICD, 1987). Nevertheless, seed is considered to be a dynamic instrument for change, as it could be used to realize agricultural production objectives more rapidly, as well as provide insurance against disease losses. This essentially underscores the need to establish a seed industry[2] capable of providing farmers with good quality seed. The government initiated a Seed Industry Project in 1976-77 to enable the farmers to improve their crop yields and realize optimum benefits from their labor and other inputs. In the Punjab province, a public sector organization--Punjab Seed Corporation (PSC)--was established to implement this project. The major objectives of this paper are to explain the rationale behind establishing the PSC, to review its wheat seed production and marketing systems, and to assess the role of the seed system in accelerating the process of varietal change.

1.2. Seed Industry in Historical Context[3]

Before 1972 the Agricultural Development Corporation (ADC) was responsible for the production and distribution of seed. This organization was established in 1961 following the recommendations of the Food and Agriculture Commission of 1959-60. It first began operations in 1962-63 and was conceived as an operational agency outside normal government channels designed to bring about rapid developments in agriculture. However, the ADC faced enormous difficulties in transferring experienced staff from the regular government departments; it therefore recruited staff from the military forces which was energetic but had little agricultural experience. Seed targets were arbitrarily established without reference to market demand.

Pre-basic seed produced at government research institutes was multiplied into basic seed at ADC farms. The basic seed was further multiplied into certified seed at registered growers' farms for sale to farmers. The seed multiplication system did not work. There was no coordination between the research institutes and the ADC. The quantities of pre-basic seed provided to ADC were often too small and of dubious quality. The basic seed produced by the ADC was not even up to certified standards. In addition, the contract multiplication system existed in name only and was never properly organized.

Quantities of wheat seed sold during the ADC period are shown in Table 1.1. On an average, these quantities were sufficient only to cover about 2% to 4% of total wheat area in the Punjab

Province. The seed sold to farmers was neither cleaned nor processed, but was simply threshed and winnowed in the traditional way. ADC was not permitted to use commission agents for seed marketing because of some alleged malpractices and seed mixing in the early years. It had to set up a network of 47 bulk centers and 212 retail points throughout the province. The farmer associations and cooperative societies were not used for marketing of seed because recovery of debt was difficult. The result of these inadequacies was that the quantity and quality of seed offered for sale to farmers proved unacceptable.

Table 1.1. Quantities of Wheat Seed Sold During ADC Period in Punjab Province.

Years	Wheat Seed Sold (000 Tons) (1)	Wheat Area (000 Hectares) (2)	Seed Sufficient to Cover Wheat Area (000 Hectares) (3)	(3) as Percent of (2)
1965-66	12.24	3682.75	123.83	3.36
1966-67	15.49	3866.85	156.71	4.05
1967-68	38.89	4273.17	393.41	9.21
1968-69	24.18	4548.77	244.63	5.38
1969-70	8.85	4477.13	89.53	1.99
1970-71	6.72	4389.50	67.98	1.55
1971-72	9.67	4228.90	97.83	2.31
1972-73	17.01	4366.50	172.09	3.94

ADC was disolved in 1972 and its functions relating to seed production and marketing were taken over by the provincial governments. In the Punjab Province, Punjab Agricultural Development and Supplies Corporation (PAD&SC) took over most of the assets and staff of ADC and continued operations. In fact, no clean break with the former ADC was made and the new organization (PAD&SC) was confronted with the same problems that brought about ADC's failure.

In order to remove the deficiencies outlined above, the "Pakistan Seed Industry Project" was designed and implemented with the financial and technical assistance of the World Bank in 1976. The major objective of the project was to replace the on-going seed production system with a modern seed industry involving variety release, seed multiplication, processing, certification, storage and marketing. To implement this project, two provincial seed corporations, one each in Punjab and Sind, were established. The main benefit from the project was anticipated to be higher crop yields for the end-users of the

improved quality seed. According to the project appraisal reports (World Bank, 1976; PSC, 1977), the use of improved seed alone can cause an increase in yield by 10% to 20% . How far this assumption is true in the case of wheat seed, and what corollary assumptions must also be held, are important questions to explore. The implications of this assumption are discussed in Section 5 of this paper within the context of seed pricing policies.

2. SEED PRODUCTION SYSTEM

2.1 Stages of Production

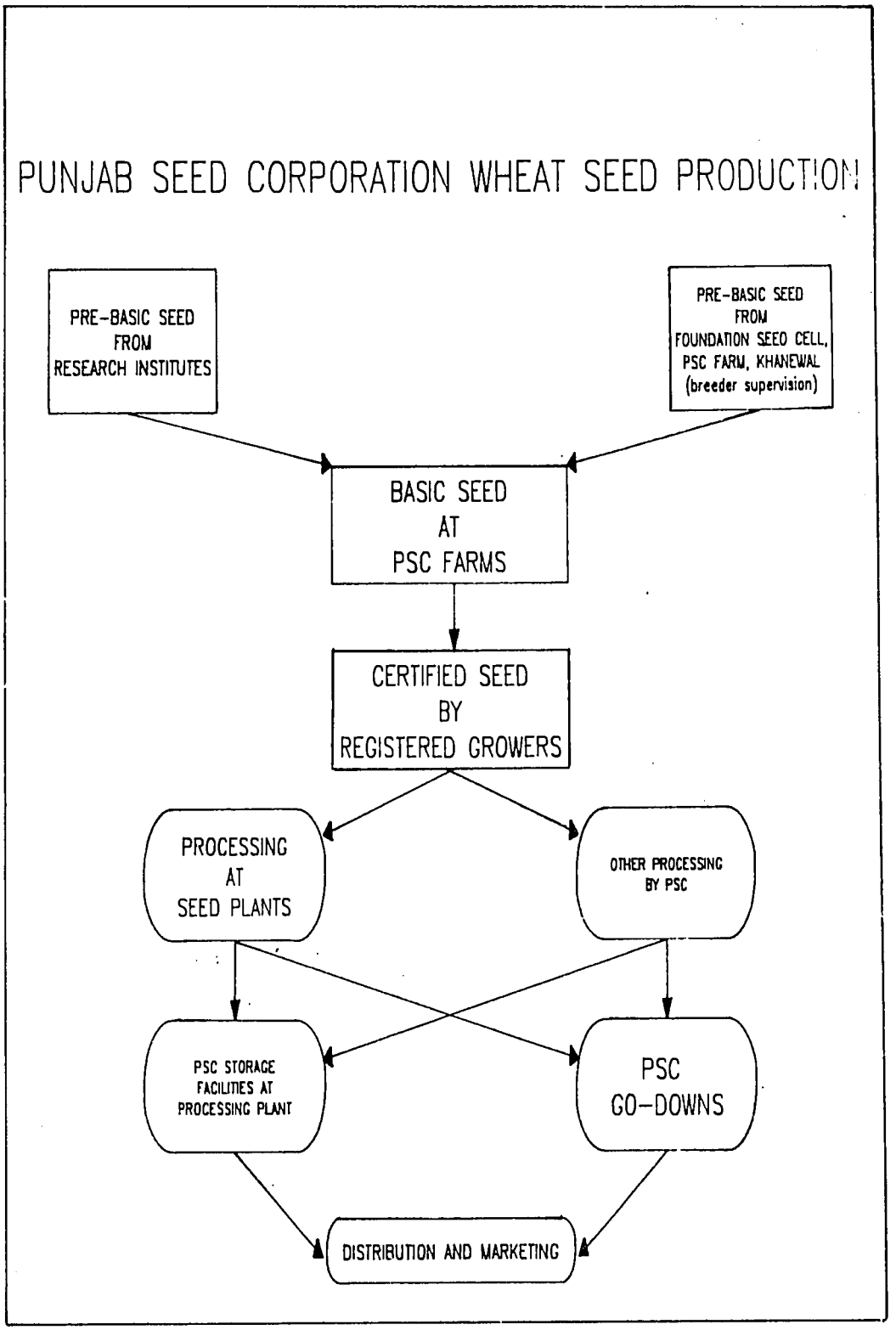
Wheat seed production is presently carried out in three stages. At stage 1, pre-basic seed is produced at the research institutes. At stage 2, pre-basic seed is multiplied into basic seed at the PSC farms. Finally, at stage 3, PSC contracts with the registered growers for the production of certified seed. The seed production system is outlined in Figure 2.1. On the face of it, the present seed production system does not seem to be different from that followed by the ADC or PAD&SC. But this is not true; the PSC system is more efficiently integrated and coordinated. A review of all the three stages of seed production under the existing system helps in understanding the salient features of the present seed production system.

2.2. Pre-Basic Seed Production

Pre-basic seed of impeccable quality is essential for the successful development of a seed program. Presently, pre-basic seed is produced at the research institutes under the direct control and supervision of plant breeders. It is produced two years ahead of the certified seed crop. In order to handle pre-basic seed production adequately, research institutes have been provided with sophisticated laboratory equipment under the Seed Industry Project.

Pre-basic seed production in year t depends upon the certified seed requirements in year t+3. The latter depends upon anticipated seed demand and rate of seed replacement[4]. In view of very high certified seed requirements for the wheat crop, it was planned to produce two generations of basic seed at the PSC farms. This was considered necessary because the breeders did not have sufficient resources to produce required quantities of pre-basic seed in one year. This essentially increased the certified seed production cycle by one year (from 3 to 4 years). In order to shorten the seed production cycle, or, in other words, to produce larger quantities of pre-basic seed in any given year, a "Foundation Seed Cell" was established in 1980-81 at PSC seed

FIGURE 2.1


PUNJAB SEED CORPORATION WHEAT SEED PRODUCTION
PRE-BASIC SEED FROM RESEARCH INSTITUTES
PRE-BASIC SEED FROM FOUNDATION SEED CELL, PSC FARM, KHANEWAL (breeder supervision)
BASIC SEED AT PSC FARMS
CERTIFIED SEED BY REGISTERED GROWERS
PROCESSING AT SEED PLANTS
OTHER PROCESSING BY PSC
PSC STORAGE FACILITIES AT PROCESSING PLANT
PSC GO-DOWNS
DISTRIBUTION AND MARKETING

farm, Khanewal. The pre-basic seed at this cell is being produced under the supervision of the breeders. The crop is inspected and seed is tested by the Federal Seed Certification Department (FSCD) for purity, disease incidence etc., in the field and laboratory, respectively.

Year-wise pre-basic seed obtained from the research institutes and produced at PSC seed farm, Khanewal, is shown in Table 2.1. Variety-wise details of pre-basic seed production for each year can be found in Table A-1. During the last six years (1980-81 to 1985-86), about 92 percent of the total pre-basic seed was produced directly by the PSC under the "Foundation Seed Cell" program. The share of PSC in pre-basic seed production has increased from 44 percent in 1980-81 to 98 percent in 1985-86.

