

# Monitoring Wheat Varietal Diffusion in the Irrigated Sind: Results from 1988-89



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### **Abbreviations:**

AERU: Agricultural Economics Research Unit  
ARI: Agricultural Research Institute  
CIMMYT: International Maize and Wheat Improvement Centre.  
PARC: Pakistan Agricultural Research Council



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**MONITORING WHEAT VARIETAL DIFFUSION  
IN THE IRRIGATED SIND:  
RESULTS FROM 1988-89**

**Introduction**

The slow adoption of new wheat varieties and the presence of rust-susceptible varieties in farmers field is an issue of major concern to Pakistan (Heisey, 1988). Wheat scientists, seed institutions and extension agents in Pakistan are continuously working to develop and disseminate cultivars that are both high yielding and resistant to rust and other diseases. However, information on the extent of adoption of these wheat cultivars is not widely available. Regular wheat varietal monitoring is needed to access transfer of new technology and changes in varietal distribution with respect to cropping patterns and farm size. Estimates of the relative areas planted to different wheat varieties are also essential to alert wheat breeders, seed distributors and policy makers to potential losses from rust epidemics.

The objective of this study is to estimate areas planted to different wheat varieties, as reported by the farmers and confirmed by wheat breeders, in the irrigated Sind. The survey was undertaken in selected villages of Hyderabad, Sanghar, Nawabshah and Khairpur district, in the cotton-wheat cropping zone, and Larkana and Dadu districts in the rice-wheat cropping zone, for the 1988-89 wheat crop. These cropping patterns are the two most important cropping patterns for wheat in Sind. The magnitude of cultivation of banned and mixed varieties was determined. In addition, farmers' perceptions about the dissemination of information regarding recommended varieties were also recorded.

**Research Methods**

A multidisciplinary team of agricultural economists from the Agricultural Economics Research Unit (AERU), and wheat breeders from the Wheat Research Institute, Tandojam, undertook the wheat varietal identification survey during the final week of February and the first week of March 1989, when the crop had headed. Farmers were asked about the wheat area that they had planted under different varieties and the wheat breeder then identified the varieties in the fields of the farmers.

The sampled villages were randomly selected with the probability of selection proportional to the size of the village population. In the cotton zone, thirty villages were surveyed from eight talukas from selected districts. Tando Allahyar and Hala talukas were selected from Hyderabad district, Tando Adam and Sanghar talukas from Sanghar district, Naushero-Feroz and Nawabshah talukas from Nawabshah district, Faiz Gang and Kotdiji talukas from Khairpur district (Figure 1). For the rice zone, sixteen villages were surveyed from four talukas. Those surveyed were Dokri and Ratodero talukas from Larkana district and Mehar and Sehwan from Dadu district (Figure 2). Ten farmers were interviewed from each village to give a total sample size of 480 farmers. Table 1 shows the breakdown of sample farmers by cropping pattern and by districts. Farmers were further identified as small (less than 5 ha cultivated area), medium (5-10 ha) and large (more than 10 ha). For both cropping patterns, just over 50 percent of the sampled farmers were small and less than 20 percent were large (Table 2).

**Table 1. Farmers and wheat fields sampled in the cotton and rice zones of Sind, 1988-89**

Area (Districts)	Farmer		Fields	
	Number	Percent	Number	Percent
(Percent farmers)				
<b><u>Cotton Zone</u></b>				
Hyderabad	80	17	117	20
Sanghar	80	17	105	18
Nawabshah	80	17	98	16
Khairpur	80	16	91	15
<b>All</b>	<b>320</b>	<b>66</b>	<b>411</b>	<b>69</b>
<b><u>Rice Zone</u></b>				
Larkana	80	17	94	16
Dadu	80	17	93	15
<b>All</b>	<b>160</b>	<b>34</b>	<b>187</b>	<b>31</b>
<b>Both Zones:</b>	<b>480</b>	<b>100</b>	<b>598</b>	<b>100</b>

