PAKISTAN'S AGRICULTURE AN ENIGMA

While The Food Production Shortages Continue A Vast Potential For Expanded Food Production Remains Unexploited

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An adequate staple food supply is the first prerequisite, in any country, for social tranquility and economic stability. This in turn is necessary for the successful launching of economic development program, while an assured food supply is an absolute necessity for continued political independence.

Pakistan is blessed with a combination of geographical and climatological factors, which provide it with the potential for producing the food required to adequately feed its large and rapidly growing populations. At the same time it can become a large exporter of food, if this potential is transformed into reality.

Pakistan has the vast flood plain of the Indus, with deep soils, favorable topography and weather conditions that are excellent for crop growth throughout the year. It has the bountiful water resources of this famous river,

which have now largely been harnessed by dams and canals so that the water can be utilized effectively throughout the year to produce food, forage and fibre crops in a multiple cropping system. Moreover, the country is blessed with having farmers who are receptive to new ideas and methods whenever effective and appropriate new technology combined with favorable economic policy is made available to them. This was clearly indicated by the rapidity with which they adopted the new wheat and rice technology during the late 1960s.

Although considerable progress has been made in increasing food production in some crops, especially wheat and rice, during the past decade, this progress has slowed in recent years. In other important crops there has been little or no change in yield and total production clearly indicating the need for imaginative and creative research to develop appropriate high yielding technology.

Events of the past several years on the research, extension and agricultural policy fronts indicate that it is urgent for the government of Pakistan, in close collaboration with the provincial governments, to examine why agricultural research and production is again declining - or stagnanting - and take corrective action. The case of wheat production problems as indicated below indicates the magnitude and scope of the problems that must be solved to exploit the unutilized production potential.

1. CAPITALIZING ON PAKISTAN'S VAST UNDER-EXPLOITED WHEAT PRODUCTION POTENTIAL

Wheat is the most important food crop of Pakistan. On a tonnage basis it constitutes 60-62 percent of the total grain production. Consequently, wheat production is a good overall indicator of the progress of agricultural production. Since about 60% of the total population is directly involved in agriculture, changes in wheat yields and production provide an indirect insight into changes in rural standards of living and rural economic development.

During the middle 1960s, following several years of widespread experimentation on farms in Pakistan, new high yield wheat production technology was introduced into Pakistan. This new technology involved a package of improved practices:

i) the introduction and use of the high yielding Mexican dwarf disease resistant varieties;

ii) the use of chemical fertilizer;

iii) the introduction of improved cultural practices such as better levelling of land, better seed bed preparation, improvements in planting methods and in irrigation practices; and

iv) reorganization and revitalization of wheat research, production (extension) and training on an interdisciplinary basis throughout West Pakistan.

Once the package of improved technology was developed, it was linked to government economic policies which stimulated farmers to adopt the new technology and consequently increase production. This stimulatory economic policy included:

i) the establishment and announcement prior to the planting season of a realistic fair floor price - or procurement price - for grain for the next harvest;

ii) the assured availability of seed of the high yielding varieties and of fertilizer at the village level prior to the planting season; and

iii) the establishment of lines of government credit to stimulate the purchase of these inputs, especially by the smaller farmers.

The results of the wheat production program in the period from 1967-1970 were spectacular. Thousands of farmers, both large and small, enthusiastically adopted the new technology when they saw the large difference in yield between the traditional methods and the new technology demonstrated by research scientists and extension workers on either their own or neighbors' land. During this period faster progress was made in Pakistan toward increasing yield and production of wheat than any other country of the world. As a result, Pakistan wheat production increased spectacularly from 3.75 million metric tons in 1965 to 6.5, 7.1 and 8.94 million metric tons in 1968, 1969 and 1977 respectively. During the 1968-69 period Pakistan achieved self-sufficiency in wheat production. Nevertheless, Pakistan has not remained self-sufficient in wheat production for several reasons. Consumption of wheat has increased greatly, as the result of population growth and also, as the result of a modest increase in per capita consumption. Moreover, in the past five or six years, the effectiveness of the wheat research program, seed multiplication program and extension program has declined and government economic policy has not encouraged wheat production. As a result increases in production have slowed. The dynamic All-Pakistan Cooperative Wheat Research and Production Team, that operated effectively on both experimental stations and on farms across the entire West Wing has lost its cohesiveness, enthusiasm, flexibility of operation and, has been fragmented into four largely independent weaker provincial programs. All of the four provincial wheat research programs

have been further weakened by more bureaucratic regulations that have reduced their efficiency and destroyed the initiative of the research team.

