

# **Cotton Varietal Adoption and Yields in the Irrigated Punjab: Results From 1986 - 1988**



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**AERU Faisalabad Staff Paper No. 89-2**

**Agricultural Economics Research Unit (PARC)  
Ayub Agricultural Research Institute Faisalabad  
PARC/CIMMYT Collaborative Programme**

**1989**

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### Abbreviations

- AARI: Ayub Agricultural Research Institute, Faisalabad.  
CCRI: Central Cotton Research Institute, Multan.  
CIMMYT: International Maize and Wheat Improvement Center.

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# COTTON VARIETAL ADOPTION AND YIELDS IN THE IRRIGATED PUNJAB: RESULTS FROM 1986-1988

## Introduction

Cotton (*Gossypium hirsutum*), the silver fiber, is an important crop of Pakistan and occupies a key position in the economy, providing significant foreign exchange. This crop is mainly grown in the southern part of the irrigated Punjab and in irrigated Sind. In the 1980's, a dramatic breakthrough occurred in cotton productivity, mainly through release of high yielding varieties alongwith enhanced input use levels, especially pesticides over the past five years, cotton production has doubled in Pakistan. Despite this improvement in cotton production, yields are below potential. At present the average yield of seed cotton in Pakistan is 1350 kg/ha against 469, 1833, 564, 2032, 2500, 2302 and 1556 kg/ha for India, U.S.A, Brazil, Turkey, Egypt, Mexico and Iran respectively (Government of Pakistan, 1985).

Important factors limiting cotton production in the area are soil type, insect-pest attacks, weeds, and unreliable weather during the cotton growing season (AARI, 1986-87). To overcome these constraints, cotton breeders, seed distribution institutions and extension agencies are continuously working to develop and disseminate a stream of new improved cultivars to replace the old ones. To examine the extent of cotton varietal adoption by farmers, a survey was carried out by AERU, Faisalabad in December 1988. Sufficient information was obtained to assess the varietal diffusion on different farm size groups, as well as farmers' yields by variety. This information was gathered to provide breeders with information on the current use of varieties by cotton farmers as well as trends over the last three years.

## Research Methods

The survey was carried out by a team of agricultural economists, from Agricultural Economics Research Unit (PARC), Faisalabad, in collaboration with Central Cotton Research Institute, Multan, in the second week of December 1988. The cotton and mixed zones of the irrigated Punjab were surveyed. Four tehsils, Lodhran, Mailsi, Bahawalpur and Rahim Yar Khan, were selected from the cotton zone. Three tehsils, Depalpur, Kamalia and Jhang were selected from the mixed zone (Figure 1). Selection of the tehsils was based on the total cotton area in the respective tehsils. Six villages from each tehsils in cotton zone and four villages from each tehsil in the mixed zone were randomly selected. A list of surveyed villages is presented in Appendix 1. Ten respondents from the selected villages of cotton zone and five respondents from the villages of the mixed





Figure 1. Spatial Distribution of the Sample Cotton and Mixed Zone:

zone were selected for interviewing, by chance meeting upon driving to the village.

The data given in the Table 1 indicate the distribution of sample farmers by tehsils and farm size. Lodhran tehsil got maximum representation in the sample (23%) as it had more area under cotton as compared with other tehsils of Punjab. Eighty percent of the sample was drawn from the cotton zone, being the main cotton growing area. Of the total sample, the number of small farms was quite high in the mixed zone (65%) as compared with the cotton zone. Overall small farms constituted half of the sample size.

**Table 1: Sample Distribution by Tehsils and Farm Size in the Cotton and Mixed Zone, 1988**

Tehsil	Farmers		Farm Size		
	Number	Percent	(<5 ha)	(5-10 ha)	(>10 ha)
<b>(Percent Farmers)</b>					
<b><u>Cotton Zone</u></b>					
R.Y. Khan	60	20	47	20	33
Bahawalpur	50	17	48	28	24
Lodhran	70	23	48	29	23
Vehari	61	20	44	28	28
<b>All Tehsils</b>	<b>241</b>	<b>80</b>	<b>47</b>	<b>26</b>	<b>27</b>
<b><u>Mixed Zone</u></b>					
Depalpur	20	6	65	30	5
Jhang	20	6	65	25	10
Kamalia	20	6	65	30	5
<b>All Tehsils</b>	<b>60</b>	<b>20</b>	<b>65</b>	<b>28</b>	<b>7</b>
<b>Both Zones</b>	<b>301</b>	<b>100</b>	<b>50</b>	<b>27</b>	<b>23</b>

### Farm Characteristics

Almost three fourths of the sample farmers used tractors (owned or hired) as the main power source, while the remainder used bullocks (Table 2). Owner-operated farms were more common in the mixed zone, as compared with the cotton zone, because of the large number of small farms in the area. Tenant operated farms were more common in the cotton zone, because of more large land holdings in this zone. Canal water, supplemented by owned

or rented tubewells was the main source of irrigation in the sample area. Extension contacts, measured by the percentage of farmers visiting extension trails or extension offices regularly, were stronger in the cotton zone, as compared to mixed zone. There was no significant difference in the ages of respondents between the cotton and mixed zones.