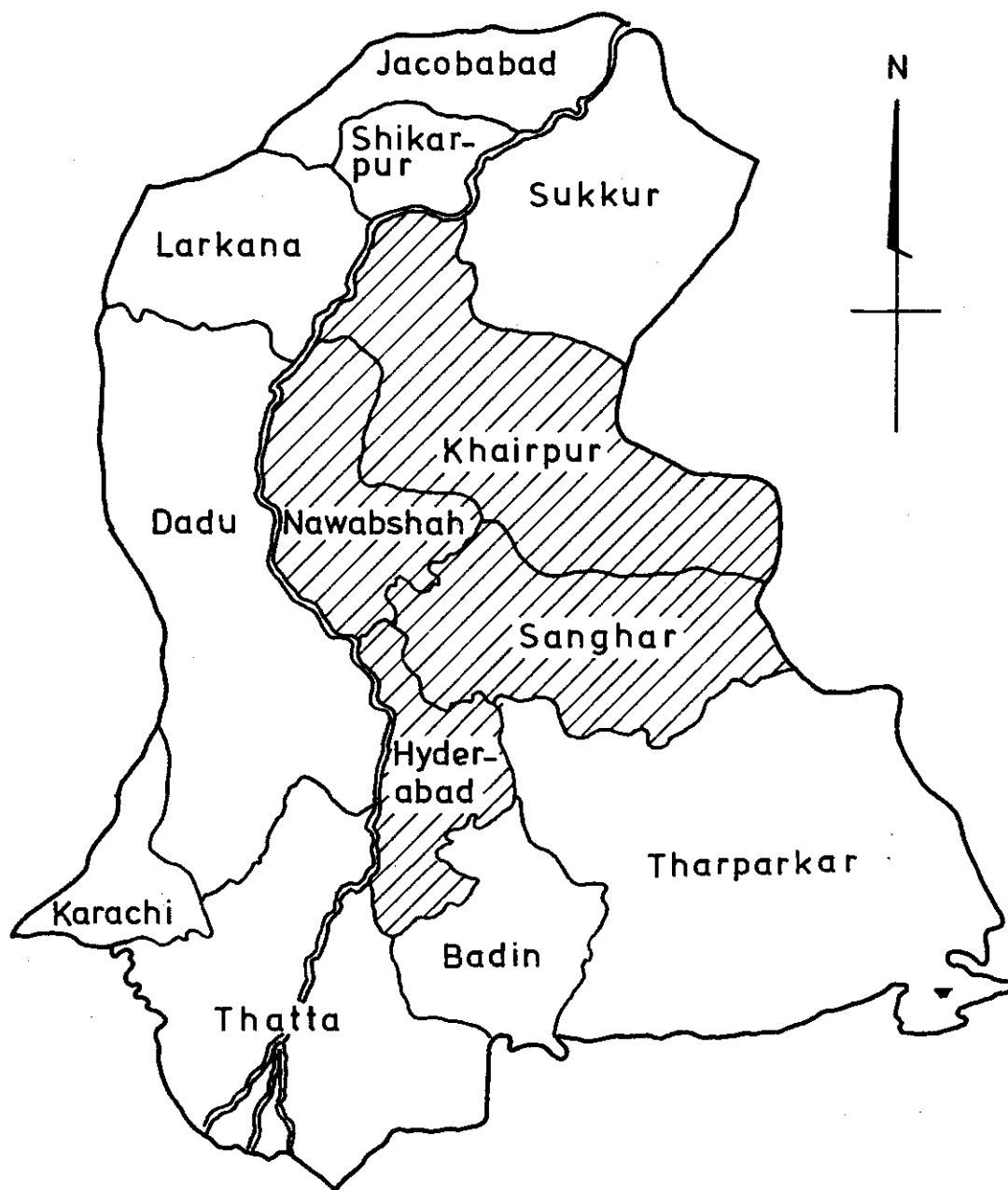


FIG.1. MAP SHOWING SURVEY AREA OF COTTON-WHEAT ZONE IN SINDH.