Government services and policy as they relate to availability of fertilizer, seed of improved varieties and stimulatory prices for grain at harvest have not demonstrated the flexibility to meet changing conditions, as it did in the late 1960s. The result is the disenchantment of research and extension workers, along with a negative effect on the farmers.

The total effect of all of these shortcoming culminated in a poor 1978 wheat harvest. The 1977 wheat crop was approximately 8.94 million metric tons,* but the 1978 harvest fell by an estimated 15 to 20 percent to somewhere between 7.2 to 7.6 million metric tons. This reduction, according to unofficial government news' releases, will require an import of 2 to 2.2 million tons of wheat during the 1978-79 year at an estimated cost of 300 to 350 million dollars.

The weather conditions for wheat production during the 1977-78 rabi season were favorable, but the harvest was disappointing. The primary cause of the reduction in yield and production were a severe epidemic of leaf rust in the Punjab and Sind, and heavy yellow (stripe) rust in the north. Other factors such as damage from frost in the north and plantings made too late (after rice) contributed in a minor way to the poor crop. These losses could have been averted if the research, seed multiplication and extension programs had been functioning properly over the past several years. It was known since 1975, that there were widely distributed races of rust which were capable of

* Source: U.S.D.A. Foreign Agriculture Circular F.G. 19-77 December 20, 1977.

attacking the popular and widely grown varieties Chenab, Mexipak, Barani 70 and Pak 70. It was also known that Lyallpur 73 and Blue Silver were resistant to these and the older races of rust. However, since there was no effective organization for multiplying the seed of the newer varieties, e.g. Lyallpur 73 and Blue Silver, little seed of these varieties was available in the fall of 1977. As a result farmers continued to plant the older susceptible varieties. Widespread frequent rains and favorable temperatures for rust infection prevailed during February and March. As a result of these favorable conditions a severe rust epidemic developed with consequent reductions in production. There are some who claim that much of the reduction in yield was caused by high temperature at time of grain filling. This conclusion is untenable since similar weather conditions, also highly favorable for rust development, prevailed in India. However since the varieties grown there were resistant to rust there was no epidemic and a record crop was harvested.

2. PAKISTAN'S WHEAT NEEDS

It is estimated that Pakistan's wheat consumption, including seed, for the 1977-78 season (May 1977-April 1978) was approximately 10 million metric tons (127 kilos per capita as food). The 1977 population of Pakistan has been estimated unofficially at 74 million, and is said to be growing at a rate of 2.9% per year*. This being the case, Pakistan must increase its wheat production by approximately 310 thousand metric tons annually to maintain per capita consumption at the 1977-78 level. This assumes no "leakage" across the border into Afghanistan where the price of wheat grain in the market in May 1978 was

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* Source: Population Reference Bureau - 1977 World Population Data Sheet.

52% higher than in Multan. Recognizing the possibilities of some "leakage" the need for providing for a higher per capita consumption and the need for developing a buffer stock which would provide some protection against adverse weather and crop losses from other causes it is probably advisable to aim at expanding wheat production by a minimum of 350 to 400 thousand metric tons annually. Pakistan should establish a food grain reserve that can be fed into the market whenever needed in order to help to stabilize food prices for the consumers.

3. PAKISTAN'S WHEAT PRODUCTION POTENTIAL

With the proper implementation of the production technology now available, Pakistan has the potential to become self-sufficient in wheat production by the 1982 harvest, or conceivably even by the 1981 harvest. In the longer term - by 1990 - with a network of drainage ditches which will require large capital investments, it would have potential to become a sizable exporter of wheat.

These goals can be achieved without adversely affecting the production of other rabi crops. Rather, Pakistan has the potential to become self-sufficient in all food crops - cereals, oil seeds, pulses, tuber crops, sugar, fruits and vegetables - by 1990, if aggressive training, research, extension and production programs and drainage are developed to transform this potential into reality.

4. THE ESTABLISHMENT OF SHORT TERM WHEAT PRODUCTION TARGETS AND THE ACTION NEEDED TO ACHIEVE THESE TARGETS

Pakistan is currently importing approximately two million tons of wheat at a probable cost of 300-350 million dollars, to meet its food needs. This is regretable considering that it has the unexploited potential to produce this grain within its borders had appropriate agricultural policy, research and extension been pursued and applied over the past several years.

For too long Pakistan has neglected the investments and the application of available improved technology that could have made it self-sufficient in wheat production. One of the principal causes that has led to this dilemma has been the continued shortsighted reliance upon food aid and concessional purchases of wheat (under PL 480 and other similar easy payment types of contracts) from friendly countries. This policy has been pursued while largely neglecting the expansion of its own production. It appears to us - long time friends of Pakistan - that the time has come for Pakistan to discard the "crutch" of concessional food purchases, as soon as possible, and develop the unexploited capacity to become self sufficient in wheat and all other basic food production as rapidly as possible.