**Table 2: Characteristics of the Sample Farmers by Zones**

Items	Zones		
	Cotton	Mixed	All
	(years)		
<u>Average Schooling</u>	3.5	2.1	3.3
<u>Average Age</u>	38	37	38
	(percent farmers)		
<u>Power Source</u>			
Owned Tractor	37	24	34
Rented Tractor	39	22	36
Owned Bullocks	9	20	11
Rented Bullocks	13	34	17
Owned Tractor and Bull.	2	-	2
<u>Tenancy</u>			
Owner	54	75	58
Tenant	29	17	26
Owner/Tenant	17	8	16
<u>Irrigation Source</u>			
Canal	26	15	23
Owned Tubewell	2	7	3
Rented Tubewell	7	30	12
Owned Tubewell/Canal	48	38	46
Rented Tubewell/Canal	17	10	16
<u>Extension Contacts</u>	42	15	36

## Results and Discussions

### Farm Size and Cotton Area

The data regarding average farm size and area under cotton in the two zones are presented in Table 3. Area under cotton was 69 and 41 percent of the farm in the cotton and mixed zones respectively. In the cotton zone, cotton occupied a high percentage of farm area on all farm size groups, being an important cash crop for all types of farms. In the mixed zone, small farms had a slightly higher percentage of the farm area in cotton as compared to medium and large farms.

**Table 3: Average Farm Size and Cotton Area in the Cotton and Mixed Zone, 1988**

<b>Zone/Farm Size</b>	<b>Average Farm Size</b>	<b>Average Cotton Area</b>	<b>Percent Farm Area in Cotton</b>
	<b>(ha)</b>	<b>(ha)</b>	<b>(%)</b>
<b><u>Cotton Zone</u></b>			
Small (<5 ha)	3.4	2.3	68
Medium (5-10 ha)	7.7	5.3	69
Large (> 10 ha)	40.8	28.6	70
All	14.6	10.2	69
<b><u>Mixed Zone</u></b>			
Small (<5 ha)	3.1	1.4	45
Medium (5-10 ha)	8.3	3.1	37
Large (>10 ha)	14.2	5.7	40
All	5.3	2.2	41
<b><u>Both Zones</u></b>			
Small (<5 ha)	3.3	2.1	63
Medium (5-10 ha)	7.9	4.9	62
Large (> 10 ha)	39.3	27.2	69
All	12.8	8.6	67

### Number of Cotton Varieties Planted on Sample Farms

The number of cotton varieties grown in both zones by farm size is presented in Table 4. Overall, a higher percentage (77%) of the small farmers were growing only one variety as compared with medium (49%) and large farms (39%). The percentage of

farmers growing only one variety was quite high in the mixed zone (85%), largely because of the much smaller area of cotton per farm in this zone.

**Table 4: Number of Cotton Varieties Planted by Farm Size in Cotton and Mixed zone, 1988**

Farm Size/ Groups Zones	Number of Varieties Planted		
	One	Two	Three and more
(Percent farmers)			
<b><u>Cotton Zone</u></b>			
Small (<5 ha)	73	24	3
Medium (5-10 ha)	40	46	14
Large (>10 ha)	35	40	25
All	54	34	12
<b><u>Mixed Zone</u></b>			
Small (<5 ha)	85	15	-
Medium (5-10 ha)	82	12	6
Large (>10 ha)	100	-	-
All	85	13	2
<b><u>Both zones</u></b>			
Small (<5 ha)	77	22	2
Medium (5-10 ha)	49	39	12
Large (>10 ha)	39	38	23
All	60	30	10

#### **Cotton Varieties Planted by Sample Cotton Growers**

The cotton varieties NIAB-78 and MNH-93 were the most common in the cotton zone, while NIAB-78 was most widely used in the mixed zone (Figure 2). The newly-released variety S-12 had some recognition amongst the farmers in the cotton zone and was adopted on 13 percent of the sample cotton area during 1988, mostly by the large farmers (see appendix v). This variety in the cotton zone has substituted mainly for 'NIAB-78', with about 9% of total area being replaced by S-12 (Table 5). In the mixed zone, NIAB-78 was the dominant variety grown, showing an increase of 14 percent in three years (i.e. 59 percent in 1986 to 77 percent in 1988). Area under B-557 in the mixed zone had decreased rapidly over time (i.e. 13 percent in 1986 to 2% in 1988).