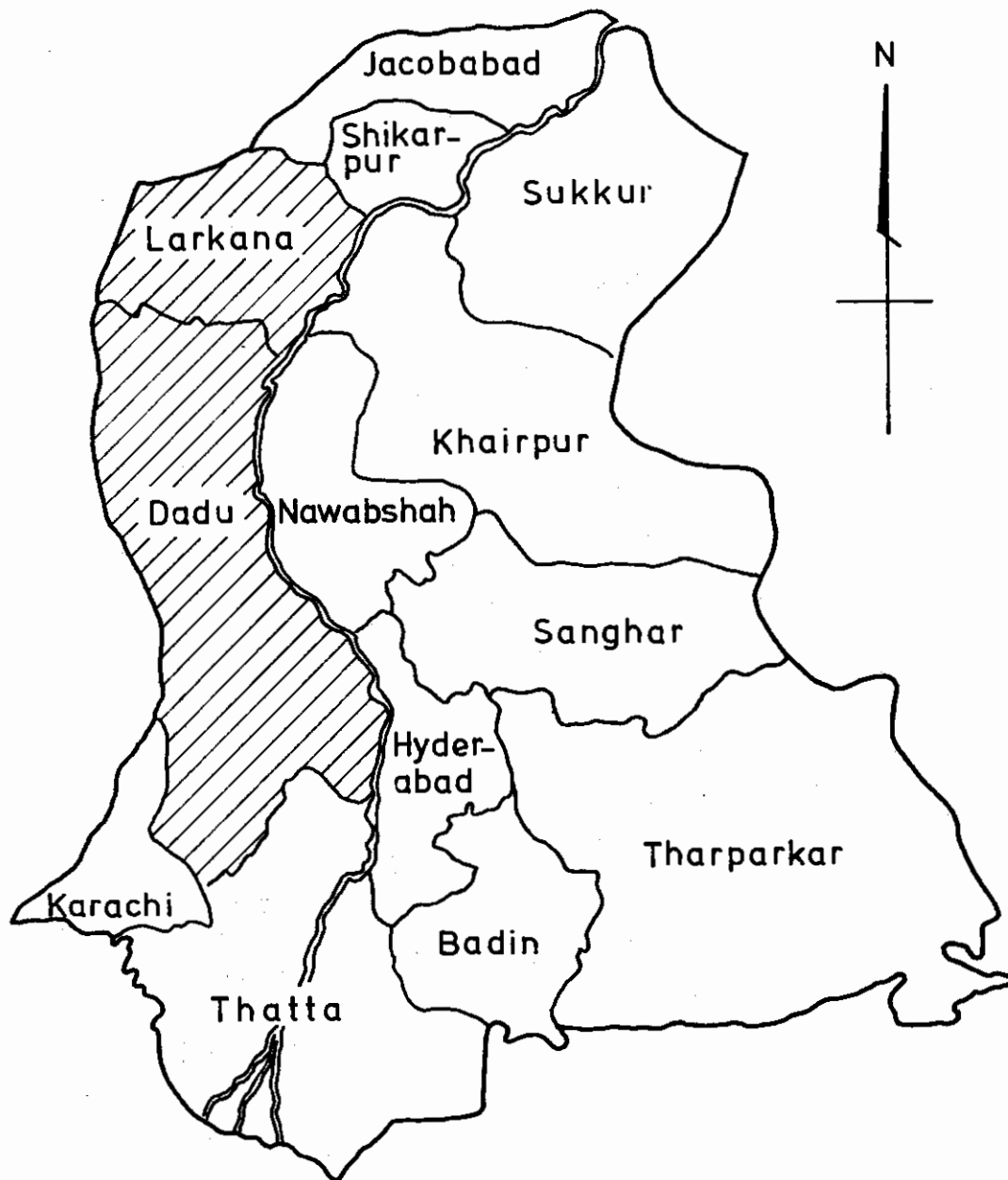


FIG.2. MAP SHOWING SURVEY AREA OF RICE - WHEAT ZONE IN SINDH

**Table 2. Percentage of sampled farmers by farm size in the cotton and rice zones of Sind, 1988-89**

Area (Districts)	Farm size		
	Small (< 5 ha)	Medium (5-10 ha)	Large (> 10 ha)
(Percent farmers)			
<b><u>Cotton Zone</u></b>			
Hyderabad	52	28	20
Sanghar	48	35	17
Nawabshah	52	29	19
Khairpur	50	26	24
<b>All</b>	<b>51</b>	<b>30</b>	<b>20</b>
<b><u>Rice Zone</u></b>			
Larkana	65	24	11
Dadu	50	34	16
<b>All</b>	<b>58</b>	<b>29</b>	<b>13</b>
<b>Both Zones:</b>	<b>52</b>	<b>29</b>	<b>19</b>

## Results and Discussion

### Farm Size and Number of Varieties Planted

Table 3 shows the wheat area by farm size. The average area under wheat for all farmers was 5.2 ha. Overall twelve different varieties were grown by the sampled farmers. An important issue is the number of wheat varieties planted by individual farmers. Some farmers plant more than one variety to accommodate different planting dates (Akhtar et al. 1986). About 27 percent of the large farmers planted more than two varieties while only 4 percent of the small farmers also planted more than two varieties.

**Table 3. Wheat area and number of varieties planted by farm size in cotton and rice zones of Sind, 1988-89**

Farm Size	Average wheat area (ha)	Number of varieties grown		
		One	Two	More than two
(Percent farmers)				
Small (< 5 ha)	1.7	67	29	4
Medium (5-10 ha)	3.0	57	28	15
Large (> 10 ha)	10.9	55	19	27
All	5.2	60	25	15

#### **Wheat Varietal Diffusion**

Tables 4 and 5 show wheat area planted under different varieties in cotton and rice zones. Almost 95 percent of the farmers were aware of the variety's name, and only 5 percent of farmers could not identify the variety. Mostly these were share farmers who obtained seed from