There could be two possible reasons for this marked shift in production share. First, the PSC might have taken over the pre-basic seed production because the research institutes did not have the capacity to respond to PSC's demand. Undoubtedly, control over pre-basic seed production provides the necessary flexibility required to run the business on commercial lines. Second, the breeders might have withdrawn themselves from the pre-basic seed production responsibilities intentionally because they wanted to concentrate more on variety evolvement programs. In any case, it is hard to concieve that the quality of pre-basic seed produced at PSC farms is as good as it can be on breeder's farms. Moreover, the land available for basic seed production at PSC farms may be reduced eventually as more and more area is allocated for the production of pre-basic seed. Nevertheless, at present, even pre-basic and basic seed production combined does not account for all the area of the PSC farms. Furthermore, even assuming the most conservative seed multiplication ratios, the pre-basic seed production of the last two years shown in Tables 2.1 and 2.3 should be sufficient to meet anticipated final demand for certified seed.

2.3 Basic Seed Production

Basic seed is the progeny of pre-basic seed. As with pre- basic seed, quality is of paramount concern. In order to ensure the closest possible control over production and handling, basic seed is produced on PSC farms. These farms also serve as demonstration for the growers. The data with respect to location and total area of each farm are shown in Table 2.2.

The cultivated area of Khanewal farms is 2369 hectares out of which 2167 hectares are under tenant cultivation and 202 hectares are under direct cultivation. The PSC, after taking over the farms, levelled the fields and provided resources like irrigation (tubewells), tractors, management, and technical guidance to the

Table 2.1 **Production of Pre-Basic Seed of Wheat Crop in Punjab**
(Figures in Tons)

Year	Pre-Basic Seed Obtained from the Research Institute	Pre-Basic Seed Produced at PSC Seed Farms	Total Pre-Basic Seed Production
1976-77	2.80	--	2.80
1977-78	5.93	--	5.93
1978-79	19.60	--	19.60
1979-80	6.81	--	6.81
1980-81	4.70	3.64	8.34
1981-82	12.33	2.82	15.15
1982-83	4.28	2.94	7.22
1983-84	1.17	30.32	31.49
1984-85	2.40	111.82	114.22
1985-86	2.58	151.00	153.58

Table 2.2. **Basic Data Regarding PSC Seed Production Farms**

FarmSite	Transferred to PSC in	Total Area (Hectares)
Chak No. 81-82/10-RKhanewal	1976-77	1014.75
Chak No. 86-87/10-RKhanewal	1976-77	814.20
Chak No. 83-85/10-RKhanewal	1982-83	708.22
Seed Farm Sahiwal	1976-77	68.90

Table 2.3. **Production of Basic Seed of Wheat Crop at PSC Farms**

Year	Pre-Basic Seed (Tons)	Area Sown (Hectares)	Basic Seed Production (Tons)	Yield (Tons/Hectare)
1976-77	2.80	552.21	182.90	3.51
1977-78	5.93	78.92	290.60	3.68
1978-79	9.60	272.52	990.60	3.63
1979-80	6.81	127.64	455.80	3.58
1980-81	8.34	86.28	312.90	3.63
1981-82	5.15	155.00	609.60	3.93
1982-83	7.22	45.61	201.66	4.42
1983-84	1.49	131.93	436.18	3.31
1984-85	14.22	684.86	2569.10	3.75
1985-86	53.58	17.47	1834.48	2.96

tenants. These farms were instrumental in imparting improved agricultural production technology not only to the registered growers but also to the farmers located in adjoining areas.

Year-wise data regarding area sown under pre-basic seed and total basic seed produced is shown in Table 2.3. Variety-wise details of basic seed production for each year can be found in Table A-2. The share of various varieties in the total basic seed production plan has been changing over the years because of the introduction of new varieties from time to time. However, seed varieties such as Sandal, Lu26, Lyp-73, and Pari-73 have dominated the PSC seed multiplication program during the last 10 years. Presently, Pak-81 and Pb-81 are the leading seed varieties in the total seed production plan. In 1985-86, the share of PakD81 and Pb-81 seed varieties in total basic seed production was 47 and 25 percent, respectively.

The data shown in Table 2.3 and the individual variety data of Tables A-1 and A-2 indicate that multiplication ratios from pre-basic to basic seed are rather low. In many seed multiplication schemes, particularly in the earlier phases, seed rates are lower than those usually planted by farmers (Hanson, et al., 1982). The aim is not to maximize biological yield (or economic profit) but rather to maximize the ratio of seed output to seed input. Though greater than normal quantities of other inputs may maintain yields (Brennan and Appleyard, 1982) some yield reduction is also a possibility.

The data in Table 2.3 show fairly good yields, indicating careful management of some production aspects on the PSC seed farms. On the other hand, seed rates implied by the second and third columns are often high, with a mean of around 125 kg/ha and a range from around 50 kg/ha to 250 kg/ha. ("Normal" seed rates for irrigated wheat in Pakistan are around 100 kg/ha; seed rates for multiplication might be considerably lower than this.) Thus, higher than necessary seed rates may be one reason for the low multiplication of pre-basic into basic wheat seed.

An alternative explanation would be that some of the seed grown as pre-basic does not meet standards thought necessary for basic seed production. Some support for this hypothesis is found in the apparent upward trend, in recent years, in supposed seed rates implied in Table 2.3. This coincides with the dramatically increasing share of pre-basic seed produced by the PSC itself. If this is the case, some of the hoped-for advantage in having the PSC produce pre-basic seed is being lost.

A third possibility is that some pre-basic seed is otherwise diverted from basic seed production, perhaps as production plans for varietal mix change. However, data for individual varieties in Tables A-1 and A-2, notably Pak 81 and Pb-81, also show rather low multiplication ratios. If this third hypothesis were correct,

one would expect these varieties, which have increasingly dominated the production plan in recent years, to have higher than average multiplication ratios.

Thus it appears likely that PSC could improve the efficiency with which it multiplies pre-basic to basic seed, either through improved management of pre-basic seed production, lower seed rates in basic seed production, or both. This would not, however, answer the question of what proportion each variety should have at this stage of the production plan. This question will be considered further in the discussion that follows.

2.4. Certified Seed Production

PSC contracts with registered growers for the production of certified seed. In order to reduce seed supply risks and to minimize managerial problems, only progressive farmers are selected as seed growers. The growers are generally selected around the seed processing plants located at Sahiwal, Khanewal and Rahim Yar Khan[5] so that the cost of transporting the seed to processing plants is reduced. However, sometimes progressive growers having large mechanized farms located at distant places are also selected. The criteria for selection of contract growers are: (i) the grower should be cooperative, reliable, financially sound, and ready to adopt recommended farm development and crop production practices; (ii) the farm unit of the grower/family should be at least 100 acres and preferably directly cultivated by the owner; and (iii) farms should be close to the seed processing plant sites.

Presently, the total number of PSC registered growers is 572. Out of these, 310 are classified as category "A" growers and 262 as category "B" growers. PSC enters into contracts with category "B" growers only if the total production target is beyond the producing capacity of category "A" growers. During recent years, on average, certified wheat seed was produced on about 19 thousand hectares of category "A" farms and 13 thousand hectares of category "B" farms.

Quantities of wheat seed procured from the registered growers are shown, variety-wise, in Table 2.4. Total wheat seed procurement has increased from 4.14 thousand tons in 1979-80 to 43.30 thousand tons in 1986-87. During the last eight years, although the total seed procurement has increased in absolute terms, it has increased at a decreasing rate. It is evident from Table 2.3 that varieties such as Lyp-73, Pak-81, Pb-81, Blue Silver and Bwp-79 captured the major share of the total wheat seed procurement plan. Two new wheat varieties (Kohinoor and Fd-83) have entered in the PSC procurement plan since 1985 and their share in the total procurement has been increasing since then.

Table 2.4. Variety-Wise Production of Certified Wheat Seed in Punjab.

(Figures in Tons)

Variety	Years							
	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Lyp-73	569.53	459.09	672.65	1494.53	1464.41	870.99	436.69	867.71
Chenab-79	-	485.73	1455.86	542.80	29.71	-	-	-
Indus-79	59.76	963.00	85.96	114.92	-	-	-	-
Pak-81	-	-	-	356.03	8785.55	25205.23	24061.66	20091.70
Pb-81	79.72	561.95	963.63	8525.62	18691.75	10641.26	8114.95	7339.32
Pari-73	696.76	2496.79	2652.47	3674.17	2720.14	1010.44	515.44	185.13
Sandal	826.47	1478.70	1424.25	725.32	506.15	479.05	369.17	137.87
Lu-26	55.24	239.13	325.69	752.34	454.68	49.94	66.70	364.69
WL-711	393.77	1747.96	7065.17	8202.32	-	-	-	-
Blue Silver	87.49	1518.30	3909.17	7435.99	10377.27	8920.44	8942.12	11914.57
Bwp-79	-	-	656.27	1421.56	983.08	1156.04	1168.09	477.90
Yecora	-	343.23	520.11	-	-	-	-	-
Sa-75	1320.56	1014.50	-	-	-	-	-	-
Barani-79	-	33.11	-	-	-	-	-	-
Punjab-85	-	-	-	-	-	-	-	106.30
Fd-83	-	-	-	-	-	-	258.02	659.96
Kohinoor	-	-	-	-	-	-	474.95	1144.99
Others	53.00	116.97	50.50	87.86	216.22	187.81	66.51	18.10
TOTAL	4142.29	11458.47	19781.72	33333.47	44228.94	48521.20	44474.31	43308.23
TARGET[a]	4142.96	14929.60	22394.40	29859.20	44788.80	52253.60	52253.60	48521.20
Planned[b]	4142.00	14925.00	22388.00	26120.00	62209.00	62209.00	62209.00	62209.00

a. Target fixed by the government. This is done on a year to year basis.
b. Planned in the PC-I Scheme.

The comparison of total seed procured and the procurement targets assigned to PSC indicate that, with the exception of 1979-80 and 1982-83, PSC has been falling short of procurement targets. Actual seed procurement in 1979-80 was almost equal to the assigned target; while in 1982-83 PSC procured about 12 percent more than the assigned target. As will be shown in Section 5.3, in both these years PSC was able to sell all the quantities it had procured. This achievement can be explained by the fact that in 1979-80 the procurement target was very low as compared to the years to follow, and it was PSC's first year in the market.Therefore, every effort was made to sell all the procured seed. The year 1982-83 turned out to be good because seed varieties WL-711 and Pb-81 were in great demand, and PSC stocks consisted mainly of these varieties.

The procurement targets fixed for the period 1979-80 to 1981-82 were very much in line with those planned in the project appraisal report (PC-I Form)[6]. In the year 1983-84 and thereafter, the target was 62 thousand tons of wheat seed annually. But procurement targets fixed by the government and quantities actually procured were significantly below the planned targets. This deviation might have changed the structure of costs and benefits and, hence, the economics of this project.

Basic seed produced in year t is used to produce certified seed in year t+1. Tables 2.3 and 2.4 may be compared to give some indication of the multiplication ratio from basic to certified seed. This figure appears to have varied widely, ranging from around 10 in some years to well over 200 in others. Registered growers who produce certified seed should be able to get higher yields than most farmers, even with lower seed rates, although the multiplication ratio from basic to certified seed will probably be somewhat lower than from pre-basic to basic. This wide variability in multiplication ratios, however, requires some explanation.