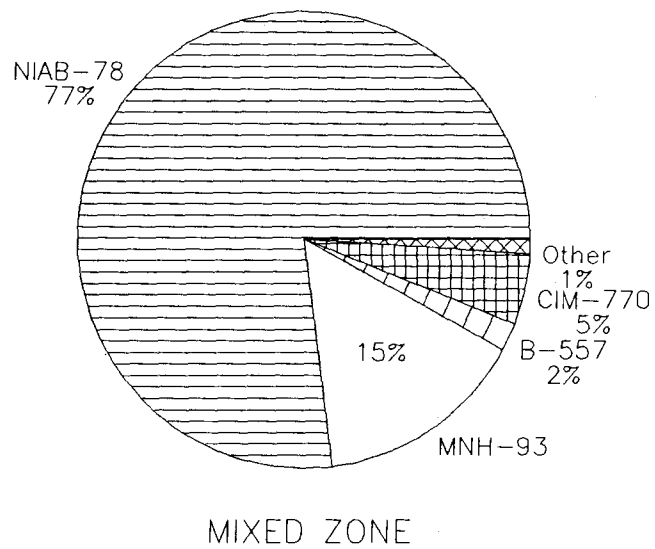
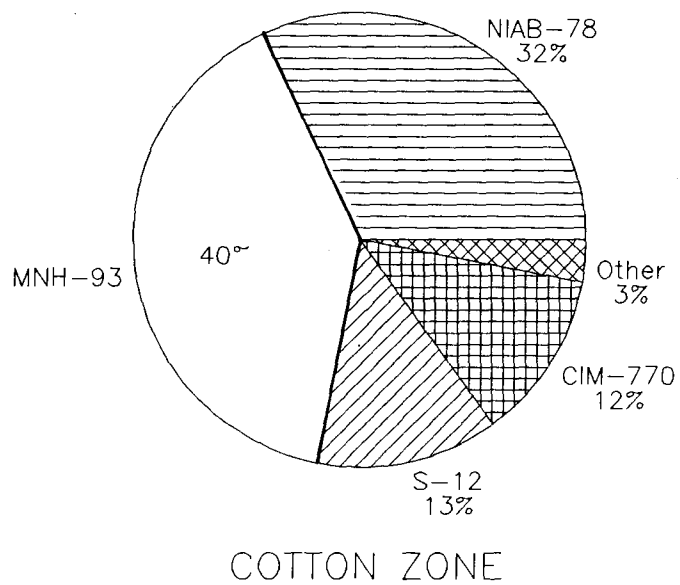


FIG 2: AREA PLANTED TO MAIN COTTON VARIETIES IN THE IRRIGATED PUNJAB, 1988.

**Table 5: Area Under different Cotton Varieties in the Cotton and Mixed Zones of the Punjab during 1986, 1987 and 1988**

Varieties	Years		
	1986	1987	1988
(Percent Area)			
<b><u>Cotton Zone</u></b>			
NIAB-78	43	41	32
MNH-93	42		40
B-557	1		-
S-12	1	-	13
CIM-70	13	14	12
FH-87	-	-	-
Others	-	2	3
<b><u>Mixed zone</u></b>			
NIAB-78	59	65	77
MNH-93	9	15	15
B-557	13	3	2
S-12	-	-	-
CIM-70	19	13	5
FH-87	-	-	-
Others	-	4	1
<b><u>Both Zones</u></b>			
NIAB-78	44	42	34
MNH-93	40	41	39
B-557	2	1	-
S-12	-	-	12
CIM-70	14	14	12
FH-87	-	-	-
Others	-	2	3

Others include, CIM-50, NIAB-82, CIM-129, CIM-83, SLH-41 MNH-129.

## Cotton Yield by Variety

The reported yields of different cotton varieties showed considerable variation in relation to different ecological zones of the sample farms (Table 6). Yields of main cotton varieties (NIAB-78 and MNH-93) in the cotton zone were more or less stagnant, whereas CIM-70's yield was high. In the mixed zone, the yield of NIAB-78 has declined over the last three years despite its increase in area. Figure 3 shows that average yield performance during last three years of NIAB-78 and MNH-93 in the cotton zone were more or less same, but lower than CIM-70 and S-12. Similarly CIM-70 was yielding more than other varieties in the mixed zone. Whereas CIM-70 and B-557 showed an increase in yield overtime. The new cotton variety, S-12, in the cotton zone gave higher yields than older varieties (NIAB-78 and MNH-93), and its acceptability was high amongst farmers.