their landlord. Pavon, Blue Silver/Sonalika, Yecora and WL-711 were the major varieties in the cotton zone, whereas Mexi-Pak, WL-711 and Pavon were the major varieties in the rice zone. 10, 51 and 29 percent of the wheat area was under new recommended, old recommended and banned varieties respectively. The high proportion of area under banned varieties (45 percent) was in district Nawabshah of the cotton zone.

The area under new recommended, old recommended and banned varieties in the rice zone was, 2, 28 and 49 percent, respectively. Larkana district had more than 50 percent area under banned varieties. A large area of the wheat planted was mixed, 21 percent.

**Table 4. Percent area planted under different wheat varieties in cotton and rice zone in Sind, 1988-89**

Category	Cotton zone	Rice zone
	(Percent area)	
<b><u>New recommended</u></b>		
Jauhar	0.8	-
TJ-83	5.1	0.7
Sind-81	2.0	1.0
Sarsabz	2.2	-
Total:	10.0	1.7
<b><u>Old but still recommended</u></b>		
Blue Silver/Sonalika	21.0	4.0
Pavon	27.5	16.7
ZA-77	2.3	7.8
Total:	50.8	28.5
<b><u>Banned</u></b>		
Mexi Pak	6.5	20.9
WL-711	10.4	10.0
Nuri	1.2	3.7
Yecora	11.3	4.1
Total	29.5	48.8
Mixed varieties:	9.4	21.0
Total:	100.0	100.0

**Table 5. Summary of the wheat varieties planted in cotton and rice zones in Sind, 1988-89**

Area (District)	Category of wheat variety			
	New recommended	Old recommended	Banned	Mixed
(Percent area)				
<b><u>Cotton zone</u></b>				
Hyderabad	12.6	73.2	5.7	8.5
Sanghar	13.1	50.3	18.6	18.0
Nawabshah	13.6	31.2	45.2	10.0
Khairpur	1.2	49.0	48.8	1.0
<b>All:</b>	<b>10.1</b>	<b>51.0</b>	<b>29.5</b>	<b>9.4</b>
<b><u>Rice zone</u></b>				
Larkana	3.3	24.1	50.6	22.0
Dadu	-	33.0	47.0	20.0
<b>All:</b>	<b>1.65</b>	<b>28.5</b>	<b>48.8</b>	<b>21.0</b>
<b>Both zones:</b>	<b>6.0</b>	<b>39.7</b>	<b>39.1</b>	<b>15.2</b>