The fluctuation in apparent multiplication ratios indicates that, at present, the amount of certified seed procured is mainly determined by the government's procurement target and PSC's perception of how much seed it can sell, not by the amount of basic seed available from the preceding production cycle. In years in which the apparent ratio of certified to basic seed is low, either some basic seed does not go into certified seed production, some seed produced by the registered growers does not meet certification standards, or the seed of the registered growers is simply not procured by the PSC. On the other hand, in years in which the apparent certified-to-basic ratio is high, the PSC may have procured certified seed from indirect sources[7].

As examples of the latter possibility, in 1982-83 actual quantities of certified seed procured were about 12 percent higher than the assigned target. Moreover, the PSC sold all the

wheat seed it procured. The government believed this to indicate a potential demand for seed and fixed a 50 percent higher procurement target for 1983-84 than the 1982-83 target. This perhaps forced the PSC to procure certified seed from indirect sources. Although in 1983-84 PSC was not able to sell all its procured stocks, the target for 1984-85 was again raised by about 17 percent above the 1983-84 target. Once again, the PSC may have procured certified seed from indirect sources in an attempt to meet the target.

2.5. PSC's Multiplication Capacity, Government Production Targets, and Initial Multiplication Decisions

Given the area PSC now has available for basic seed production and the number of contract growers, the corporation clearly has the capacity to meet targets for wheat seed production easily. Lower seed rates, particularly at the basic seed production stage, and improved management at the certified seed stage to raise the likelihood of meeting certification standards, could improve the PSC's multiplication capacity even further.

However, the PSC generally follows a conservative approach and procures only as much seed as its managers feel can be sold. It is important to mention here that seed production targets are fixed annually by the Federal Committee on Agriculture (FCA). These targets are set as part of the macro-level agricultural development strategy to attain a pre-specified growth rate in the agricultural sector. They are generally based on actual seed sold and targets assigned in the previous year. PSC is not a member of the FCA and as such, constraints faced by the PSC in the procurement and sale of seed are not taken into account when the targets are set. Too high a procurement target often leads to procurement of seed that is either not up to seed certification standards or is of unapproved varieties.

In terms of individual varieties, the PSC now appears to have the capacity to make 8-9000 tons of seed available to farmers three years after release (Pak 81) or even two years after release (Pb 81) in a case where release seems to have been anticipated (see Table 2.4). There may be several ways to increase this capacity. The first would be a general improvement in multiplication ratios in the manner suggested above. The second would be off-season seed multiplication in highland areas of Baluchistan or NWFP. Major disadvantages of such a scheme would be the substantial amount of transportation and inter-provincial cooperation this would require. On the other hand, increasing the number of seed multiplication cycles within a given time would also make possible more rapid seed multiplication in the face of crises such as disease epidemics. A third possibility would be to increase the production of pre-basic and basic seed in anticipation of release. It has been

shown above that the PSC has made an attempt to increase the capacity for producing pre-basic seed through its Foundation Seed Cell program. Breeders could also contribute to earlier seed availability by multiplying seed of candidate varieties before release (PARC 1987).

This last measure would require early decisions about which varieties to multiply. The past record of coordination between the Federal Government and the PSC with regard to varietal choice has not been encouraging. In general, the procedures regarding selection, retention, and withdrawal of varieties for seed multiplication and distribution have caused confusion. As mentioned earlier, the seed production cycle presently takes 3-4 years to complete. But decisions regarding retaining or rejecting a seed variety are made yearly. For example, in 1981-82, MINFA/PARC[8] recommended that Pari-73, Sandal, Blue Silver, Bwp-79 and Indus-79 should be grown for one year only and even so in limited, specified zones. Farmers were thus discouraged from growing these varieties. The next year, PSC was again asked to multiply these varieties since substitution possibilities were very limited. In another instance, during 1981-82 the variety WL-711 was not allowed to be distributed but PSC had to procure it because it was already planted with the contract growers.

Sometimes there is a difference of opinion between federal and provincial agencies. For example, during the early 80's the variety Chenab-79 was approved by the Punjab Province but was not included in the MINFA/PARC list. Incidentally, this was the only high yielding variety at that time in the early planting group. At one time, Indus-79 was recommended for early planting as it was known to be rust resistant, but it could not be sold because of very low yield.

Two questions arise. First, how can short-run (yearly) decisions be made regarding the retention or rejection of seed varieties when the seed production cycle takes several years to complete? Second, how can the various institutions associated with policy formulation better coordinate their activities with those of the PSC, which is responsible for the actual implementation of seed production programs? The preceding discussion clearly implies there is little coordination at present.

One reason for the PSC's conservatism in multiplying recently released varieties is that, at release, both the breeders and seed corporation have limited knowledge of the variety's acceptability to farmers. At present, breeders make some attempt to discover this in microplots planted on farmers' fields througout the province. After that, their candidate varieties are tested for two years in the NUWYT (National Uniform Wheat Yield Trials). Plot sizes and the number of varieties in the NUWYT are too small for farmer evaluation; management is somewhat more intensive than usually given by farmers; and in any case farmer

reaction is not recorded. This ultimately leads to a lack of understanding on the breeders' part about a variety's commercial characteristics over a wide area.

The present system could be improved by planting the NUWYT's at a smaller but more carefully selected number of sites, and especially by planting provincial microplots and NUWYT's simultaneously (PARC 1987). The former program (microplots) might be expanded to include less rigorous management by the breeders. Small amounts of seed of promising candidate varieties (i.e. varieties that yield well and have good disease resistance) could be given to farmers to plant under their own management conditions. Since more rigorous quantitative evaluation of important characteristics should be available from the NUWYT's, the microplot program in such an expanded version should concentrate on monitoring farmer reaction to the new variety. One important characteristic to record would be farmer evaluation of performance at late planting dates, since this late planting is a common feature for wheat in many of Pakistan's multiple cropping systems (Byerlee, Hobbs, et al., 1986; Tetlay, et al., 1987b).

3. SEED PROCESSING

Seed processing includes operations such as drying, cleaning, grading, and packing. All of these operations are essential for the production of high quality seed. Drying may be necessary for storage without loss of germination. Cleaning and grading removes impurities such as inert matter, impure seed and undersize seeds.

Under the Seed Industry Project, three seed processing plants were to be installed, one each at Sahiwal, Khanewal and R.Y. Khan. Seed processing plants at Sahiwal and R.Y. Khan are not functional yet and their installation has been delayed inordinately. There are a number of technical and managerial reasons for this delay; a discussion of these reasons is beyond the scope of this study. The third seed processing plant at Khanewal has been in operation since 1985. On completion of the project each cereal seed processing plant will have the capacity to process about 27,600 tons of wheat seed. As such, the total wheat seed processing capacity of PSC will be 82,800 tons, when all the three processing plants start functioning. The single most important problem relating to seed processing plants is that they are small in number and large in size. This eventually translates into high cost of processed seed because seed is to be transported over long distances, and under-utilization of plant capacity.

Since one of the major objectives of the Seed Industry Project was to supply processed seed to the farmers, PSC has been

undertaking seed processing through other mechanical means. In the case of wheat seed, cleaning is being done on locally made sieves.

Storage silos have been completed only at the Khanewal center. However, the construction of open storage facilities is almost complete. Total storage facilities designed under the project included 198 silos and open storage of 29400 square meters. This storage is sufficient to accommodate about 43,000 tons of wheat seed. The PSC presently stores about 22,000 tons of wheat seed in its own storage facilities and hires godowns, some of which do not permit proper fumigation, for the storage of the remaining seed.

4. QUALITY CONTROL

At all the stages of seed multiplication, standing crops are inspected by an independent agency called Federal Seed Certification Department (FSCD). Crop seeds are procured only from those fields which are approved by the FSCD. This agency also tests the purity and quality of seed during the seed processing and distribution stages. Theoretically, this is a very satisfactory arrangement but the FSCD has not been able to enforce the seed certification standards very strictly. Some of the registered growers succeed in having their crops declared as "certified" or "approved" by virtue of their political power or personal relations with the staff of the FSCD. The ICD report (1987) notes that although "... it is assumed that the current seed certification law addresses consumer protection issues and assures the quality of seed actually bought by the consumers, this is not so ...".

Consumer protection laws seem to be non-existent at the retail level. This provides an opportunity for unscrupulous merchants to mix non-certified seed with high quality certified seed. Farmers often fail to detect this misrepresentation because adulterated seed, on physical inspection, appears similar to certified seed.

In addition to the routine seed certification tests of the FSCD, PSC has also established an Internal Quality Control Cell at each plant site. This system is an attempt to doubly ensure the purity and quality of seed. The samples of the produce of registered growers are drawn from their stores/fields and tested for purity and germination. The produce of the registered growers is transported to PSC plant sites or stores only after it has been approved by the Internal Quality Control Cell. When the produce reaches the PSC stores or plant sites, quality control tests are carried out again. The rationale behind all these quality control efforts is to supply genetically pure and

physically healthy seed to farmers.

The question then arises: are farmers satisfied with the quality of seed produced by the PSC? The results of two current studies done by the Punjab Economic Research Institute (PERI) and the Seed Corporation (Sharif, et al., 1986; PSC, 1986) can be used to answer this question. Both these studies covered all of Punjab, and the sample size of the PERI and PSC studies were 1077 and 1250 farmers, respectively. According to the PERI study, about 83 percent of the sampled farmers were satisfied with the quality of wheat seed supplied by the PSC. The PSC survey concluded that 90-94 percent of the sampled farmers were satisfied with the purity and germination of PSC seed. However, the results of the PSC survey might be positively biased for two reasons. First, the survey was carried out by the field staff of PSC who were also responsible for procurement and distribution of seed. Second, the response regarding quality was reported for seeds of all crops. Since the quality of cotton seed produced by the PSC is exceptionally good, it might have contributed some positive bias to the overall results.

In conclusion, the PSC has apparently been able to satisfy consumers with the quality of its product. However, as a matter of general government policy, consumer protection measures should be strengthened.

5. MARKETING OF SEED

5.1. Review of Marketing System

In the context of the present study, marketing is defined as the process of transferring the seed to farmers. The success of any marketing system can be viewed by the degree to which buyers or consumers are satisfied. The present marketing system of PSC is reviewed in the following lines within the context of changes over time in institutional arrangements, market shares, and cost structure.

5.2. Distribution Network

PSC sells its seed both through public and private sector organizations. In the early years of its operations, PSC started selling its seed through the retail outlets of PAD&SC. However, this network was considered insufficient because of the expanding activities of the PSC. Therefore, PSC started selling seed through private dealers, branches of the Provincial Cooperative Bank, and its own outlets. The PAD&SC also markets seed through private dealers who are primarily agents for PAD&SC fertilizer

sales. The distribution network is outlined in Figure 5.1. The total number of outlets for the years 1981 to 1986 is shown in Table 5.1, and the breakdown by division and district is indicated in Table 5.2. As will be seen, the figures in these tables should not be interpreted to mean that market shares of the various distribution channels have expanded in the same proportion as the number of outlets.