**Table 6: Seed Cotton Yields of Different Varieties, 1986-88**

Zone/ Variety	Yields			Average 1986-88
	1986	1987	1988	
t/ha				
<b><u>Cotton Zone</u></b>				
NIAB-78	2.3	2.5	2.5	2.4
MNH-93	2.3	2.5	2.4	2.4
B-557	1.8	1.8	1.2	1.8
S-12	3.2	2.5	2.7	2.7
CIM-70	2.3	2.6	3.0	2.7
FH-87	-	-	2.0	-
Others	2.4	2.4	2.1	2.3
<b><u>Mixed Zone</u></b>				
NIAB-78	2.1	2.1	1.8	1.9
MNH-93	1.5	1.6	1.6	1.6
B-557	1.5	1.6	2.0	1.6
CIM-70	2.4	2.3	2.6	2.4
FH-87	-	-	2.8	-
Others	-	2.2	1.8	-
<b><u>Both Zones</u></b>				
NIAB-78	2.3	2.4	2.4	2.4
MNH-93	2.3	2.5	2.4	2.4
B-557	1.7	1.8	1.8	1.7
S-12	3.2	2.5	2.7	2.7
CIM-70	2.1	2.6	3.0	2.6
FH-87	-	-	2.2	-
Others	2.4	2.4	2.1	2.2