#### **Wheat Varieties Planted by Farm Size**

Generally smaller farmers are slower to adopt new varieties. Table 6 shows wheat varieties planted by farm size. The area under new recommended varieties is greater with larger farmers and the area under banned varieties more with small farmers. One specific varietal difference was that Blue Silver/Sonalika was grown of 16 percent of small farmers and 12 percent of large farmers. This may be the result of the wide adaptability and performance of this varieties compared to other varieties, particular when planted late (Khushk et al. 1987). Although Blue Silver/Sonalika is rust susceptible and needs replacement, the national wheat varietal evaluation committee continue to recommended it as there is lack of replacement short duration varieties.

**Table 6. Wheat varieties planted by farm size in Sind, 1988-89**

Category of variety	Farm size		
	Small (< 5 ha)	Medium (5-10 ha)	Large (> 10 ha)
(Percent farmers)			
<b><u>New recommended</u></b>			
Jauhar	-	1.3	-
TJ-83	1.5	2.6	5.6
Sind-81	3.5	4.0	4.8
Sarsabz	1.8	1.3	5.1
<b><u>Old but still recommended</u></b>			
Blue Silver/Sonalika	16.3	20.1	11.5
Pavon	26.3	22.8	19.6
ZA-77	0.3	4.0	2.5
<b><u>Banned</u></b>			
Mexi Pak	11.2	9.0	6.5
WL-711	6.3	8.6	10.5
Nuri	18.6	12.5	11.3
Yecora	5.8	7.1	3.0
Mixed varieties:	9.1	8.0	6.0

#### **Farmers' Sources of Seed**

Agricultural scientists suggest that farmers should use pure, clean and disease free seed to obtain optimum yields. Farmers have a number of options available to them as regards seed sources i.e. own seed, other farmers, seed depots and village shops. Table 7 shows that about 75 percent of farmers used their own seed or obtained it from landlord. The second main source of seed was other farmers, while about 11-12 percent of sampled farmers purchased seed from depots or shops. Small farmers are unable to purchase certified seed in small quantities due to the unavailability of bags of less than 100 kg. from S.S.S.C. depots (Khushk et al. 1987).



**Table 7. Farmers' seed sources for wheat varieties planted in cotton and rice zones in Sind, 1988-89**

Seed source	Cotton zone	Rice zone
	(Percent farmers)	
Own	58	65
Landlord	15	9
Other farmer	12	13
Seed depot	5	3
Village shop	7	8
Research/Extension	3	2
<b>All:</b>	<b>100</b>	<b>100</b>

Farmers' wheat seed sources by varieties are presented in Table 8. For the cotton zone, a common pattern is visible. For older varieties more farmers are likely to use own retained seed. For example, more than 50 percent of the sampled farmers growing Pavon, Blue Silver, Nuri and mixed varieties used their own seed, respectively. However, for the newer varieties, i.e. Sind-81, TJ-83 and Sarsabz, less than 18 percent used own seed. Of the external sources of seed, other farmers are always most important, whatever variety planted.

In the rice zone, major varieties grown are Mexi-Pak, Nuri, Blue Silver and WL-711. Table 9 indicates that for the older varieties planted, Mexi-Pak, Nuri, Blue Silver and WL-711, farmers own seed was the most important. For newer varieties, Sind-81 and Pavon, the external seed sources are most important, especially other farmers and seed depots.