Unfortunately, the current wheat deficits can not be overcome within the next year or two. A "magic" high yield technology does not exist for such an increase. Certainly, every effort must be made to utilize widely the best technology now available in an allout effort to increase production rapidly, but without the unreliable and unpredictable blessing of unusually favorable weather during the next two rabi seasons the deficits can not be overcome.

Two serious obstacles limit the rapidity with which production can be changed, namely, the availability of proper seed and fertilizer.

The first, and most serious, is shortage of seed of the rust resistant varieties Lyallpur 73 and Blue Silver. Although these varieties were released for distribution a number of years ago - there was no responsible, effective seed organization to multiply and distribute them widely to farmers. Consequently there is currently only a limited amount of seed of these varieties available for the forthcoming rabi plantings. Both of these varieties are resistant to the new races, as well as the older races, of leaf and stripe rust which caused serious reduction in yield in most other varieties during the 1977-78 season. Therefore as things now stand it will be necessary to again sow the vast majority of the 1978-79 rabi crop to varieties such as Chenab 70, Mexipak, Pak 70, SA 75, which were damaged by rust during the last season, and only smaller areas to the varieties Lyallpur, Blue Silver, Sandal, Noori, Yecora, PARI and LU 26. Consequently should weather during the forthcoming rabi season again be favorable for rust development - frequent winter rains combined with favorable temperature for the pathogen - there could again be serious losses from rust.

One grave weakness of the Pakistan wheat program is the absence of effective seed producers associations, companies or corporations. There is little point in investing money in large wheat breeding programs if there are no effective organizations to multiply and distribute the new varieties that are developed by the breeding program. At present under a World Bank loan to Pakistan, two seed corporations, one in the Punjab and the other in Sind, are being organized to meet this need. Unfortunately, it will be two years before

these organizations become fully functional. Meanwhile the wheat crop will remain largely vulnerable to attacks by rust if the weather is favorable for the pathogen.

The second major obstacle to the rapid expansion of wheat production is the recurring inadequate supply of both nitrogenous and phosphatic fertilizer within the country at time of planting. The situation at present is not clear and may be even worse than in other years. It is questionable whether the supply at village level can be corrected prior to planting season, because of an overload on the transport systems. The flooding of highways has slowed truck transportation.

If there are shortages of phosphatic fertilizer at time of sowing it will be particularly detrimental to plans for increasing wheat production, since this nutrient should be applied prior to or at time of planting for best results.

The shortage of fertilizer at the onset of planting is not a new obstacle. It is a recurring serious handicap and indicates the need to revise schedules for placing of purchase orders and advancing dates of delivery.

There are positive stimulatory effects obtained from establishing realistic production targets which will challenge farmers, extension workers, researchers and government planners and administrators. The establishment of such production targets can only be useful if they have the whole hearted administrative and budgetary support of all key levels of government.

In the following paragraphs the authors submit for consideration a number of production targets thought to be attainable if they are programmed and supported.

5. A. THE FIRST PRODUCTION TARGET

To achieve a production of 10 million metric tons in the 1980 harvest.

At first glance this appears to be a modest target of production increase, if one uses as a point of reference the record 8.9 million metric tons 1977 harvest. However, it is indeed a large increase over the poor 1978 harvest, which appears to have been between 7.2 to 7.6 million tons.

Were it not for the shortage of seed of rust resistant varieties e.g. Lyallpur 73, Blue Silver, it would be realistic to aim at achieving the 10 million ton target in the 1979 harvest. Recognizing that the rust susceptible varieties Chenab 70, Mexipak, Barani 70, Pak 70, etc. will constitute most of the commercial acreage in the 1978-79 rabi season, and the possibility exists that they will again suffer reduction in grain yield from rust if ecological conditions are favorable. Therefore it seems wiser to program for reaching the 10 million ton target in the 1980 harvest.

5. B. THE SELF-SUFFICIENCY TARGET

The target of self sufficiency in wheat by 1982 will require a production of approximately 12 million metric tons. If this target is to be achieved it will require the re-establishment of dynamic on-farm research

and extension programs to study, in detail, the present status of all major factors that currently limit yield and production.

In the 1965 to 1971 a dynamic on-farm wheat research and extension program was established and operated throughout the West Pakistan. It developed the high yield technology which successfully launched the so-called wheat revolution. Unfortunately, with the break-up of West Wing, into four provincial agricultural departments, coordination of the program was disrupted. Currently, it is believed that a number of factors that now limit yield and production were of little significance in the 1966-1971 period.