PSC sale depots accounted for approximately 14 percent of wheat seed sold within Punjab in 1985-86. They are either located on the seed processing plant sites or at the divisional headquarters level. The only rationale for having sale depots at seed processing plant sites is that the required storage and staff are available to handle the sale of seed. Sale depots are also established at divisional headquarters level because the office of Assistant Manager (Marketing) is located at that site.

Table 5.1. Yearly Expansion in the Distribution Network of PSC,

Year	Private Dealers	PAD&SC Sale Depots	Provincial Cooperative Bank Branches	PSC Depots	Total
1981	151	84	131	7	373
1982	259	252	136	8	655
1983	285	262	136	11	694
1984	375	271	136	11	793
1985	413	271	136	11	831
1986	581	286	140	11	918

The PAD&SC held a 59 percent share of the PSC wheat seed marketed in Punjab in 1985-86. This included seed sold by PAD&SC sale depots as well as that handled by private dealers contracting with the PAD&SC. PSC uses the PAD&SC retail network because no other distributing agency is willing to sell the seed of a crop that is not in great demand. On the other hand, PAD&SC accepts this responsibility because its survival is very much linked with the sale of seed.

The PAD&SC has had difficulty establishing itself as an effective institution for marketing agricultural inputs. All it is doing now is distributing seeds and fertilizer. Its market share has been reduced over time because of greater private sector involvement in input marketing. In view of this trend, it has reduced its sale points in recent years from 550 to 271. PSC also recognizes this and is not very enthusiastic about selling its seed through the PAD&SC network. However, PSC has been doing so for two major reasons. First, the government wants PAD&SC to keep going and to do so, it is necessary that the PSC should sell its seed through the PAD&SC network. Second, the Chairman and

Figure 5.1

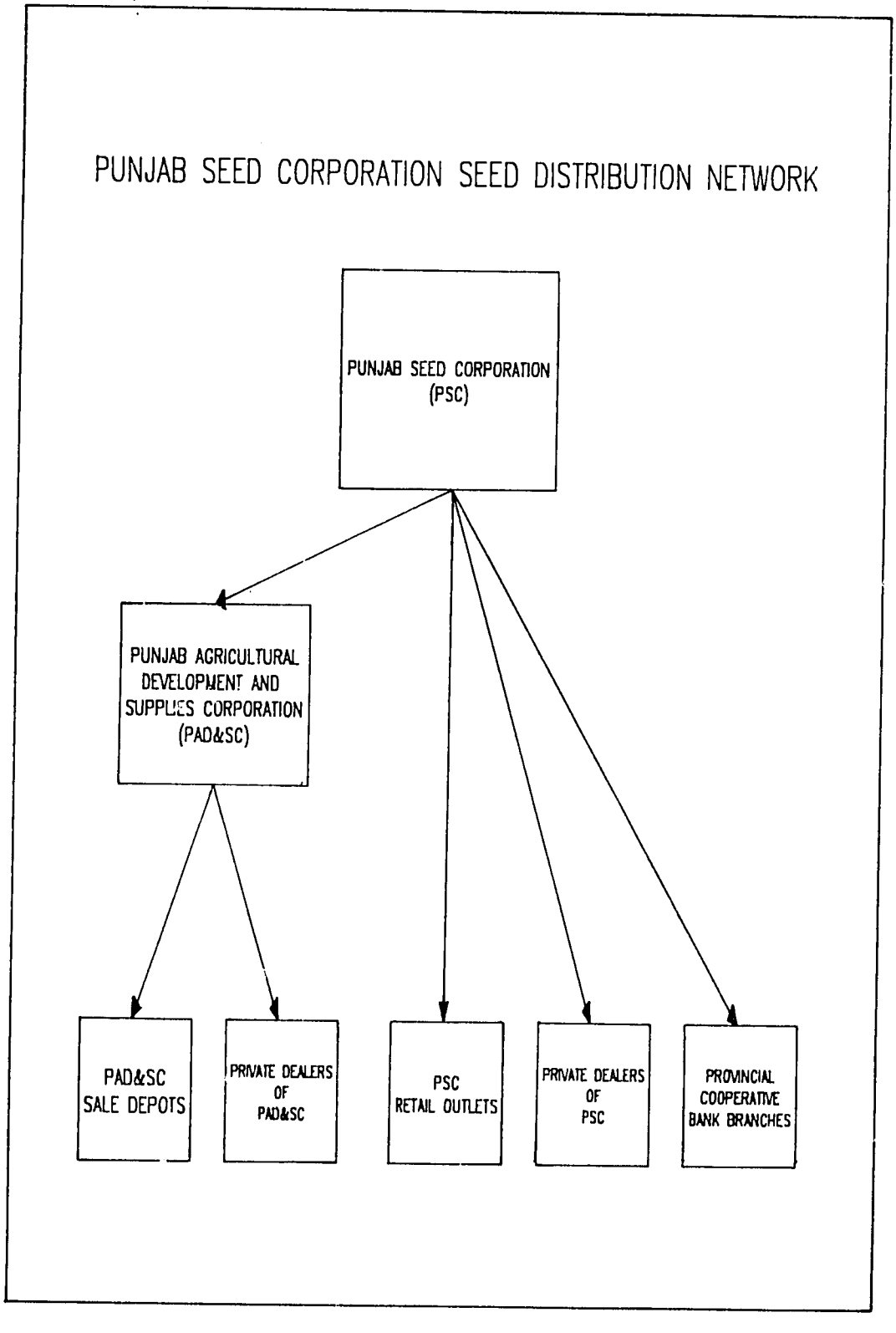

PUNJAB SEED CORPORATION SEED DISTRIBUTION NETWORK
PUNJAB SEED CORPORATION (PSC)
PUNJAB AGRICULTURAL DEVELOPMENT AND SUPPLIES CORPORATION (PAD&SC)
PAD&SC SALE DEPOTS
PRIVATE DEALERS OF PAD&SC
PSC RETAIL OUTLETS
PRIVATE DEALERS OF PSC
PROVINCIAL COOPERATIVE BANK BRANCHES

Table 5.2. Numbers of Outlets, Division/District-wise, in the PSC Distribution Network for Sale of Seed

Division/ District	Private Dealers	Provincial Cooperative Bank Branches	PAD&SC Sales Depots	PSC Depots	Total
RAWALPINDI	35	16	19	1	71
Attock	9	3	5	1	18
Rawalpindi	18	5	9	-	32
Jhelum	5	4	3	-	12
Chakwal	3	4	2	-	9
GUJRANWALA	37	15	35	-	87
Gujrat	18	5	10	-	33
Sialkot	8	6	11	-	25
Gujranwala	11	4	14	-	29
LAHORE	55	20	36	1	112
Sh. Pura	11	10	14	-	35
Lahore	16	1	7	1	25
Kasur	8	3	9	-	20
Okara	20	6	6	-	32
MULTAN	179	28	25	4	236
Sahiwal	42	8	7	1	58
Khanewal	50	8	7	1	66
Multan	48	7	7	1	63
Vehari	39	5	4	1	49
D.G. KHAN	49	15	13	1	87
M. Garh	18	3	6	-	27
Rajanpur	12	5	2	-	19
Leiah	7	3	2	-	12
D.G. Khan	12	4	3	1	20
BAHAWALPUR	116	16	26	2	160
R.Y. Khan	52	4	10	1	67
Bahawalpur	41	5	8	1	55
B. Nagar	23	7	8	-	38
FAISALABAD	65	17	19	-	101
Faisalabad	22	8	5	-	35
T.T. Singh	16	4	5	-	25
Jhang	27	5	9	-	41
SARGODHA	45	13	13	2	73
Sargodha	15	5	5	1	26
Khushab	11	3	2	-	16
Mianwali	10	3	4	1	18
Bhakhar	9	2	2	-	13
G. TOTAL:	581	140	186	11	918

members of the Board of Directors of both organizations (PSC and PAD&SC) are the same. Thus it is practically impossible for PSC not to accept PAD&SC as its distributing agent, particularly when the PSC has no effective alternative marketing arrangement and has not been able to develop one although it has been in business for almost eight years.

Some of these problems are reflected in the dealings of the two public sector organizations with the private dealer network. A majority of the private dealers selling seed are agents of the PAD&SC. When they come to PAD&SC stores to lift fertilizer, they are forced to lift seed as well. In other words, sale of seed is tied with the sale of fertilizer. Private dealers who deal directly with the PSC received a commission of Rs. 12 per 90 kg bag in 1985-86, but those selling seed for the PAD&SC received only Rs. 8 per 90 kg bag. The PAD&SC retains the balance of the PSC commission to support its own operations. Understandably, these dealers for the PAD&SC are not at all happy with the situation.

Private dealers receiving seed directly from the PSC accounted for 27 percent of the Punjab market share in 1985-86. It is evident from Table 5.2 that about 59 percent of all private dealers (agents of either PSC or PAD&SC) are located in the cotton-growing region. This suggests that private dealers find it more profitable to sell cotton seed.

The market share of the Cooperative Department has always been very low; in 1985-86 it stood at less than 1 percent. The Cooperative Department sells seed through cooperative societies as well as directly through Cooperative Bank branches. The staff of Cooperative Bank branches, trained for banking and not input marketing, view the sale of seed as an additional responsibility and not as an integral part of their operations.

5.3. Distribution System

Before the start of the sale season, PSC enquires from all its dealers (both private and public) about their anticipated demand. Thereafter, PSC starts transporting the seed to dealers' stores at its own expense in accordance with some mutually agreed upon supply schedule. As the sale season proceeds, supplies are adjusted in accordance with the market situation.

Supplies to both public sector agencies and private dealers are made on a "cash and carry" basis as a matter of policy, but in practice this requirement is usually relaxed for public sector agencies. Some of the private dealers who have established their creditability with the PSC also lift PSC seed on a credit basis against some assured guarantees. The government policy of encouraging agricultural credit through cooperative societies

enables these societies to buy seed on a credit basis, although, as has been seen, these societies handle very little of the actual market volume.

The PSC pays the same rate of commission to all distributing agents with whom it deals directly. As seen, in 1985-86 this was Rs. 12 per 90 kg bag, up substantially from previous years. However, it has also been seen that the PAD&SC, as an intermediate agent, retains some of this commission and only passes Rs. 8 through to private dealers obtaining seed from the PAD&SC.

If some of the stocks supplied to distributing agents are not sold, PSC is responsible for lifting these stocks back at its own expense and refunding money to the dealers. However, the PSC is now considering a policy of not lifting back the unsold stocks so that financial losses stemming from huge transportation costs can be avoided. Nevertheless, this would discourage PSC agents from lifting more seed. Already some dealers complain the PSC is reluctant to lift back unsold stocks.