**Table 8. Percent area planted by different seed sources in cotton and rice zones in Sind, 1988-89**

Variety	Seed sources					
	Own	Other farmers	Seed depot	Village shop	Research extension	Land-lord
(Percent area)						
<b><u>Cotton zone</u></b>						
Pavon	55	15	8	2	5	15
Blue silver	52	16	5	13	-	14
Sind-81	8	37	21	-	14	20
TJ-83	18	28	24	-	20	10
Sarsabz	12	22	28	-	25	13
Mexi-Pak	53	24	-	12	-	12
WL-711	42	30	-	10	-	18
Yecora	39	31	3	12	-	15
Nuri	50	-	-	-	-	50
Mixed	60	6	5	14	-	15
<b><u>Rice zone</u></b>						
Pavon	35	20	12	12	6	15
Blue silver	40	24	-	23	-	13
ZA-77	36	12	-	22	-	30
Sind-81	15	40	30	-	8	7
Mexi-Pak	57	25	0	5	-	13
WL-711	40	20	-	10	-	30
Nuri	60	20	-	-	-	20
Mixed	45	20	-	10	-	25

**Wheat Varieties Comparison with 1986-87**

In Sind province a study of wheat varietal use was conducted during 1986-87, in the cotton-wheat and sugarcane-wheat cropping systems presently under discussion (Khushk et al. 1987). On the basis of this study, an analysis of change in the adoption of wheat varieties over time can be made. The data are shown in Table 9.

**Table 9. Wheat varieties grown in cotton zone:  
Comparison with 1986-87**

Variety	Cotton zone	
	1986-87 <sup>1</sup>	1988-89
New recommended	2.4	10.0
Old recommended	69.7	51.0
Banned	8.5	29.5
Mixed	19.4	9.5
All:	100.0	100.00

<sup>1</sup> Farmers' perceptions reported by Khushk et al. 1987.

In the cotton zone, the area under new recommended varieties has increased from 2.4 to 10 percent respectively, and the area under banned varieties has increased from 9 to 29 percent, mostly due to a reduction in area under Pavon and an increase in Blue Silver/Sonalika. The reason for increasing area under banned varieties may be that this year's study was over four districts in the cotton-wheat cropping system, whereas the 1986-87 study was done only in one district in the cotton-wheat cropping system. The area under new recommended varieties is slowly increasing, especially after the release of Sind-81, TJ-83 and Sarsabz varieties. Overall the proportion of area under recommended varieties is still very low, at 61 percent. There are a number of reasons for this.

1. Imperfections in the seed multiplication of new varieties.
2. Farmers lack of knowledge about the new released varieties.
3. Cash constraints to buy commercial seed.
4. No severe rust epidemic since 1978.

The problem with using mixed seed and old recommended and banned varieties is that the potential for losses due to disease is high. Over time, varieties decline in performance as new pathogens evolve. In certain years, such as 1988-89, diseases are less prevalent and the losses will be small. However, scientists all over Pakistan

participating in a recent wheat travelling seminar, organized by the Pakistan Agricultural Research Council (PARC), using conservative estimates, have estimated losses of over one million tonnes of wheat due to use of varieties susceptible to rust and loose smut and mixed seed (PARC 1986). This amounts to Rs. 2.2 billions. Under epidemic conditions, of course, welfare losses will be much greater. To face this problem, it is essential to speed up the diffusion of improved seed at the farm level.

### **Summary and Suggestions**

The major finding of this study is that wheat varietal diffusion remains very slow in irrigated Sind. A large area remains under banned and mixed varieties in the cotton and rice zones. Many farmers complained that mixed seed was being sold by depots and dealers. The Sind Seed Corporation should provide pure seed of new improved varieties in time to the farmers, to solve this problem.

The uptake of newly released varieties in Sind is small. The Sind-81, TJ-83 and Sarsabz were released in 1981, 1982 and 1986 respectively, but still they have not been widely adopted by the farmers. The question arises, whether the farmers are not familiar with these new varieties or whether they are familiar but do not want to adopt them. Further detailed research is needed in this area.

Old but still recommended, banned and mixed varieties are susceptible to the rusts and loose smut. If farmers are not aware of this, there is a need to assess yield losses from the use of mixed seed and old/banned varieties. The results should then be disseminated to farmers. Furthermore, some of the new releases show some sign of rust susceptibility (PARC, 1987). There is a need to assess the actual rust risk in the Sind, as well as the yield losses resulting from the use of present varieties.