Consequently, during the next several years the ARC and provincial agricultural research institutes and universities must launch dynamic cooperative on-farm interdeciplinary research programs. These should develop new additional information to guide the extension and production programs in the years ahead. What needs to be done at this stage is to develop a package of practices that is relevant to current conditions.

I. Agronomy and Soils Under Irrigated Conditions

a) A better understanding of N:P ratio

b) Continuing examination of potassium needs

c) Micronutrient studies

d) Determine the best dates and rates of seeding for each of the Principal Varieties of each region

e) Studies of drainage on wheat yields in alkaline water logged soils versus non-drained plots in the same field

f) Weed control studies both cultural and chemical

g) Survey of farmers fields at harvest time to obtain data on differences in grain yield with different production in each region

h) Develop improved cultural practices for a rice-wheat cropping sequence.

II. Barani Agronomic and Soils Research

This area of research has had little attention in the past. Research must be launched to determine:

a) How to best conserve and best utilize the moisture that falls during the monsoon season via:

   i) Different tillage treatments

   ii) Methods of sowing

   iii) Rates of seeding

   iv) Dates of seeding

b) Best fertilizer treatments for barani conditions

c) Identify the best long season varieties for barani conditions.

III. Plant Breeding, On-farm Varietal Trials

a) Enlarge and strengthen the replicated regional variety yield test

b) Non-replicated screening nursery:

   This nursery should include promising new lines from all breeding programs to be evaluated for disease resistance.

IV. Plant Pathology

a) Intensification and exploration of the National Disease Screening Nursery

All promising lines from the breeding programs and international nurseries be included and tested at 10 or 12 locations for disease data. This data need to be integrated with yield data.

b) The Regional Disease and Insect Screening Nursery

The material in this nursery can be a valuable source of new combinations of genes for disease resistance.

c) Monitoring of Diseases in Commercial Fields

Monitoring of disease in commercial fields is absolutely necessary to identify at an early stage the appearance of new races of rust. The pathologist must use this information to identify lines from the breeding programs which are resistant to both new races as well as the older races. The information developed by the pathologist is of no value unless it is utilized effectively by the breeder to develop and opportunely release new resistant varieties. In the future there must be better cooperation between the plant pathologists and wheat breeders.

d) The Summer Nursery at Kaghan

This nursery can be a highly important mechanism for developing several epidemics of leaf and stem rust which could be of great value to assist the breeders in identifying lines with high levels of disease resistance. Unfortunately, bureaucratic administrative procedures have severely handicapped the operation of this valuable nursery in the past. This must be corrected promptly if the nursery is to play an effective role in protecting the Pakistani wheat crop.

5. C. MAINTAINING WHEAT SELF-SUFFICIENCY THROUGH 1990

The data in Table 1 indicate the production that will be necessary to achieve self-sufficiency in wheat production in 1982 and 1990 assuming two different levels of consumptions.

The data in Table 2, assuming a constant area of 6.27 million hectares sown to wheat indicate the yield increases that will be necessary to produce the different levels of production.

These projections indicate that the 1977 record yield of 1630 and 800 kilograms per hectare for irrigated and barani areas respectively, must be increased to 2750 and 1300 kilos per hectare by the year 1990 to produce the 13.8 to 15.8 million metric tons that will be required to feed the projected 1990 population of 105 million.

The increase in yields required to achieve this goal is a difficult undertaking. This challenge indicates the need for developing strong programs of on-farm research. It also requires that these improvements in technology be effectively transmitted to farmers through agressive extension programs if self-sufficiency is to be maintained. Moreover, it also points out the importance of yield and production stability ~~in striving~~ to avoid severe losses from rust, as occurred in the 1977-78 crop, ~~must be avoided~~.

These projections do not take into consideration the possibilities of increasing the area cultivated to wheat. However, since there continues to be a need for increasing the production of winter grain legumes and forages, there is likely to be a growing shortage of land for rabi crops by 1990. Moreover, each year much land is lost to cultivation by water logging and salinity.

6. THE LONG TERM TARGET AND NEEDS FOR DEVELOPING A LARGE SCALE DRAINAGE SYSTEM FOR THE INDUS

Each time one flies over the Indus one cannot help but be appalled by the vast land area that has been removed from production by the relentless advance of the twin-headed monster of salinity and water logging. According to some reports every year several tens of thousands of additional hectares are being reduced in productivity or removed from cultivation by this monster. Although several studies have been made of this problem over the past two decades no decisive large scale program has been made to solve it. The problem continues to grow in intensity and magnitude and if ignored will destroy the agriculture of much of the Indus valley.