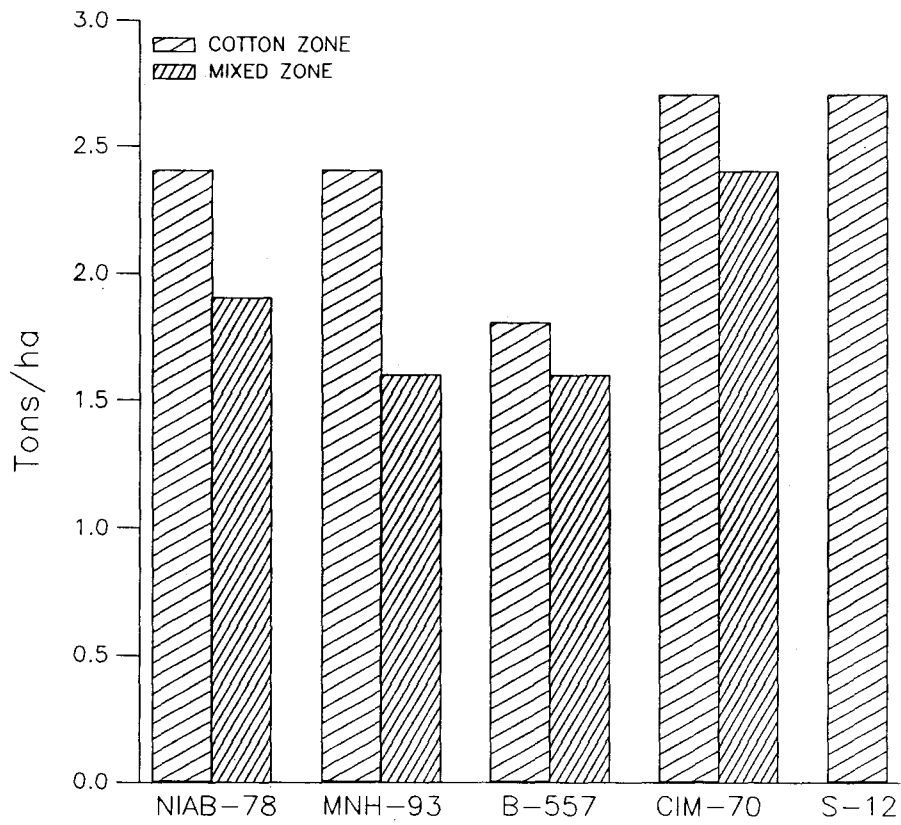


FIG 3: YIELDS OF MAIN COTTON VARIETIES GROWN IN THE PUNJAB: AVERAGE OF THREE YEARS

## Intended Area Under Different Cotton Varieties During 1989

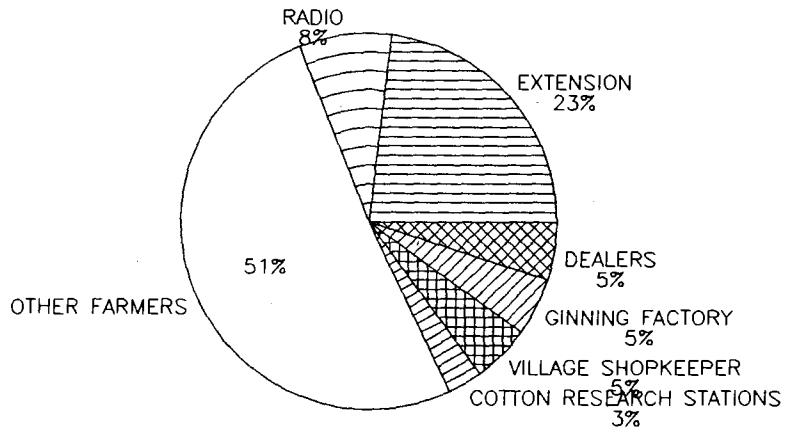
Farmers were asked about the area they intended to allocate to different cotton varieties during the crop season 1989 (Table 7). NIAB-78 and MNH-93 varieties do not show any big variation in their areas as compared to the 1988 crop season (Table 5). The newly released cotton variety S-12 shows an increasing trend, from 13% to 17% with the anticipated increase to occupy mainly on medium farms.

**Table 7: Intended Area of Different Cotton Varieties Sown During 1989, on the Sample Farms by Farm Size Groups**

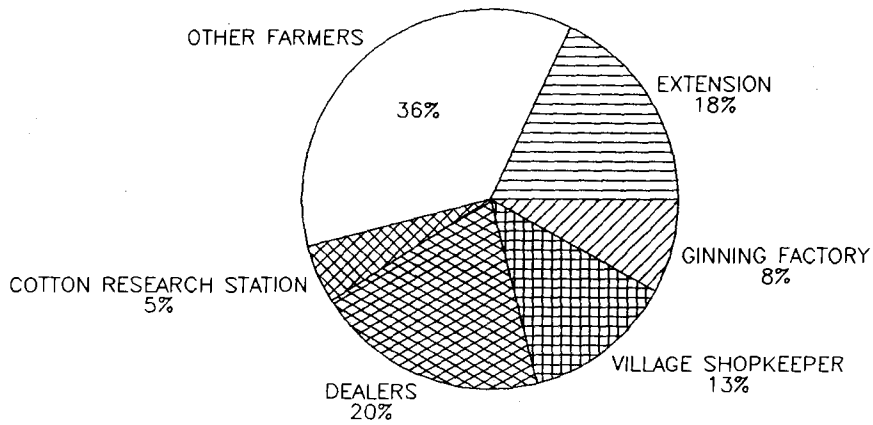
Varieties	Farm Size Groups			All
	Small ( < 5 ha)	Medium (5-10 ha)	Large ( > 10 ha)	
	(percent area)			
NIAB-78	44	23	34	34
MNH-93	30	37	39	30
B-557	-	1	-	-
S-12	9	30	15	16
CIM-70	14	7	19	17
FH-87	1	-	1	1
Others	2	3	2	2

## Awareness of Newly Released Cotton Variety S-12

Farmers were asked about the source of awareness of the new cotton variety S-12, which was released for the cotton zone during 1987-88 (AARI, 1987). The results are presented in Table 8. The majority of the growers (51%) obtained their first information about the variety from fellow farmers. Extension and radio informed over percent of farmers about this variety (Figure 4). Other information sources, notably village shopkeepers and dealers (input/output), also contributed sizably to dissemination, being the main source of information for small farmers.



SOURCE OF INFORMATION



SOURCES OF INITIAL SEED

FIG 4: SOURCES OF INFORMATION AND INITIAL SEED OF NEWLY RELEASED COTTON VARIETY S-12 IN THE COTTON ZONE

**Table 8: Source of Information of Sample Growers About Newly Released Cotton Variety 'S-12' by Farm Size Groups**

Source	Source of Initial Information			All
	Small ( < 5 ha)	Medium (5-10 ha)	Large ( > 10 ha)	
(percent farmers)				
Extension	25	22	23	23
Radio	-	14	6	8
Fellow Farmers	37	36	71	51
CRS <sup>1</sup>	-	7	-	3
CCRI <sup>2</sup>	-	-	-	-
Village Shopkeeper	13	7	-	5
Ginning factory	-	14	-	5
Dealer (input/output)	25	-	-	5

<sup>1</sup> CRS : Cotton Research Station, Multan.

<sup>2</sup> CCRI: Central Cotton Research Institute, Multan.

#### Source of Initial Seed of Variety S-12

The majority of the sample farmers obtained seed of cotton variety S-12 from fellow farmers (36%) and different other agencies like arthis and ginning factories (33%) (Table 9). Fellow farmers and extension services were also the major sources of seed for this newly released variety. Village shopkeeper and dealers (output/input) were the main source of seed, particularly for small farmers (Figure 4).

