NOTE

FARMERS' AND BREEDERS' PERCEPTIONS OF WHEAT VARIETIES GROWN IN THREE MAJOR CROPPING SYSTEMS IN PAKISTAN

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Most farmers in Pakistan grow high-yielding varieties of wheat. The initial adoption of a high-yielding variety, however, does not imply the achievement of production stability over time. Attaining consistently high yields requires a steady stream of new cultivars, and as productivity rises, a growing amount of *maintenance research* must be devoted to sustaining yield increases. Maintenance research is the research required to assure that when yields begin to decline due to disease, insects, or other problems, replacement cultivars are available (7).

A major rust epidemic caused tremendous losses to Pakistan's wheat crop in 1978. In other years, disease also brings losses to the crop, with the economic effect varying with agro-climatic conditions, the amount of disease inoculum present, and the susceptibility of varieties planted. In 1985-86, scientists participating in the sixth annual Wheat Travelling Seminar estimated losses of over one million tons of wheat attributable to the use of disease prone varieties and mixed seed (6). Wheat breeders and extension workers in Pakistan will continue to face the challenge of developing and disseminating cultivars that are both high-yielding and resistant to rust and other diseases.

Policy makers, wheat breeders and plant pathologists can use information on wheat variety coverage to assess the impact of exposure of the wheat crop to disease. Knowledge about the area planted to individual wheat varieties contributes to the information base required to formulate policies affecting breeding, extension, and seed distribution programmes. At present, wheat varieties planted by farmers in Pakistan are not regularly monitored. National agricultural statistics report varieties planted by farmers as *high yielding* or *traditional*, based on farmer identification. As noted, most farmers in Pakistan grow the fertilizer-responsive semi-dwarf or dwarf wheats collectively known as high yielding. Many of these cultivars, however, have been banned nationwide, or in given agro-climatic zones, because of susceptibility to disease, although they continue to be grown. A simple identification of varieties as *high yielding* or *traditional*, even if correct, does little to assess the exposure of Pakistan's wheat crop to a rust epidemic or to indicate

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whether the achievements of breeding research are being transferred to farmers' fields.

This paper reports the results of an exercise in varietal identification carried out in 1985-86. It was not a sample survey intended to produce nationwide estimates of the relative areas planted to given varieties. Instead, a series of special studies were conducted in three important cropping systems in the irrigated wheat-growing areas of Pakistan — the rice-wheat and cotton-wheat tracts in the Punjab and the maize/sugarcane-wheat area of the NWFP. Estimates of the areas planted to various cultivars were based on two different methods. First, farmers were asked about the varieties they had planted and the area allocated to each variety. Second, wheat breeders travelled to a large number of wheat fields and identified varieties grown. This was done near to maturity to make identification more reliable. Besides providing estimates of varietal coverage in these cropping systems, this exercise also gave an indication of some of the problems likely to be faced in a large-scale monitoring effort.

Methods

Teams of agricultural economists and wheat breeders conducted the wheat varietal identification survey in two stages. The first stage took place in February and March, 1986. In this stage, agricultural economists from the Agricultural Economics Research Unit (PARC), Faisalabad, undertook a survey of area under different wheat varieties in the rice-wheat and cotton-wheat cropping systems of the Punjab. At the same time, agricultural economists from the Agricultural Economics Research Unit, Tarnab, Peshawar, conducted a similar survey in the maize/sugarcane-wheat cropping system in NWFP. Thirty villages in three adjacent tehsils were randomly selected, with probability of selection proportional to the size of village population, in both the rice-wheat and cotton-wheat areas. Similarly, twenty villages were randomly selected, with probability proportional to population, in the irrigated area of Mardan, NWFP. The survey teams asked from 10 to 40 farmers in each villages the wheat area that they had planted to different varieties in 1985-86. In total, 1281 farmers were interviewed. Results of these interviews are reported below as "farmers' perceptions" of varieties planted.

The second stage of the survey took place in April, 1986. Wheat breeders from Ayub Agricultural Research Institute, Faisalabad visited the same villages in the rice-wheat and cotton-wheat tracts in which the earlier survey was conducted. Similarly, wheat breeders from the Cereal Crops Research

Institute, Pirsabak, Nowshera, and from NWFP Agricultural University visited the same villages in the maize/sugarcane-wheat system covered by the survey of farmers. In this stage, the sampling unit was the wheat field. In each village, the breeders identified varieties planted in 25 to 70 fields. During this stage, the breeders identified varieties in a total of 3190 wheat fields. Results of this stage are reported below as "breeders' perceptions."

Details of the sample are summarized in Table 1. In this table, the Tehsils covered, the number of villages sampled, the number of farmers interviewed during the first stage, and the number of fields observed during the second stage, are recorded for each of the cropping systems in which the study was conducted.