Most PSC dealers are not satisfied with the current seed distribution arrangements made by the PSC. The current practice, when the sale season is on, is for dealers to inform the marketing staff about their short-run demand either verbally or by telephone. Demand is usually expressed in truck loads. The marketing staff, in turn, advises the concerned stores staff to despatch the seed to dealers. Due to lack of careful planning and efficient coordination between different wings of the PSC, seed supplies are often delayed. Sometimes the quantities despatched are more than the quantities requested. This, in turn, causes storage and handling problems for the dealers. Sometimes the seed of certain varieties is despatched, which has no demand in a particular geographic zone. Dealers become aware of these mix-ups only when the seed has arrived at their doorsteps. The quality of packing material has also been reported to be very poor. All of these factors negatively affect the total volume of sales at the retail level and compound the problem of unsold stocks.

As mentioned earlier, the success of any marketing system can be gauged by the degree to which buyers or consumers are satsified with the system. According to the PSC survey of 1986, 51 percent of the sampled farmers did not use PSC seed because it was not available. This clearly suggests the need to establish a more efficient, aggressive and expanded marketing network.

All the marketing activities of the PSC are supervised by the staff of Marketing Division. According to the existing staffing pattern, one Assistant Manager is responsible for monitoring the sale of seed in each division. Undoubtedly, this is too large an area to cover for one person. In order to supervise the sales

operations effectively, there is a need to expand the marketing field staff.

5.4. Total Sales

Presently, the PSC produces about 44,000 tons of wheat seed which is about 9.3 percent of the total provincial demand. This is also about 70 percent of the planned demand for certified seed in the project paper. Thus, Punjab has not yet been able to meet planned demand for high quality seed of improved varieties, not to mention potential demand (ICD, 1987). Year-wise quantities of wheat seed procured and sold are shown in Table 5.3. For each year, district-wise sales in the Punjab Province are shown in Table A-3. Total sale figures include the quantities sold to other provinces and exported to various countries as well. However, the quantities sold to other provinces and countries are very small relative to total sales.

Table 5.3. Procurement and Sale of Wheat Seed in Punjab
(Figures in Thousand Tons)

Years	Target	Procured	Sale	Balance
1979-80	4.14	4.14	4.14	0.00
1980-81	14.93	11.46	10.00	1.46
1981-82	22.39	19.78	19.63	0.15
1982-83	29.86	33.33	33.33	0.00
1983-84	44.79	44.23	41.09	3.14
1984-85	52.25	48.52	48.52	0.00
1985-86	52.25	44.49	40.98	3.51

The procurement targets and the quantities actually procured and sold increased consistently from 1979-80 until 1984-85. However, the quantities procured and sold went down in 1985-86. Historically, PSC has followed a conservative approach as it has been procuring smaller quantities than the targets assigned by the government. Even under this approach PSC has not been able to sell all the procured seed in some years. The unsold stocks of seed are sold by the PSC as grain in the open market at a price which is 37-43 percent lower than the seed price.

There are a number of reasons that why PSC has not been successful in selling all the seed stocks. First, the procurement targets are arbitrarily set and are not supported by any kind of empirical analysis. The government should therefore consider involving PSC while developing seed production policy. Second, the existing seed marketing system is not very efficient. In order to ensure the supply of seed at the farmers' doorstep, the

need for the establishment of a more coordinated, integrated and expanded marketing system can hardly be over-emphasized. In this context, it is also necessary that the coordination between different wings of the PSC is improved. Improved marketing will also require improved planning of which individual varieties to produce and where they should be marketed. Third, neither the seed project planners nor PSC management have resolved the aims and principles of seed pricing in the marketing process. Seed pricing will be discussed in the next two sections.

5.5 Seed Pricing: Theoretical Considerations

This section begins by considering the current debate over seed pricing in Pakistan. Following this, some general principles for the pricing of seed are enunciated. Current procedures used by the PSC in pricing wheat seed are described in the following section.

All parties to the seed pricing discussion agree that the marginal benefits of using improved seed must exceed the marginal costs for farmers to buy the improved seed. There is a widespread feeling in Pakistan that farmers will not pay prices for seed that diverge too widely from the grain price. This argument may be supported by some survey evidence[9]. On the face of it, this seems to argue for a low seed-to-grain price ratio. It was assumed at the design of the Seed Industry Project that use of improved seed could increase wheat yields by 10 percent. However, the impact of PSC-produced wheat seed on yield does not appear to be significantly different from the yield obtained through the use of ordinary wheat seed, assuming variety and all other factors of production are held constant[10]. Moreover, since, unlike cotton, there are no quality premiums for better grades of wheat, benefits of using improved seed are reflected only in yield.

On the other hand, experience in other countries clearly shows that farmers will pay two to three times the price of grain for seed, once they are convinced of the economic benefits of using it (ICD, 1987). Furthermore, seed prices that are too low to cover production and marketing costs tend to stifle the production and distribution of high quality seed, even when the difference between revenues and costs is made up by government subsidy.

There are two steps that can be taken to resolve these apparent contradictions: looking at the components of the farmers' cost-benefit comparison between improved and own seed, and relaxing the assumption that variety remains constant in the comparison.

The static framework for seed-to-grain price ratio comparisons

has been discussed by Longmire and Stewart (forthcoming). The higher the percentage improvement in yield from new seed, the higher is the ratio of the maximum seed-to-grain price farmers are willing to pay. Given equal percentage improvements in yield, the maximum ratio is higher the higher the base yield. The maximum ratio is lower the higher the seed rate, and the ratio is lower the higher the marginal rate of return the farmer wishes to obtain on his seed investment. (The marginal rate of return can be interpreted as partially reflecting the farmers' risk preferences as well as the opportunity cost of capital).

Further considerations allow this static model to be extended to a dynamic context. First it must be recognized (as was done in the project planning document) that for a self-pollinated crop such as wheat, farmers may wish to obtain new seed only after a period of several years. Second, over time, the benefits of improved seed may increase with the introduction of newer, higher yielding varieties. Byerlee, et al., (forthcoming) calculate that since the advent of semi-dwarf varieties in Pakistan, the long-run yearly average increase in yield due to varietal improvement has been about 1.0 percent. Finally, even for self-pollinated varieties, the other side of the comparison--expected benefits from using own seed--will deteriorate over time. This is true even though at any given time, for many farmers a comparison between own seed and certified seed with variety held constant may not appear to justify the purchase of the improved seed. Eventually, however, farmers' seed quality deteriorates as it becomes mixed with seed of other varieties, or worse, with weed seed, or as the old variety becomes increasingly susceptible to disease.

In a dynamic cost-benefit model, in addition to the effects of partial changes in the static model stated above, several other results can be shown. Naturally, the higher the rate of varietal improvement, or the higher the rate of deterioration of the farmers' own seed, the higher will be the maximum seed-to-grain price ratio farmers would be willing to pay. Finally, the smaller the number of cycles after which farmers would be expected to change seed, the lower will be the maximum acceptable seed-to-grain price ratio[11].

As examples, one can make varying assumptions regarding the parameters noted above and calculate maximum seed-to-grain price ratios that farmers would be willing to pay when changing seed. First, it is assumed, as in the project planning document, that farmers would replace varieties every five years. A base wheat yield of 1.6 tons/ha and a seed rate of 100 kg/ha are further assumed. For marginal rate of return, a very conservative rate of 100 percent over a single wheat production cycle is chosen. A 1.0 percent annual increase in varietal improvement is also assumed. Under these assumptions, if no deterioration in farmers' own seed performance over time is admitted, the maximum

seed-to-grain price ratio that farmers would be willing to pay when buying improved wheat seed would be 1.41. The 1986-87 seed-to-grain price ratio was 1.49, so under all of these assumptions the current ratio of seed price to grain price could be said to be "too high." With a change in any one of these assumptions--yield of farmers' variety now assumed to deteriorate by 1.0 percent per year, or marginal rate of return assumed to be 50 percent, or base yield assumed to be 2.0 tons/ha, or number of years before varietal change increased from 5 to 7--the current ratio is not too high. Either of the first two changes in assumption might be plausible. The third change in assumption shows why farmers with higher base yields, presumably because of better crop management, might be quicker to change varieties. The final change is a less desirable possibility: a five year target turnover period is probably desirable from the standpoint of evolving disease threats as well as simply because it coincides with the seed project planning document (Byerlee, et al., forthcoming).

These simplifying assumptions do not, of course, reflect all the complexity of real-world seed demand. A long-run average of 1.0 percent per year in yield gains attributable to varietal improvement hides considerable year-to-year variation. Similarly, the decline in yield of old varieties varies with farmers' own seed management practices and with changing levels of disease threat. In particular, after a severe disease epidemic, one would expect farmers growing susceptible varieties to be willing to pay very high prices for seed of resistant cultivars. Other changes in yield caused by variations in management practices or the weather make it more difficult for farmers to evaluate performance attributable to variety alone. Furthermore, the alternatives facing the Punjab's wheat farmers are not simply own seed vs. PSC seed. A farmer may choose to wait and get seed of a new variety from a neighbor. In a 1986 survey, around half of the sampled farmers growing recent wheat releases in Punjab's rice-wheat and cotton-wheat zones said they first obtained seed from other farmers (Tetlay, et al., 1987a). Of course this seed is not the same input as PSC seed, but particularly in the early years of a variety, the differences might be relatively small.

There are several important points to be made here. First, price ratio is only one of a number of parameters to be considered when evaluating potential demand for improved seed. Second, marketing problems for an input like seed, which each individual farmer demands only in some years, and which may be obtained from other farmers, are likely to be more complex than those for an input like fertilizer, which farmers are likely to demand every year and which is obtainable only at a depot or private retailer.

5.6. Pricing and Subsidies--Current Practice

Punjab Seed Corporation, like many other quasi-public organisations dealing in seeds, tends to base its pricing decisions on cost figures. Before the start of the sale season, the Marketing Division of PSC fixes the sale rate of seed. The Board of Directors of PSC usually gives its approval to the sale rate proposed by the PSC. The sale rate is fixed so as to recover the actual expenditure incurred in the procurement, storage and handling of seed. In order to ensure financial viability of the PSC, a corporation margin is also added in calculating the end price of seed. Various cost items that enter into the calculation of the retail price of seed are shown in Table 5.4.

Except for the procurement price of wheat which is fixed by the government, and the premium paid to growers, there is no clear-cut pattern as to how the costs of various parameters are behaving over time. The procurement price of wheat showed an increasing trend and has increased by 60 percent since 1980-81. The premium paid to contract growers stayed constant during the last five years. It is difficult to interpret why other cost items are showing such erratic behavior. The PSC distributes most of its seed handling and other operating costs over wheat and cotton seed. The magnitude of procurement and sale of seed of these crops also vary in total volume; this might have been the reason for the non-symmetric behavior of the cost structure.

At the same time, the data presented in Table 5.4 clearly reflect lack of objectivity on the part of PSC while carrying out the important exercise of seed pricing. For example, it is hard to understand why corporation margin is charged in one year and not in another. Or, how the distribution costs can stay constant over time particularly when the total quantities handled, transportation costs and wage rates are all going up. Also, it is important to note that the commission paid to dealers was Rs.12.00 per 90 Kgs. bag instead of Rs.8.00 as used in the calculation of the sale rate in 1986-87. This discrepancy may result from the inconsistencies in actual commission paid to the ultimate dealer, noted above in the sections on distribution.