**Table 9: Source of Initial Seed of Newly Released Cotton Variety 'S-12' of Sample Growers by Farm Size Groups**

Source	Source Of Initial Seed			All
	Small ( < 5 ha)	Medium (5-10 ha)	Large ( > 10 ha)	
(percent farmers)				
Extension	13	14	23	18
Radio	-	-	-	-
Fellow Farmers	25	22	53	36
CRS <sup>1</sup>	-	7	6	5
CCRI <sup>2</sup>	-	-	-	-
Village Shopkeeper	25	14	6	13
Ginning factory	-	21	-	8
Dealer (input/output)	25	7	6	20

<sup>1</sup> CRS : Cotton Research Station, Multan.

<sup>2</sup> CCRI: Central Cotton Research Institute, Multan.

## Summary and Suggestions

In the cotton zone, farmers allocated a major proportion of their cotton area to the varieties NIAB-78 and MNH-93. Also, the newly-released variety S-12 fetched some recognition from the farmers, because of its relatively good yield results in the cotton zone. In the mixed zone, NIAB-78 was the main variety. Over time, area under NIAB-78 has increased in the mixed zone. The CIM-70 cotton variety proved to be better yielding than other varieties on all type of farm in the cotton zone. Despite this yield performance, its adoption seems to be slow, because it requires very high levels of management. A new variety 'FH-87' released for the mixed zone has not yet popular among the farmers, because of its lengthy stem.

The results of this study underlines the need for researchers and cotton marketers to monitor varietal use closely over time. Of special interest are the changes in the main varieties, NIAB-78 and MNH-93 and the uptake of S-12 in the cotton zone. Another issue for research is the sources of changes in cotton yields over time, by variety. These changes need to be placed in broader perspective of other changes occurring on cotton farms in the irrigated Punjab, including pesticide use, fertilizer use, weed control and other crops management practices. Dynamic change has occurred with cotton recently and this is likely to continue. These changes should be monitored regularly.

## References

Annual Progress Report. 1986-87. "Department of Agriculture Punjab Research Wing, Annual Progrss Report 1986-87, Cotton Research Institute, Ayub Agricultural Research Institute, Faisalabad".

Annual Progress Report. 1987-88. "Department of Agriculture Punjab Research Wing, Annual Progrss Report 1986-87, Cotton Research Institute", Ayub Agricultural Research Institute, Faisalabad.

Government of Pakistan. Agricultural Statistics of Pakistan, Ministry of Food, Agriculture and Co-operatives, Food and Agriculture Division (Planning Unit), Islamabad, 1985.

**Appendix i: Characteristics of the Sample Farmers  
of Cotton Zone by Farm Size**

Items	Cotton Zone			All
	Small	Medium	Large	
	(years)			
<u>Average Schooling</u>	2	4	5	4
<u>Average Ages</u>	40	39	36	38
	(percent farmers)			
<u>Power Source</u>				
Owned Tractor	16	30	79	37
Rented Tractor	58	36	9	39
Owned Bullocks	11	13	1	9
Rented Bullocks	15	21	3	13
Owned Tractor/Bullocks	-	-	8	2
<u>Tenancy</u>				
Owner	55	43	62	54
Tenant	22	36	32	29
Owner/Tenant	23	21	6	17
<u>Irrigation Source</u>				
Canal	27	24	23	26
Owned Tubewell	-	-	8	2
Rented Tubewell	10	7	3	7
Owned TW/Canal	38	52	63	48
Rented TW/Canal	25	18	3	17
All				
<u>Extension Contacts</u>	24	41	76	42

**Appendix ii: Characteristics of the Sample Farmers  
of the Mixed Zone by Farm Size**

Items	Mixed Zone			All
	Small	Medium	Large	
	(Years)			
<u>Average Schooling</u>	2	2	3	2
<u>Average Ages</u>	36	40	38	37
	(percent farmers)			
<u>Power Source</u>				
Owned Tractor	8	57	50	24
Rented Tractor	31	6	-	22
Owned Bullocks	25	6	25	20
Rented Bullocks	36	31	25	34
Owned Tractor/Bullocks	-	-	-	-
<u>Tenancy</u>				
Owner	68	82	100	75
Tenant	21	12	-	17
Owner/Tenant	11	6	-	8
<u>Irrigation Source</u>				
Canal	15	19	-	15
Owned Tubewell	5	13	-	7
Rented Tubewell	33	31	-	30
Owned TW/Canal	36	31	75	38
Rented TW/Canal	10	6	25	10
All				
<u>Extension Contacts</u>	6	25	50	15