The Extension Department can assist in the dissemination of new varieties through well-conducted demonstrations on farmers' fields. The popular media should be used to make farmers aware of the importance of good quality, disease resistant wheat seed. Once farmers are convinced, they will go for new improved seed.

The present situation calls for important changes in developing and extending wheat varieties to farmers. In particular, specific varieties should be recommended for specific environments and times of planting. The survey results reveals that there are no specific varieties for dubari wheat (wheat grown on residual moisture only). There

is a need to develop new varieties for this type of environment where moisture stress is particularly serious.

Another important policy issue is the lack of any statutory regulations about the use of banned wheat varieties. Once such regulations are made, they must be backed by an effective seed distribution system.

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**Appendix I. Percent area planted under different wheat varieties in selected districts in cotton zone, 1988-89.**

<b>Category</b>	<b>Hyderabad</b>	<b>Sanghar</b>	<b>Nawabshah</b>	<b>Khairpur</b>	<b>Average</b>
<b>(Percent area)</b>					
<b><u>New recommended</u></b>					
Jauhar	0.8	-	-	-	-
TJ-83	8.0	4.0	8.0	-	5.1
Sind-81	2.2	4.5	3.0	1.2	2.8
Sarsabz	1.3	4.6	2.6	-	2.2
<b>Total:</b>	<b>12.2</b>	<b>13.1</b>	<b>13.6</b>	<b>1.2</b>	<b>10.1</b>
<b><u>Old but still recommended</u></b>					
Blue Silver	16.0	10.0	13.0	45.0	21.1
Pavon	56.0	36.0	16.0	2.0	27.5
ZA-77	1.2	3.8	2.2	2.0	2.3
<b>Total:</b>	<b>73.2</b>	<b>50.3</b>	<b>31.2</b>	<b>49.0</b>	<b>51.0</b>
<b><u>Banned</u></b>					
Mexi Pak	1.3	6.8	18.0	-	6.5
Pak-70	-	-	-	-	-
WL-711	-	8.8	17.0	16.0	10.4
Nuri	0.4	0.6	3.2	0.8	1.2
Yecora	4.0	2.4	7.0	32.0	11.3
<b>Total:</b>	<b>5.7</b>	<b>18.6</b>	<b>45.2</b>	<b>48.8</b>	<b>29.5</b>
<b>Mixed varieties:</b>		<b>18.0</b>	<b>10.0</b>	<b>1.0</b>	<b>9.4</b>
<b>Total:</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Appendix II. Percent area planted under different wheat varieties in selected districts in rice zone, 1988-89.**

Category	District		Average
	Larkana	Dadu	
(Percent area)			
<b><u>New recommended</u></b>			
TJ-83	1.3	-	0.65
Sind-81	2.0	-	1.00
Total:	3.3	-	1.65
<b><u>Old still recommended</u></b>			
Blue Silver	2.0	6.0	4.0
Pavon	19.0	14.0	16.7
ZA-77	2.7	13.0	7.8
Total:	24.1	33.0	28.5
<b><u>Banned</u></b>			
Mexi-Pak	32.8	9.0	20.9
WL-711	-	20.0	10.0
Nuri	14.5	13.0	13.7
Yecora	3.3	5.0	4.1
Total:	50.6	47.0	48.8
Mixed varieties:	22.0	20.0	21.0
Total:	100.0	100.0	100.0

**Appendix III. Number of wheat varieties planted in selected districts in cotton and rice zone by farm size in Sind, 1988-89**