During the last seven years, the price of wheat seed has increased at an average annual rate of 8 percent. Three important variables which have pushed the price of wheat seed upward are: (i) consistent increase in the procurement price of wheat; (ii) gradual withdrawal of subsidy by the government; and (iii) an increase in corporation overheads.

Grain price and seed price have increased in almost the same proportion (at an average annual rate of about 8 percent) during the last seven years. However, the corporation overheads have increased considerably (about 100 percent) in the last couple of

Table 5.4. Price of Wheat Seed from 1980-81 to 1986-87 in Punjab

(Rs. per 90 Kgs. bag)

Description	YEARS						
	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Procurement price	112.50	130.50	130.50	144.00	144.00	157.50	180.00
Premium to growers	9.67	9.67	11.25	11.25	11.25	11.25	11.25
Procurement costa	16.57	15.36	14.11	15.12	15.75	15.14	13.86
Cost of Jute bag	14.00	11.75	12.40	13.25	14.27	15.40	15.73
Sieving lossesb	0.00	0.00	4.68	3.40	3.42	3.66	4.10
Distribution costc	7.10	7.10	7.10	7.10	9.48	10.99	8.30
Commission to dealer	5.00	5.00	5.00	5.00	6.00	6.00	8.00
Interest on capitald	9.02	8.16	10.13	11.92	11.97	12.87	14.36
Corporation overheads	6.94	5.49	7.79	7.48	15.04	14.58	13.20
Corporation margine	4.83	0.00	0.00	5.36	5.40	5.82	0.00
Total Cost	185.63	193.03	202.96	223.88	236.58	253.21	268.80
Subsidy	15.63	18.03	18.03	18.03	11.56	6.21	0.00
Sale Rate	170.00	175.00	184.93	205.85	225.02	247.00	268.80
Say:	170.00	175.00	185.00	205.00	225.00	247.00	269.00

[a]Includes filling, weighing, stitching & stacking, loading & unloading, transportation from grower's field to plant site, storage, sieving, fumigation, transportation from plant to stores, workcharge staff, octroi, sutli, and market fee etc.

[b]About 2 percent of "total procurement price" (Procurement price + premium + procurement cost).

[c]Transportation from PSC stores to dealers' store, loading, unloading, stacking and octroi etc.

[d]Charged on "total procurement price" for six months. Interest rate used was 13 percent in 1980-81 and 1982-83; 10.5 percent in 1981-82; and 14 percent from 1983-84 onwards.

[e]About 3-5 percent of "total procurement price".

years--although PSC assigns a smaller share of corporation overheads to wheat seed than to cotton seed because farmers' willingness to pay for cotton seed is relatively high. If the corporation overheads had not increased at such a fast rate, the output-seed price ratio would have been more favorable to the farmers.

The price of wheat seed was subsidized for the first six years of the project (1980-81 to 1985-86). The amount of subsidy was Rs.15.63 per 90 kgs bag in 1980-81. The subsidy was increased to Rs.18.03 per 90 kgs bag in 1981-82 and stayed the same until 1983-84. Thereafter, the amount of subsidy was gradually reduced and it was completely eliminated in 1986-87. The rationale behind providing the subsidy to farmers was to overcome their distrust of the purchased seed and to establish a market for the new product. It seems that, with the exception of cotton seed, the PSC has not developed its markets to the extent envisioned in the project planning document. The government decision to withdraw the subsidy from wheat seed has its own merits and demerits. On the one hand, the demand for a commodity whose market is not yet fully established might suffer adversely. On the other hand, the taxpayers would be happy that their money is not being used to subsidize public sector inefficiencies.

In order to establish an accurate sale price of seed, the need to develop a consistent and realistic data base for each crop can hardly be over-emphasized. Moreover, efforts could be made to reduce the costs of seed production and distribution. One possible way to accomplish this objective is to increase seed output. This alternative may not prove feasible because there is not much demand for processed wheat seed. However, a reduction in the price of seed may increase the demand and consequently the throughput. A reduction in corporation overheads is another alternative to reduce the price of seed.

Other specific cost components that might be reduced or eliminated in the interests of greater efficiency include corporation margin and octroi charges. Furthermore, if revenues from saleable wastes were included in the PSC's calculations final seed price could also be reduced.

There is little justification to include the corporation margin in calculating the end price of seed as long as corporation overheads are included in the end price, as they are at present. As noted above, the role of the corporation margin is rather mystifying.

In Table 5.4, octroi charges are reflected in the distribution costs. These charges vary from market to market and in some markets are as high as Rs.10 per 90 kg bag. On the other hand, no octroi is charged on other inputs and very little octroi is charged on grain. PSC should take up the matter with relevant

government institutions and persuade them not to levy octroi charges on wheat seed.

In the existing price-setting method, saleable waste resulting from seed processing operations is not taken into account. In the case of wheat seed, if saleable waste were accounted for, the price of a 90 kg bag of seed would be reduced by at least Rs.5 per bag [12].

As argued in Section 5.5, when farmers change varieties, their willingness to pay for seed is relatively high. However, for a given variety, incremental benefits associated with the use of processed wheat seed may not always be enough to support a high seed-to-grain price ratio if the farmer has only been planting a variety a few years or if he has the alternative of purchasing fairly good seed from a neighboring farmer. Therefore, PSC should recognize that though it enjoys a monopoly in the wheat seed market, it cannot increase the price of wheat seed indefinitely without changing its strategy towards more effective marketing with an emphasis on varietal replacement.

5.7. Marketing Research

The PSC does not have a trained marketing research unit that could search through the facts and relationships pertaining to various marketing problems. Because very little attention is paid to collecting information on important marketing parameters, seed production and distribution plans are based on historical trend. Also, no information is collected as to why one seed variety is preferred over another seed variety in a particular cropping zone. The PSC has been in the business for the last 9 years, yet its product's brand name has not been established. All these factors necessitate the need to establish a strong marketing research unit capable of generating information and analyzing marketing problems on a regular basis. In this context, it would be appropriate to reorganize the existing procurement and marketing field staff in such a way that procurement, distribution and market research activities are carried out in an organized and efficient manner.

During 1986 a large scale farm level survey was carried out to find out farmer's preferences about varieties, packing sizes and publicity media. The survey data have been tabulated and compiled but not statistically analyzed. Some of the survey results are reviewed in the following paragraph.

About 28 percent of the farmers' wheat area sampled by the PSC was sown under the variety Pak-81 in 1985-86. Area sown with WL-711 was 12.9 percent followed by area under Blue Silver (12.8 percent) and Pb-81 (11.7 percent). These figures roughly correspond with unpublished estimates for the Punjab in 1985-86

by the Crop Reporting Service, Lahore, except for Pak 81 where the PSC estimate is much higher[13]. A farmer's preference for a particular variety can be viewed from his decision regarding how much area he will plant under that variety during the next year. Varieties expected to increase in area included Pak-81, Kh-83, Fd-83, and Bwp-79. The area under Pb-81, Sandal, Pari-73, WL-711 and Yecora was expected to decline. The area under varieties Lyp-73 and Blue Silver was likely to stay roughly the same. Unpublished estimates for 1985-86 and 1986-87 from the Crop Reporting Service indicate that the majority of these predictions were correct. The exceptions were Fd-83 and Kh-83, which have areas too small to be picked up by the CRS, and WL-711 and Pb-81, which continued to increase slightly in area. However most evidence indicates the area under these latter varieties is leveling off and may be expected to decrease over the next few years (Akhtar, et al., 1987)[14].

This varietal information might be used in different ways depending on whether the PSC were following a "general sale" marketing strategy, as it appears to be doing, or a varietal replacement strategy, as discussed above. In the former case, the PSC would attempt to alter the production mix of approved varieties marginally in the directions suggested by the survey. In the latter case, production would be shifted more radically to varieties expected to increase in area, particularly those with little area so far. On the other hand Bwp-79, which is likely to be withdrawn from the recommended list soon, would be excepted from this shift.

Sixty-seven percent of the farmers in the PSC sample liked the existing packing size of the 90 kg bag. About 21 percent and 12 percent of the sampled farmers favored 40 kg and 80 kg, respectively. However this may reflect the fact that, at present, seed of new varieties initially reaches smaller farms through larger farmers, who plant larger areas (Tetlay, et al., 1987b). Smaller farmers may be willing to experiment with smaller amounts of seed, as evidenced by the success of the field day program organized jointly by extension and seed corporations in the Indian Punjab. At these field days five kg packets of seed of new varieties are sold to farmers along with a set of instructions for planting and management (PARC, 1987).

Most of the farmers (about 93 percent) indicated their preference for treated seed. Seed treatment (e.g. Vitavax for smut) may increase the relative profitability of PSC seed compared with own seed. On the other hand, many farmers are illiterate and there are dangers of poisoning. One necessary precaution is treatment that leaves the seed different in color from grain.

About 50 percent of the farmers indicated radio as the most effective medium to educate farmers about various aspects of seed

use. This information was obtained partly from the response of farmers to a question presenting radio, television, newspapers, or pamphlets as the most effective sales promotion medium. In another survey, with open ended questions, 71 and 77 percent of all sampled farmers in rice and cotton growing zones reported "other farmers" as the main source of information about new wheat technologies. In the two zones, 70 and 48 percent, respectively, of the farmers growing new varieties reported other farmers as their major source of information about the new seed. Extension was the second most mentioned source and radio was only noted by about 10 percent of the farmers. On the other hand, a multivariate analysis of the same data shows a significant relationship between listening to agricultural programmes on the radio and awareness of new varieties in the rice zone (Tetlay, et al., 1987b). Taken together, these results may indicate that radio is the most effective of the "modern" dissemination media, but personal contact is still by far the most important way knowledge about farming technology, in particular seed use, reaches the majority of farmers.

6. POLICY IMPLICATIONS

6.1 Scope for Improvement

The description and analysis of this paper have shown that PSC has made positive changes in the system of multiplying and distributing improved wheat seed. Nonetheless, there is ample room for further improvement. In absolute volume of seed produced and distributed, PSC presently achieves about 70 percent of the planned targets. More telling, perhaps, is the fact that new varieties do not seem to reach farmers' fields at a rapid enough rate.

PSC has, in many regards, achieved the ability to produce the amount of seed planned. The major constraints appear to be less in the physical capacity of the PSC (although there are improvements that can be made in seed multiplication) than in the perceived or actual ability of the corporation to market its product. Actually, the problems of production and marketing are related, since part of the marketing problem is choosing which varieties to multiply and sell. Policy implications and alternatives are discussed below, beginning with marketing, moving to production planning, and finishing with specific production and multiplication issues.

6.2. Marketing System

Although the PSC distribution network has expanded quite rapidly

in the recent past, it is not very well organized or effectively coordinated. The PSC does not have sufficient marketing staff that can supervise sales operations effectively. In the case of wheat seed, PSC relies upon the distribution network of PAD&SC, which has not established itself as an effective seed marketing institution. Private dealers do not find it profitable to sell wheat seed. All these factors necessitate the development of a well-coordinated, integrated, and expanded marketing system.