The only sizable programs that have been installed to recover land that was lost to water-logging and salinity was the S.C.A.R.P. # 1 and 2. Nevertheless the amount of land reclaimed by these projects were less than 2 million acres which is a small area compared to the total area needing drainage. Moreover the techniques used in S.C.A.R.P. # 1 and 2 are not feasible in vast areas where the subterranean water is highly saline.

Sooner or later the Government of Pakistan will have to come to grips with this enormous problem and invest in a vast network of horizantal drains. It cannot be solved by small projects initiated at local or provincial government level. The cost of installing such a network of drains will require enormous investments and will necessitate long term financing by international funding agencies.

In the past the Government of Pakistan has been primarily involved in building dams to provide more irrigation water to farms in the Indus basin with virtually no thought being given to either protecting the watershed above the reservoirs from silting or providing drainage in the irrigated land below the dams. It would seem that the time is now at hand to turn attention to drainage. Salinity and waterlogging destroyed the fertile irrigated areas of Mesopotamia thousands of years ago. To continue to ignore the problem in Pakistan will bring a similar fate to the Indus.

7. CAN PAKISTAN DEVELOP ITS AGRICULTURAL PRODUCTION POTENTIAL IN THE NEXT FIFTEEN YEARS?

We are convinced that Pakistan can transform its agricultural production potential into reality within the next fifteen years. To do so will require a firm commitment by all officials of both national and provincial governments. This will require large financial allocations and flexibility to use these funds. The bureaucratic red-tape which at the moment suffocates the system needs to be slashed. Finally, scientists, engineers, educators and politicians must lay aside their personal egos and biases and commit themselves as a team to attack and conquer the tremendous challenge that lies ahead.

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Table 1

Population Growth and Wheat Production Needs of Pakistan
For Two Rates of Consumption Over The Next Twelve Years

Year	Population* Millions	Production Needs (including seed) Millions of Metric Tons C O N S U M P T I O N 125 kg/Capita/Year	 145 kg/Capita/Year
1978	74	9.85	11.33
1982**	83	11.00	12.60
1990	105	13.8	15.80

* Source: Population Reference Bureau Data for 1977

1. Estimated Pakistan Population 1977 was 74 millions
2. Estimated Population Growth Rate 2.9%

**It is assumed that self-sufficiency in 1982 will require a production of about 12 million metric tons.

Table 2

Production Figures For Different Yield Levels of Irrigated and Barani Wheat Based on The 1977 Area of 6.4 Million Hectares*

Yield Levels Kg/Hectare		Production Million Metric Tons		Total
Irrigated	Barani	Irrigated	Barani	Million Metric Tons
1200	750	5.66	1.17	6.83
1500	850	7.08	1.33	8.31
2000	1000	9.44	1.57	11.01
2500	1150	11.80	1.80	13.60
2750	1300	12.94	2.04	14.98

* 1977 Pakistan Wheat Crop Data. Source: USDA Foreign Agriculture Circular FG 19-77 Dec. 1977.

	Area Millions Hectares	Production Millions Metric Tons	Yield Metric Tons/Hectare
Total Crop:	6.27	8.94	1.43
IRRIGATED (75% Area)	4.70	7.69	1.630
BARANI (25% Area)	1.57	1.25	0.800

PAKISTAN'S AGRICULTURE AN ENIGMA

Summary

1. Pakistan is not exploiting its total agricultural potential.

2. For the past few years wheat production has levelled and the 1977-78 season fell well below expectations mainly due to the sowing of rust susceptible varieties.

3. To meet the needs of its rapidly increasing population, Pakistan will need to produce 13.8 million metric tons of wheat by 1990. This will means yields of 2750 kg/ha and 1300 kg/ha on irrigated and barani land respectively.

4. To achieve these goals the following needs to be done:

   a) Development of rust resistant varieties.

   b) Effective organizations to multiply and distribute the new varieties.

   c) Timely supply of both nitrogenous and phosphatic fertilizers, and in proper proportions, at time of planting.

   d) The ARC and provincial agricultural research institutes and universities must launch dynamic on-farm research programs on both irrigated and barani lands. Better use has to be made of existing data from breeding and disease nurseries along with the monitoring of commercial fields to keep ahead of disease and to facilitate the opportune release of new varieties.

5. In the long term the twin-headed monster of salinity and waterlogging in the Indus valley has to be checked.

6. A firm commitment to agricultural production must be made at all government levels and bureaucratic red-tape in agriculture has to be slashed.