**Appendix iii: Area Under Different Cotton Varieties by Farm Size in 1986**

Zone/ Varieties	Farm Size Groups		
	Small ( $< 5$ ha)	Medium (5-10 ha)	Large (10 ha)
(percent area)			
<b><u>Cotton Zone</u></b>			
NIAB-78	39	25	32
MNH-93	48	55	36
B-557	-	-	-
S-12	5	9	14
CIM-70	5	7	15
FH-87	1	-	-
Others	2	4	3
<b><u>Mixed Zones</u></b>			
NIAB-78	70	73	100
MNH-93	21	15	-
B-557	-	5	-
CIM-70	7	6	-
FH-87	-	-	-
Others	2	1	-
<b><u>Both Zones</u></b>			
NIAB-78	44	32	33
MNH-93	44	49	36
B-557	-	1	-
S-12	4	8	14
CIM-70	5	7	14
FH-87	1	-	-
Others	2	3	3

**Appendix iv: Area Under Different Cotton Varieties by  
Farm Size in 1987**

Zone/ Varieties	Farm Size Groups		
	Small (< 5 ha)	Medium (5-10 ha)	Large (10 ha)
(percent area)			
<b><u>Cotton Zone</u></b>			
NIAB-78	43	41	41
MNH-93	47	50	40
B-557	3	1	-
S-12	-	-	-
CIM-70	6	8	16
FH-87	-	-	-
Others	1	-	3
<b><u>Mixed Zone</u></b>			
NIAB-78	67	74	36
MNH-93	14	8	40
B-557	6	-	-
CIM-70	13	18	-
FH-87	-	-	-
Others	-	-	24
<b><u>Both Zones</u></b>			
NIAB-78	47	45	41
MNH-93	42	45	40
B-557	3	1	-
S-12	-	-	-
CIM-70	7	9	17
FH-87	1	-	-
Others	1	1	2

**Appendix v: Area Under Different Cotton Varieties  
by Farm Size in 1988**

Zone/ Varieties	Farm Size Groups		
	Small (< 5 ha)	Medium (5-10 ha)	Large (10 ha)
(Percent Area)			
<b><u>Cotton Zone</u></b>			
NIAB-78	39	25	32
MNH-93	48	55	36
B-557	-	-	-
S-12	5	9	14
CIM-70	5	7	15
FH-87	1	-	-
Others	2	4	3
<b><u>Mixed Zone</u></b>			
NIAB-78	70	73	100
MNH-93	21	15	-
B-557	-	5	-
CIM-70	7	6	-
FH-87	-	-	-
Others	2	1	-
<b><u>Both Zones</u></b>			
NIAB-78	44	32	33
MNH-93	44	49	36
B-557	-	1	-
S-12	4	8	14
CIM-70	5	7	14
FH-87	1	-	-
Others	2	3	3

**Appendix vi: Average Seed Cotton Yield of Different Cotton Varieties by Farm Size, 1986**

Zone/ Varieties	Farm size Groups		
	Small ( < 5 ha)	Medium (5-10 ha)	Large ( > 10 ha)
(tons/ha)			
<b><u>Cotton zone</u></b>			
NIAB-78	2.1	2.4	2.4
MNH-93	2.0	2.2	2.4
B-557	1.3	1.3	3.0
S-12	-	-	3.2
CIM-70	2.0	2.6	2.3
FH-87	-	-	-
Others	3.6	-	-
<b><u>Mixed Zone</u></b>			
NIAB-78	1.8	2.3	1.9
MNH-93	1.5	1.1	1.8
B-557	1.5	1.3	1.6
CIM-70	2.5	2.3	-
FH-87	-	-	-
Others	-	-	-
<b><u>Both Zone</u></b>			
NIAB-78	1.8	2.4	2.4
MNH-93	2.0	2.1	2.4
B-557	1.4	1.6	2.3
S-12	-	-	3.2
CIM-70	3.2	2.4	2.3
FH-87	-	-	-
Others	2.4	-	-

**Appendix vii: Average Seed Cotton Yield of Different Cotton Varieties by Farm Size, 1987**

Zone/ Varieties	Farm Size Groups		
	Small (<5 ha)	Medium (5-10 ha)	Large (>10 ha)
	(tons/ha)		
<b><u>Cotton zone</u></b>			
NIAB-78	2.4	2.3	2.5
MNH-93	2.1	2.3	2.7
B-557	1.5	2.2	-
S-12	-	-	2.5
CIM-70	3.1	2.0	2.6
FH-87	-	-	-
Others	3.2	2.2	2.4
<b><u>Mixed Zone</u></b>			
NIAB-78	1.8	2.2	2.4
MNH-93	1.6	1.6	1.6
B-557	1.6	-	-
CIM-70	2.1	2.4	-
FH-87	-	-	-
Others	-	-	2.2
<b><u>Both zones</u></b>			
NIAB-78	2.2	2.3	2.5
MNH-93	2.1	2.4	2.7
B-557	1.5	2.2	-
S-12	-	-	2.5
CIM-70	2.8	2.1	2.6
FH-87	-	-	-
Others	3.2	2.3	2.3