6.2.1 Economic Incentives to Final Agents

The commission presently paid to dealers is only 4.5 percent of the price of seed, while private dealers make about 18 percent on the sale of fertilizer. Furthermore, private dealers contracting with the PAD&SC receive less than private dealers contracting directly with PSC. Also, the sale of seed on a "cash and carry" basis restricts many dealers from lifting more seed as they do not want to block their working capital in a business where the rate of return is very low.

All private dealers handling seed should receive the same rate of commission. In the intermediate to longer run, the option of phasing PAD&SC out of the seed distribution business altogether should be seriously considered, since to date it has only attempted to increase seed movement by tying it to the sale of its major product, fertilizer, without recognizing or attempting to solve the special problems of seed marketing. Under this alternative, some PAD&SC staff could perhaps be absorbed into an expanded marketing wing.

Second, PSC should attract private dealers by offering them a much higher rate of commission, more in line with fertilizer commissions or the 20 percent recommended by the ICD (1987). One option would be a two-tiered system in which farmers would have the choice of buying at centrally located PSC or PAD&SC depots at prices close to the current ones, or from local dealers at higher prices, reflecting the higher commission. In this system, PSC could discontinue the present lifting back of unsold stocks; the dealer would bear the risk in exchange for the increased return. This would give dealers additional incentives for sales promotion. Whether or not PSC continues lifting back unsold stocks, the original supply schedule should be planned more carefully.

Finally, PSC could relax the "cash and carry" condition to some extent and supply the seed to dealers against assured legal guarantees.

6.2.2 Seed Pricing and PSC Costs

Greater incentives to private dealers and more expenditures on marketing are likely to increase the end price of seed to the farmer. To avoid higher than necessary increases in the price of seed, PSC should monitor its own costs more closely. As a quasi-public monopoly, it does not always have an incentive to do this. One step that should be taken is a more accurate description and accounting of PSC costs. For example, transportation costs do not appear to have been recorded accurately, and there is some confusion over the distinction between "corporation margin" and "corporation overheads."

One immediate action should be the elimination of octroi charges on transported seed. There is little justification for tariffs on seed when no octroi is charged on other inputs and very little is charged on grain. PSC should persuade the relevant government institutions not to levy charges on wheat seed.

6.2.3 Package Size and Sales Promotion

PSC appears to be satisfying its current customers--generally larger farmers--by selling seed in 90 kg bags. The success of the mini-pack program in India, in which seed corporations and extension services cooperate in selling 5 kg packets of seed of new varieties, suggests that smaller farmers are keen to experiment with new seed. PSC should consider selling small (5 or 10 kg) packages as a sales promotion device, at a higher price to cover the additional marketing costs. Packaging could also be chosen to help differentiate the PSC's product and make selling of adulterated seed less likely.

6.2.4 Consumer Protection

According to the available evidence, farmers are generally satisfied with the quality of PSC seed. At the same time, there have been complaints that some influential registered growers persuade the staff of the FSCD to declare their crops "certified" or "approved". Seed certification standards could be enforced more strictly through random testing by the senior staff of FSCD.

At the retail level, seed certification laws do not perform all the necessary functions of consumer protection. ICD (1987), for example, propose a "truth in labelling" requirement for germination and purity for all seed moving through commercial channels, to be monitored by both federal and provincial governments.

6.2.5 Inter-Wing Coordination

Under the existing marketing system, seed supplies are often delayed because of the lack of coordination among different wings of the corporation. Therefore, efforts should be made to improve the inter-wing coordination of PSC so that seed supplies are ensured to dealers at the right time, in the required quantities, and of the right varieties.

6.2.6 Market Research

Market research on issues such as consumers' preference, product performance, market structure and system efficiency serves as an important base for the development of future production and distribution plans. Presently, no such information is collected regularly. Also, PSC lacks the analytical capabilities to search through the facts and relationships pertaining to various marketing problems. This underscores the need to establish a strong marketing research unit capable of generating information and analyzing marketing problems on a regular basis.

6.3 Production Planning

There is an overall lack of coordination among institutions associated with the policy formulation and actual implementation of seed production programs. Morevoer, the seed production policy lacks long term planning. These factors not only result in the fixation of unrealistic seed production targets, but also disturb the whole seed multiplication process. Since it presently takes three to four years to introduce a new variety, seed production policy should be planned and implemented accordingly.

6.3.1 Streamlined Varietal Testing

Pre-release varietal testing should be aimed at developing information regarding the variety's commercial acceptability as well as its yield, disease resistance, and environmental adaptability. These aims could be achieved more easily if provincial microplots and National Uniform Wheat Yield Trials (NUWYT's) were planted at the same time (PARC 1987). The former could be aimed at obtaining farmer evaluation, while the latter would be planted at strategically chosen locations and times to make possible a statistically sound analysis of the genetic characteristics and adaptability of different varieties.

6.3.2 Pre-Release Multiplication

It has been seen that PSC has developed the Foundation Seed Cell program because research institutes could not provide necessary quantities of pre-basic seed. Nonetheless there appears to be some scope for breeders to demonstrate their own confidence in their varieties by multiplying seed of the strongest candidates in advance of release. This seems to have happened with Pb-81, and, as a result, this variety initially spread more quickly than others.

6.3.3 Coordination Between PSC, VEC and FCA

Views of the PSC should be taken into account when approved varieties are chosen and when varietal targets are set for procurement. Therefore, seed corporation representatives should have observer status at meetings of the wheat Varietal Evaluation Committee (VEC), which decides which varieties should be approved for the coming year. The PSC should have voting membership in FCA (Federal Committee on Agriculture) meetings which set seed procurement targets.

6.4 Improved Production

Actual physical capacity to multiply seed has been seen to be the least binding of PSC's current constraints. Nonetheless, there are a number of areas in which PSC's production and processing could be improved.

6.4.1 Improved Multiplication Ratios

Multiplication ratios from pre-basic to basic seed, and from basic to certified seed, vary widely from year to year. In the case of very high ratios PSC may, for example, be procuring certified seed from farmers who are not necessarily growing it from PSC basic seed. This should not be discouraged, since if seed meets certification standards its origin makes little difference. Low ratios are another matter. These indicate either higher than necessary seed rates at planting, or diversion of some seed at the various stages. The former could be rather easily corrected by changing the recommended agronomic practices for seed production. The latter possibility may require a review of existing standards at each level of seed multiplication, and relaxation if necessary. Having a large amount of seed of 97 percent purity is better than having very little that is 100 percent pure seed.

6.4.2 Out-of-Season Seed Increase

PSC should consider the possibility of increasing wheat seed out of season in highland areas elsewhere in Pakistan. This would probably require federal government action as well as initiative by the PSC. Furthermore, small farm sizes in highland areas could prove problematic. Nonetheless, such a step in the early stages of multiplication could hasten the process.

6.4.3 Location of Seed Production Farms

In order to produce seed of varieties suitable for different cropping zones, as well as to improve marketing, seed farms should be diversified to more locations within the province. PSC requires farm land in more areas for the production of pre-basic and basic seed; it could also seek out registered growers over a wider area. It appears that the initial decision to concentrate seed production and processing in a few sites was erroneous; however, given the initial investment, it is unlikely major restructuring will occur in the near future. Nonetheless, some obvious steps could be taken now. Since PSC is in the process of installing a seed processing plant at R. Y. Khan, it is important that PSC have a seed farm at this site.

6.4.4 Seed Processing

It is now almost 10 years since the Seed Industry Project was started, yet not all the planned seed processing plants have been installed. If they are still only in the planning stages, smaller, more decentralized processing should be considered. Otherwise PSC should make strenuous efforts to install the proposed processing plants.

NOTES

1. "Banned" varieties are those that have been withdrawn from the recommended list, usually because of susceptibility to disease (Heisey, et al., 1987).

2. A seed industry is the entire complex of organizations, institutions and individuals associated with the seed program of a country; the commercial seed industry includes those individuals, seed enterprises, and marketing groups involved in producing and marketing seed for sale to consumers (Douglas, 1980).

3. Much of this section draws upon the information contained in "Appraisal of the Seed Industry Project", World Bank, 1976.

4. Various assumptions made in the project report regarding the production of pre-basic seed are as follows: (i) area under high yielding varieties (HYVs) is not expected to expand significantly since this already occupies about 90 percent of the irrigated areas and 50D60 percent of the rainfed areas; (ii) HYVs use in rainfed areas is not expected to increase much because the HYVs material available is not suitable for areas of marginal growing conditions; (iii) the cash demand is 75 percent of the HYVs area because smaller and poorer farmers would continue to obtain seed on a farmer to farmer exchange basis; and (iv) rate of seed renewal is 5 years. This implies, very roughly, a certified seed requirement of approximately 70,000 tons per year for the Punjab, assuming present areas and seed rates in addition to the above assumptions. Pre-basic seed requirements could then be calculated using assumed multiplication ratios. These ratios will be discussed below in the main text.

5. At present, only the Khanewal plant is operating.

6. The original PC-I Form was prepared in 1977. This was revised in 1982 and again revised in 1983.

7. "Indirect sources" refers to those farmers to whom basic seed was not issued for contract multiplication. However, seed they produced was procured since it met the specified seed certification standards.

8. Ministry of Food and Agriculture (MINFA); Pakistan Agricultural Research Council (PARC).

9. The PSC survey noted above in the text concluded that 75 percent of the sampled farmers who did not use improved seed did not do so because they felt its price was very high. The PERI survey indicated that 30 percent of the sampled farmers felt the price of PSC seed was too high.

10 This hypothesis is developed on the basis of many discussions held with the farmers, agronomists and staff of the seed production wing of the PSC.

11. In the dynamic context it is amusing to note that in a world where all of its assumptions held exactly, and it were assumed that farmers would change varieties every 5 years, the long-run expected value of the percentage of farmers saying improved seed prices were "too high" would be 80 percent!

12. Sale of: (i) Kachra grade 1 @ Rs.1.61 per Kg (output = 5.0% of quantity processed); (ii) Kachra grade 2 @ Rs.0.98 per Kg (output = 2.5% of quantity processed); (iii) Kundi @ Rs.0.60 per Kg (output = 1.8% of quantity processed).

13. This suggests that the PSC sample may have over-represented large farmers and/or farmers who are changing their variety to Pak 81.