Table 1. The Sample

Cropping System	District	Tehsil	Number of Sampled Villages	Number of Sampled Farmers	Number of Sampled Fields
Rice-Wheat	Sheikhupura Gujranwala Sialkot	Ferozwala Gujranwala Daska	30	438	955
Cotton-Wheat	Multan Vehari Bahawalpur	Lodhran Mailsi Bahawalpur	30	345	1252
Maize/Sugar-cane-Wheat	Mardan	Mardan Swabi	20	498	983
		TOTAL:	80	1281	3190

Results

For each of the three principal survey areas, varieties are classified as *new recommended, old recommended,* and *banned. Recommended* avarieties are those recommended for planting by wheat scientists under the auspices of Pakistan Agricultural Research Council; *banned* varieties are those that have been withdrawn from the recommended list, usually because of susceptibility to disease. *New recommended* varieties are those released in 1979 or

since; *old recommended* varieties those released before 1979. A variety may be classified differently depending on the survey area. A notable example is Punjab-81, which is listed as a *new recommended* variety in the cotton-wheat area, but which is categorized as *banned* in the other survey areas. This is because Punjab-81 is not recommended for planting north of Faisalabad district.

Results will be reported here in reverse order of the two survey stages; that is, estimates of varietal coverage based on breeders' perceptions will be presented first. Since it is assumed that breeders are more likely to identify varieties correctly than farmers. After presenting estimates based on breeders' perceptions and farmers' perceptions a brief comparison of the two estimates will be made.

a.   *Breeders' Perceptions of Varieties Planted*

Tables 2 and 3 summarize estimates of area planted to different varieties obtained from the breeders' survey. In addition to the three categories just defined, Table 2 also lists a fourth category, *mixed.* A mixed field is defined as one in which the breeders estimated that the dominant variety covered less than 70 per cent of the area of the field.

Table 2.   Wheat Varieties Planted: Breeders' Perceptions

Cropping System	Variety			
	New Re-commended	Old Re-commended	Banned	Mixed/others
	(Percent Area)			
Rice-Wheat	15.5	32.6	32.4	19.5
Cotton-Wheat	33.8	9.8	44.9	11.6
Maize/Sugarcane-Wheat	24.5	13.7	56.1	5.7

Table 2 shows that according to the breeders' survey, approximately 40 to 50 per cent of the wheat area in the sampled cropping systems was planted to recommended varieties. However, only one-sixth to one-third of the area was planted to new recommended varieties. Since many of the old

recommended varieties are disease-susceptible or declining in performance, the area under new recommended varieties may be taken as a better indictor of performance potential and the extent of disease resistance than the area under all recommended varieties.

Table 3 indicates prominent varieties grown in each of the three cropping systems, according to the breeders' survey. Varieties listed in this table are those that covered over 10 per cent of the surveyed area in the indicated cropping system.

There are several notable findings from the breeders' survey that are summarized in Table 3. Pak-81 is a new recommended variety that appears to have spread widely. Punjab-81 appears to be having its greatest success in the rice-wheat zone, in which it is not recommended. Notable, too, is the widespread planting of the banned variety WL-711 in cotton-wheat zone.

Table 3. Prominent Varieties (Over 10 percent of cropping system area): Breeders' Perceptions

Cropping System	Variety		
	New Re-commended	Old Re-commended	Banned
	(Percent Area)		
Rice-Wheat	Pak-81 15.5	Sandal 15.2	Punjab-81 14.0*
			WL-711 12.3
Cotton-Wheat	—	—	WL-711 44.6
Maize/Sugarcane - Wheat	Pak-81 24.1	—	WL-711 33.9
			SA-42 21.7

*Punjab-81 is not recommended north of Faisalabad district because of rust susceptibility.

b. *Farmers' Perceptions of Varieties Planted, 1985-86*

Table 4 summarizes the results of the survey of farmers. Varieities are classified as *new recommended, old recommended,* and *banned.* In addition,

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some farmers stated that they did not know the name of the variety which they had planted. The percentage of total wheat area falling into this category is also included in Table 4.

Table 4 shows that, according to the survey of farmers, one-fifth to one-fourth of the wheat area in the respective zones was planted to new recommended varieties. An additional one-sixth to one-fourth of the area was planted to old recommended varieties. Slightly under one-half of the wheat area in the rice-wheat and cotton-wheat zones was planted to banned or unknown varieties; in the maize/sugarcane-wheat zone this area was over 60 per cent.

Table 4. Wheat Varieties Planted: Farmers' Perceptions

Cropping System	Variety			
	New Re-commended	Old Re-commended	Banned	Don't Know
	(Percent area)			
Rice-Wheat	26.6[1]	25.9	33.6	13.9[1]
Cotton-Wheat	27.4[2]	24.3	36.9	11.4[2]
Maize/Sugarcane-Wheat	20.2	16.7	52.8	10.3

[1] If the wheat area of farmers who stated that their varieties were new, although they did not know the name, is included in the *new recommended* category, the area estimate for new recommended varieties in the rice-wheat tract becomes 31.3 percent.