Appendix viii: Average Seed Cotton Yield of Different Cotton Varieties by Farm Size, 1988

Zone/ Varieties	Farm Size Groups		
	Small (<5 ha)	Medium (5-10 ha)	Large (> 10 ha)
	(tons/ha)		
<b><u>Cotton zone</u></b>			
NIAB-78	2.3	2.4	2.5
MNH-93	2.4	2.3	2.4
B-557	1.2	-	-
S-12	2.6	3.0	2.6
CIM-70	3.0	2.4	3.1
FH-87	2.0	-	-
Others	2.6	2.1	2.1
<b><u>Mixed Zone</u></b>			
NIAB-78	1.7	1.8	2.0
MNH-93	1.9	1.2	-
B-557	-	2.0	-
CIM-70	1.7	3.1	-
FH-87	2.6	3.2	-
Others	1.8	-	-
<b><u>Both Zones</u></b>			
NIAB-78	2.1	2.2	2.5
MNH-93	2.4	2.2	2.4
B-557	1.2	2.0	-
S-12	2.6	3.0	2.6
CIM-70	2.7	2.6	3.1
FH-87	2.1	3.2	-
Others	2.5	2.1	2.1

**Appendix ix: Yields of Different Cotton Varieties by Tehsils during, 1986**

<b>Cotton Varieties</b>							
<b>Tehsils</b>	<b>NIAB-78</b>	<b>MNH-93</b>	<b>B-557</b>	<b>S-12</b>	<b>CIM-70</b>	<b>FH-87</b>	<b>OTH</b>
<b>(tons/ha)</b>							
<b><u>Cotton Zone</u></b>							
R.Y. Khan	2.04	1.94	1.83	-	2.90	-	2.71
Bahawalpur	2.91	2.00	-	-	2.46	-	1.69
Lodhran	2.27	2.43	-	3.16	2.29	-	1.13
Vehari	2.45	2.40	1.43	-	1.59	-	-
<b><u>Mixed Zone</u></b>							
Depalpur	2.28	1.78	-	-	-	-	-
Jhang	1.31	1.06	1.49	-	1.75	-	-
Kamalia	1.83	1.78	-	-	2.39	-	-

**Appendix x: Yield of Different Cotton Varieties by Tehsils during, 1987**

<b>Cotton Varieties</b>							
<b>Tehsils</b>	<b>NIAB-78</b>	<b>MNH-93</b>	<b>B-557</b>	<b>S-12</b>	<b>CIM-70</b>	<b>FH-87</b>	<b>OTH</b>
<b>(tons/ha)</b>							
<b><u>Cotton Zone</u></b>							
R.Y. Khan	2.44	2.38	1.77	2.47	1.79	1.98	2.38
Bahawalpur	2.18	2.93	-	-	2.87	-	-
Lodhran	2.55	2.46	-	-	2.53	-	1.98
Vehari	2.25	2.47	-	-	3.16	-	1.98
<b><u>Mixed Zone</u></b>							
Depalpur	2.16	1.98	-	-	1.82	-	2.17
Jhang	1.53	1.49	1.58	-	-	-	-
Kamalia	2.14	1.72	-	-	2.33	-	-

**Appendix xi: Yield of Different Cotton Varieties by Tehsils during 1988.**

<b>Cotton Varieties</b>							
<b>Tehsils</b>	<b>NIAB-78</b>	<b>MNH-93</b>	<b>B-557</b>	<b>S-12</b>	<b>CIM-70</b>	<b>FH-87</b>	<b>OTH</b>
<b>(tons/ha)</b>							
<b><u>Cotton Zone</u></b>							
R.Y. Khan	2.13	2.36	1.19	2.71	-	1.98	2.30
Bahawalpur	2.41	2.73	-	2.22	2.46	-	1.69
Lodhran	2.69	2.34	-	2.76	2.76	-	2.37
Vehari	2.29	2.26	-	2.19	3.00	-	1.82
<b><u>Mixed Zone</u></b>							
Depalpur	1.97	1.87	-	-	-	-	1.73
Jhang	1.20	1.26	-	-	-	2.57	-
Kamalia	1.84	1.75	1.98	2.24	2.52	3.16	-