14. Thus the farmers in the PSC sample appear to be slightly ahead of Punjab wheat farmers in general.

ARI = Research Institute
PSC = Punjab Seed Corporation Farms
TOT = Total

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APPENDIX A

Seed Production and Distribution Statistics

Table A.1. Variety-Wise Pre-Basic Seed Production on Research Institutes and PSC Farms
(Figures in Tons)

Varieties	Source	Years									
		1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
PUNJAB 76	RI	1.12	2.24	-	-	-	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	1.12	2.24	-	-	-	-	-	-	-	-
CHENAB 70	RI	.74	-	.56	-	-	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	.74	-	.56	-	-	-	-	-	-	-
SA 75	RI	.74	1.49	1.22	.20	.20	-	-	-	-	-
	PSC	-	-	-	-	.56	-	-	-	-	-
	TOT	.74	1.49	1.22	.20	.76	-	-	-	-	-
SANDAL	RI	.15	.56	4.47	1.14	.40	.45	.10	.10	.10	.05
	PSC	-	-	-	-	.54	.53	-	2.27	3.43	3.66
	TOT	.15	.56	4.47	1.14	.94	.98	.10	2.37	3.53	3.71
Bb ON	RI	.03	-	-	-	-	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	.03	-	-	-	-	-	-	-	-	-
PARI 73	RI	-	.56	1.10	1.30	.25	-	.25	.20	.10	.15
	PSC	-	-	-	-	.72	.53	.22	2.27	3.70	4.99
	TOT	-	.56	1.10	1.30	.97	.53	.47	2.47	3.80	5.14
LYP 73	RI	-	.37	4.77	1.00	.45	.30	.46	.10	.10	.15
	PSC	-	-	-	-	.45	.19	.26	2.76	3.39	3.74
	TOT	-	.37	4.77	1.00	.90	.49	.72	2.86	3.49	3.89
SANORA/V 1287	RI	-	.09	5.60	.30	-	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	.09	5.60	.30	-	-	-	-	-	-
POTHOWAR	RI	-	.37	-	-	-	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	.37	-	-	-	-	-	-	-	-
PI MAZO/PK 2858	RI	-	.15	-	-	-	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	.15	-	-	-	-	-	-	-	-

Varieties	Source	Years									
		1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
BLUE SLIVER	RI	-	.02	-	.03	.25	.07	.45	.07	.15	-
	PSC	-	-	-	-	-	.39	1.21	15.30	45.36	77.85
	TOT	-	.02	-	.03	.25	.46	1.66	15.37	45.51	77.85
LU 26	RI	-	.07	1.86	1.85	1.55	1.07	.40	.30	.40	-
	PSC	-	-	-	-	.61	.08	-	1.75	3.09	4.04
	TOT	-	.07	1.86	1.85	2.16	1.15	.40	2.05	3.49	4.05
INDUS 79	RI	-	-	-	.30	.10	.40	.20	-	-	-
	PSC	-	-	-	-	-	.28	.18	-	-	-
	TOT	-	-	-	.30	.10	.68	.38	-	-	-
WL 711	RI	-	-	-	.04	.10	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	.04	.10	-	-	-	-	-
BWP 79	RI	-	-	-	.10	-	-	-	.10	.10	-
	PSC	-	-	-	-	-	.40	.24	1.38	3.13	4.44
	TOT	-	-	-	.10	-	.40	.24	1.48	3.23	4.44
BARANI 79	RI	-	-	-	.15	-	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	.15	-	-	-	-	-	-
YECORA	RI	-	-	-	-	.20	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	.20	-	-	-	-	-
ARZ	RI	-	-	-	-	.20	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	.20	-	-	-	-	-
NOORI	RI	-	-	-	-	.20	-	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	.20	-	-	-	-	-
PUNJAB 81	RI	-	-	-	-	.40	.92	1.01	.10	.15	.40
	PSC	-	-	-	-	.32	.41	.40	2.14	13.78	17.07
	TOT	-	-	-	-	.72	1.33	1.41	2.24	13.93	17.47
K 342	RI	-	-	-	-	.16	-	-	.10	.10	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	.16	-	-	.10	.10	-

Varieties	Source	Years									
		1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
HD 2009	RI	-	-	-	-	-	-	-	-	-	-
	PSC	-	-	-	-	.20	-	-	-	-	-
	TOT	-	-	-	-	.20	-	-	-	-	-
PAVON	RI	-	-	-	-	-	-	-	-	-	-
	PSC	-	-	-	-	.22	-	-	-	-	-
	TOT	-	-	-	-	.22	-	-	-	-	-
CHENAB 79	RI	-	-	-	.40	.20	.50	.40	-	-	-
	PSC	-	-	-	-	-	-	.41	-	-	-
	TOT	-	-	-	.40	.20	.50	.81	-	-	-
PAK 81	RI	-	-	-	-	-	8.52	1.01	.10	.50	.60
	PSC	-	-	-	-	-	-	-	2.44	35.92	35.19
	TOT	-	-	-	-	-	85.20	1.01	2.54	36.42	35.79
P 94	RI	-	-	-	-	-	.09	-	-	-	-
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	-	.09	-	-	-	-
KOHINOOR 83	RI	-	-	-	-	-	-	-	-	.30	.40
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	-	-	-	-	.30	.40
FAISALABAD 83	RI	-	-	-	-	-	-	-	-	.40	.45
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	-	-	-	-	.40	.45
WADANIK 85	RI	-	-	-	-	-	-	-	-	-	.20
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	-	-	-	-	-	.20
BARANI 83	RI	-	-	-	-	-	-	-	-	-	.10
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	-	-	-	-	-	.10
PB 85	RI	-	-	-	-	-	-	-	-	-	.07
	PSC	-	-	-	-	-	-	-	-	-	-
	TOT	-	-	-	-	-	-	-	-	-	.07
GRAND TOTAL	RI	2.79	5.93	19.59	6.81	4.66	12.33	4.28	1.17	2.40	2.57
	PSC	-	-	-	-	3.64	2.82	2.94	30.32	111.81	150.99
	TOT	2.79	5.93	19.59	6.81	8.30	15.15	7.22	31.49	114.21	153.56

Table A.2. Variety-Wise Basic Wheat Seed Production on PSC Farms
(Figures in Tons)

Varieties	Years									
	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
PUNJAB-76	85.6	73.9	-	-	-	-	-	-	-	-
CHENAB-70	55.0	-	29.0	-	-	-	-	-	-	-
SA-75	32.4	36.8	48.7	7.7	24.0	-	-	-	-	-
SANDAL	6.7	30.1	257.3	116.8	38.4	10.2	3.5	19.7	84.5	1.5
Bb ON	3.2	-	-	-	-	-	-	-	-	-
PARI-73	-	63.5	61.8	92.5	33.8	25.9	21.2	83.9	45.1	6.7
LYP-73	-	31.8	303.1	55.4	21.1	18.1	22.9	49.3	70.6	10.2
SANORA/V 1287	-	10.1	167.5	22.2	-	-	-	-	-	-
POTHOWAR	-	22.3	-	-	-	-	-	-	-	-
PI MAZO/PK 2858	-	13.7	-	-	-	-	-	-	-	-
BLUE SILVER	-	1.5	-	3.5	10.2	11.1	32.7	22.9	807.0	546.0
LU-26	-	6.9	123.2	87.7	89.4	41.7	11.4	67.1	21.9	7.6
INDUS-79	-	-	-	19.1	2.0	14.6	-	-	-	-
WL-711	-	-	-	4.0	6.8	-	-	-	-	-
BWP-79	-	-	-	6.1	-	7.9	6.4	15.4	53.8	25.9
BARANI-79	-	-	-	7.0	-	-	-	-	-	-
YECORA	-	-	-	-	10.7	-	-	-	-	-
ARZ	-	-	-	-	10.7	-	-	-	-	-
NOORI	-	-	-	-	5.3	-	-	-	-	-
PUNJAB-81	-	-	-	-	31.9	52.5	53.8	85.7	160.0	326.9
K-342	-	-	-	-	5.5	-	-	3.9	4.0	-
HD-2009	-	-	-	-	10.9	-	-	-	-	-
PAVON	-	-	-	-	5.0	-	-	-	-	-
CHENAB-79	-	-	-	33.8	7.2	21.7	-	-	-	-
PAK-81	-	-	-	-	-	402.0	49.6	87.8	1291.9	865.7
P-94	-	-	-	-	-	3.2	-	-	-	-
KOHINOOR-83	-	-	-	-	-	-	-	-	15.5	13.0
FAISALABAD-83	-	-	-	-	-	-	-	-	14.6	18.0
WADANIK-85	-	-	-	-	-	-	-	-	-	5.3
BARANI-83	-	-	-	-	-	-	-	-	-	3.1
PB-85	-	-	-	-	-	-	-	-	-	4.2
GRAND TOTAL	182.9	290.6	990.6	455.8	312.9	609.6	201.5	435.7	2569.0	1834.1

Table A.3 District-Wise Sale of Wheat Seed in Punjab
(Figures in Tons)

District	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
Attock	-	166.68	215.55	401.94	667.71	796.23	611.46
Rawalpindi	-	221.04	219.51	414.45	436.41	1301.22	1484.10
Chakwal	-	83.70	157.41	229.50	449.19	694.98	340.92
Jhelum							369.72
Gujrat	-	99.00	465.75	879.30	1218.06	1192.86	1315.35
Sialkot	47.70	91.53	279.27	774.54	1049.85	904.50	1169.10
G. Wala	129.60	140.85	628.11	1019.88	1498.41	1599.93	1796.22
Sh. Pura	121.50	152.01	800.64	1151.46	1191.96	1174.23	1400.40
Lahore	116.10	188.73	549.72	1217.97	1784.34	1213.65	1111.05
Kasur	55.80	89.73	308.79	522.09	589.23	622.80	691.65
Okara	-	-	-	1312.02	1255.14	1234.35	1099.44
Sahiwal	562.50	685.53	3157.47	4866.21	3753.27	5960.97	3704.40
Multan	2783.25	3312.63	4414.32	7547.04	8721.00	9772.11	1944.36
Vehari	208.80	366.75	1783.26	1332.63	1452.51	1469.70	1530.90
M.Garh	58.95	156.51	720.90	975.60	2061.72	1755.54	1658.70
Leiah	-	-	-	177.30	273.51	349.11	614.25
Rajanpur	-	-	-	205.65	432.45	912.15	877.68
D.G. Khan	58.77	74.25	546.75	444.24	855.45	923.40	1021.68
R.Y. Khan	-	459.90	1284.39	2614.14	4314.60	5101.65	3319.29
Bwp. Pur	-	187.56	377.10	1135.98	1630.71	1805.40	1629.36
Bwp. Nagar	-	112.95	421.20	847.53	651.78	994.05	1292.40
Fs. Abad	-	177.39	468.54	342.90	628.02	964.26	1210.95
T.T. Singh	-	-	-	262.80	523.44	670.50	1108.17
Jhang	-	119.07	338.85	645.75	979.20	1124.82	1545.48
Sargodha	-	189.18	857.07	1151.91	1360.44	1587.69	1577.43
Khushab	-	-	-	182.70	327.60	341.55	402.30
Mianwali	-	88.11	285.30	147.60	171.00	417.15	481.77
Bhakhar	-	-	-	124.56	290.25	305.10	401.40
Total	4142.97	7168.77	18279.81	30927.69	38574.90	45[illegible].45	39261.60
Other Prov.	-	2867.58	1317.96	2369.25	2535.48	2300.13	1703.52
Export.	-	16.02	15.03	19.98	-	1005.03	-
G. Total:	4142.97	10052.37	19612.80	33316.92	41101.38	48494.61	40965.12