Farm size	Number of varieties grown		
	One varieties	Two varieties	More than two varieties
<b><u>Cotton Zone</u></b>			
<b><u>Hyderabad</u></b>			
Small (< 5 ha)	54	31	24
Medium (5-10 ha)	50	31	19
Large (> 10 ha)	5	8	87
<b><u>Sanghar</u></b>			
Small (< 5 ha)	34	40	26
Medium (5-10 ha)	67	28	5
Large (> 10 ha)	70	20	10
<b><u>Nawabshah</u></b>			
Small (< 5 ha)	52	30	18
Medium (5-10 ha)	39	20	39
Large (> 10 ha)	49	29	22
<b><u>Khairpur</u></b>			
Small (< 5 ha)	54	24	22
Medium (5-10 ha)	44	33	22
Large (> 10 ha)	60	25	15
<b><u>Rice zone</u></b>			
<b><u>Larkana</u></b>			
Small (< 5 ha)	73	16	11
Medium (5-10 ha)	80	14	6
Large (> 10 ha)	65	20	15
<b><u>Dadu</u></b>			
Small (< 5 ha)	54	31	15
Medium (5-10 ha)	60	20	20
Large (> 10 ha)	80	10	10
All:	55	24	22

**Appendix IV. Number of wheat varieties planted in selected districts in cotton and rice zones by land tenure in Sind, 1988-89**

Land tenure	Number of varieties grown		
	One varieties	Two varieties	More than two varieties
(Percent farmers)			
<b>Hyderabad</b>			
Owner	52	23	25
Tenant	80	18	2
<b>Sanghar</b>			
Owner	74	7	19
Tenant	85	8	8
<b>Nawabshah</b>			
Owner	60	25	15
Tenant	70	20	10
<b>Khairpur</b>			
Owner	80	11	9
Tenant	83	14	3
<b>Rice zone</b>			
<b>Larkana</b>			
Owner	79	12	9
Tenant	90	7	3
<b>Dadu</b>			
Owner	83	8	8
Tenant	85	9	6
All:	77	14	9

**Appendix V. Percent area planted under different wheat varieties by farm size in cotton and rice zones in Sind, 1988-89.**

Category	Farm size					
	Cotton zone			Rice zone		
	Small	Medium	Large	Small	Medium	Large
(Percent area)						
<b><u>New recommended</u></b>						
Jauhar	-	1.3	-	-	-	-
TJ-83	2.25	4.0	7.5	-	-	-
Sind-81	5.25	3.0	1.25	-	-	-
Sarsabz	2.75	2.0	7.75	-	-	-
<b><u>Old but still recommended</u></b>						
Blue Silver	22.75	22.5	17.0	3.5	15.0	-
Pavon	35.75	34.0	24.75	7.5	-	9.5
ZA-77	-	2.0	2.75	1.0	10.0	14.0
<b><u>Banned</u></b>						
Mexi Pak	8.25	8.5	9.0	16.0	10.0	13.5
Pak-70	-	-	-	-	-	12.5
WL-711	7.0	11.25	12.0	5.0	5.5	7.5
Nuri	5.25	-	1.5	45.5	37.5	31.0
Yecora	8.25	9.5	11.5	1.0	3.5	4.0
Mixed	3.5	2.75	5.0	20.5	18.5	8.0

**Appendix VI. Farmers seed sources for wheat varieties  
planted in cotton and rice zones by  
districts in Sind, 1988-89**

Variety	Seed source					
	Own	Other farmers	Seed depot	Village shop	Research/ Extension	Landlord
(Percent farmers)						
<b><u>Cotton zone</u></b>						
Hyderabad	60	13	6	4	5	12
Sanghar	54	14	7	7	3	15
Nawabshah	47	14	5	5	4	25
Khairpur	70	5	3	10	3	9
<b>All:</b>	<b>58</b>	<b>12</b>	<b>5</b>	<b>7</b>	<b>4</b>	<b>15</b>
<b><u>Rice zone</u></b>						
Larkana	62	20	3	5	2	8
Dadu	67	6	3	12	2	10
<b>All:</b>	<b>65</b>	<b>13</b>	<b>3</b>	<b>8</b>	<b>2</b>	<b>9</b>
<b>Both zones:</b>	<b>61</b>	<b>12</b>	<b>4</b>	<b>8</b>	<b>3</b>	<b>12</b>