[2] If the wheat area of farmers who stated that their varieties were new, although they did not know the name, is included in the *new recommended* category, the area estimate for new recommended varieties in the cotton-wheat tract becomes 31.3 percent.

. Table 5 summarizes major varieties grown in the three areas, according to the survey of farmers. Once again, a major variety is one estimated to cover 10 per cent or more of the total wheat area.

Table 5 shows that, as in the breeders' survey, Pak-81 is the most widely identified new recommended variety. According to the survey of

farmers, the old recommended, shorter maturity variety Blue Silver/Sonalika is widely grown in the two Punjab cropping systems, particularly in the cotton-wheat zone. Farmers in the cotton-wheat zone, as did the breeders, identified WL-711 as a major variety. Farmers in the NWFP maize/sugar-cane-wheat system, where the breedes reported a large area under WL-711, did not specify this variety. Instead they often stated that they were growing Mexipak.

Table 5. Prominent Varieites (Over 10 Percent of Cropping System Area): Farmers' Perceptions

Cropping System	Variety					
	New Recommended		Old Recommended		Banned	
	(Percent Area)					
Rice-Wheat	Pak-81	26.3	Blue Silver/ Sonalika	10.4	Punjab-81 Yecora	17.4[1] 10.5
Cotton-Wheat	Bahawal-pur-79	12.3	Blue Silver/ Sonalika	21.2	WL-711	37.2
Maize/Sugarcane Wheat	Pak-81	19.3	—		Mexipak SA-42	25.8 14.0

[1] Punjab-81 is not recommended for cultivation north of Faisalabad.

c. *Comparison of Breeders' and Farmers' Perceptions*

Some differences between the estimates resulting from the breeders' survey and the survey of farmers have just been noted. Whenever, there are differences, there are several possible explanations. One is that these differences are well within an acceptable range from the true percentage, given the fact that they originate in two separate samples. Another is that varieties are misidentified in one or the other survey. One possible reason for this might be that farmers do not know the names of varieties, perhaps because they obtain the seed under a different name. The wider the difference between the estimates from the two surveys, the more likely is that either misidentification or sampling problems have occurred.

There appears to be a difference in varietal identification in the two Punjab cropping systems when compared to identification in the NWFP cropping system. In the rice-wheat zone, the estimate of new recommended varieties from the survey of farmers is much larger than in the breeders' survey. In the cotton-wheat zone, the estimate of old recommended varieties from the survey of farmers is much larger than in the breeders survey. In both cropping systems, farmers identified the old recommended variety Blue Silver/Sonalika more frequently than the breeders. In contrast, in the maize/sugarcane-wheat zone the estimate of new recommended varieties are somewhat lower in the survey of farmers than in the breeders' survey. On the other hand, farmers in the NWFP sample often stated they were growing Mexipak, the original *Green Revolution* variety. *Maxipak* is also the generic name applied to semidwarf or dwarf wheats in Pakistan's grain marketing system.

It seems quite possible that farmers in the Punjab are more likely to be aware of the names of more recent wheat introductions, but that some wheat grown under these names is actually an older variety. Farmers in the NWFP sample are less aware of the names of recent varieties and often use *Mexipak* as a generic name for the Post-Green Revolution varieties.

Regardless of which survey results are used, and regardless of which cropping system is represented, the estimate of wheat area planted to banned, mixed, or unknown varieties ranges from nearly half the total area to over 60 percent. To the other side of the question, the largest area planted to new recommended varieties, regardless of survey or cropping system, is one-third. This confirms a widely held hypothesis — that the wheat crop in Pakistan is far too susceptible to a rust epidemic should one occur.

Conclusion

These studies have shown that in three major wheat cropping systems in Pakistan, two in Punjab and one in NWFP, the area under new recommended varieties appears to be increasing; but at far too slow a pace in relation to the constant evolution of rust races. More than half of the total wheat area is still planted to banned varieties or mixed seed.

Many hypotheses have been put forward to explain the slow rates of adoption. Some are related to a need for improvement in the research system; improvements in extension; and improvements in the seed distribu-

tion system. The first category includes two related hypotheses: that the release of rust resistant varieties has been too slow, especially since only some released varieties gain widespread acceptance by farmers; and that farmers find that newly released varieties inferior in important characteristics to currently popular varieties. The second set of hypotheses points to inadequate extension. Farmers may be unaware of the superior characteristics of newly released varieties or they may be unaware of the breakdown in rust resistance of currently planted varieties. In the final category are the hypotheses that seed depots are sparsely located and not easily accessible to many farmers, particularly small farmers; and that seed multiplication is inadequate or seed certification is too rigid to provide an adequate quantity of improved seed to wheat farmers.

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