Some Physical and Economic Determinants of Cotton Production in West Pakistan

by

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INTRODUCTION

There has been no increase in area under cotton in West Pakistan during the last 25 to 30 years in spite of a considerable increase in the total area under all other crops over the same period[1]. This article investigates possible causes of stagnation in West Pakistan's cotton production.

Two possible causes for the failure of cotton-cropped area to expand along with expansion of the total area cropped in West Pakistan during the last 25 to 30 years suggest themselves. These are:

i) Rising ground watertable in canal-irrigated areas of West Pakistan which may make it physically more difficult and less advantageous for farmers to grow cotton.

ii) Decline in the relative price of cotton compared with competing crops brought about by:

a) export duty on cotton, and

b) artificially maintained high prices for some of the competing crops.

II. EFFECTS OF WATERLOGGING ON COTTON PRODUCTION

The first hypothesis to be tested, therefore, is that rising ground water-tables in different parts of the province may be one of the principal causes for the stagnation of cotton production in West Pakistan[2].

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[1] For a detailed account of importance of cotton in the economy of Pakistan, the main varieties of cotton grown, the domestic consumption, and the earnings from exports, *see* Appendix A.

[2] For a more detailed analysis of waterlogging problem in West Pakistan, *see*, Ghulam Mohammad and C. Beringer, "Waterlogging and Salinity in West Pakistan: An Analysis of the Revelle Report", *Pakistan Development Review*, Vol. III, No. 2, Summer 1963. Pp. 250-278.

In comparison with other crops, cotton has a deeper tap-root system. Roots of *desi* cotton grown in West Pakistan generally penetrate the soil to a depth of about 6 feet while those of American cotton go to a depth of about $6\frac{1}{2}$ feet[3]. Most other crops grown in the summer (*kharif*) season, such as sugarcane, rice, maize, jawar and bajra, have shallow fibrous root systems penetrating the soil to a depth of about 2 to 3 feet. A rising ground watertable is, therefore, likely to affect cotton before it affects other *kharif* crops.

To analyse this waterlogging effect, we have compiled figures on the area under cotton and other *kharif* crops in the different regions of West Pakistan for the last 28 years, 1935/36 to 1962/63 (Table I). West Pakistan has been divided into three major cotton-producing regions for the purpose:

   i) The old canal colonies of the former Punjab.

   ii) The Multan District of the Punjab and the former Bahawalpur State.

   iii) The left-bank areas of Sind and the former Khairpur State.

In the first of these areas the construction of perennial[4] canals was started in the last part of the nineteenth century to serve lands in the districts of Lyallpur, Jhang, Sheikhupura, Gujranwala, Gujrat, Sargodha, Lahore and Montgomery. By 1915 the entire area in these districts was covered with a close network of irrigation canals. Due to continuous seepage of water from these canals the ground watertable has been rising at an average rate of about $\frac{1}{2}$ to $1\frac{1}{2}$ feet per year, so that by 1940 the watertable had come to within 10-15 feet[5] of the ground surface in major parts of these districts.

The Sutlaj Valley canals opened in 1927 provide irrigation water to the former Bahawalpur State and the major part of Multan District. Most of these canals are nonperennial and provide water only during the summer season. For this reason, there has been much less rise in the ground watertable in Bahawalpur and Multan Districts, the second major area listed above.

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3 M. Afzal, *Growth and Development of the Cotton Plant.* (Lahore: Superintendent of Government Printing Press, 1949), pp. 5-9.

4 Canals flowing all the year round and fed from a permanent barrage or diversion dam spanning the source river.

5 *a*) West Pakistan Water and Power Development Authority (WAPDA), *Programme for Waterlogging and Salinity Control in the Irrigated Areas of West Pakistan.* (Lahore: WAPDA, May 1961), p. 5 and plates IV and V.

b) Water and Soil Investigation Division, West Pakistan WAPDA, *Basic Data Release No. 3, Records of Ground Water Levels, Rechna Doab.* (Lahore: WAPDA, 1960).

c) Water and Soil Investigation Division, West Pakistan WAPDA, *Basic Data Release No. 5, Records of Ground Water Levels in the Chaj Doab.* (Lahore: WAPDA, 1960).

TABLE I

AREA UNDER COTTON IN DIFFERENT REGIONS OF WEST PAKISTAN

Year	Punjab[a]	Multan Bahawalpur	Sind[b]	Total West Pakistan[c]
	(......................in 000 acres ....)			
1935/36	1575	733	823	3131
1936/37	1502	816	929	3247
1937/38	1716	938	948	3602
1938/39	1560	888	851	3299
1939/40	1483	789	848	3120
1940/41	1517	841	909	3267
1941/42	1608	973	895	3476
1942/43	1330	870	697	2897
1943/44	1445	1068	889	3402
1944/45	1441	901	860	3202
1945/46	1383	885	843	3111
1946/47	1349	884	849	3082
1947/48	1256	982	814	3052
1948/49	1068	864	742	2674
1949/50	1042	791	805	2638
1950/51	1102	952	845	2899
1951/52	1244	1060	884	3188
1952/53	1347	997	951	3295
1953/54	1095	765	877	2737
1954/55	1140	981	881	3002
1955/56	1260	1084	973	3317
1956/57	1232	1182	997	3411
1957/58	1218	1195	1050	3463
1958/59	1112	1042	1025	3179
1959/60	1114	1122	991	3227
1960/61	1064	1111	1002	3177
1961/62	1110	1159	1003	3272
1962/63	1113	1192	974	3279

Source: Compiled from data contained in :

    i) A Rab, *Acreage, Production and Prices of Major Agricultural Crops of West Pakistan (Punjab), 1931-59.* (Karachi : Institute of Development Economics, 1961).

    ii) West Pakistan Bureau of Statistics, *Statistics of West Pakistan Agricultural Data by Divisions and Districts.* (Lahore: Superintendent of Government Printing Press, 1960).

    iii) Karachi Cotton Annual, 1948-49. (Karachi: Karachi Cotton Association, 1949), p. 68.

    iv) Data supplied by Director of Land Records, Northern Zone, Lahore; Director, Bureau of Statistics, West Pakistan, Lahore; and Director of Agriculture, Southern Zone, Hyderabad.

  a) Gujranwala, Gujrat Jhang, Lahore, Lyallpur, Montgomery, Sargodha and Sheikhupura Districts.

  b) Hyderabad, Khairpur, Nawabshah, Sanghar and Tharparkar Districts.

  c) Excluding area under cotton in Peshawar and D.I.Khan Divisions and Rawalpindi, Jhelum, Mianwali, Sialkot, Muzaffargarh, D.G. Khan, Sukkur, Jacobabad, Larkana, Dadu, and Thatta Districts.

The Sukkur Barrage Project, which provides water to the cotton-growing areas of Sind, was opened in 1932. Even though these canals are perennial, the watertable in the cotton-growing districts of Sind has not as yet risen extensively. The only areas where the watertable has already risen considerably are the Khairpur District and the southern parts of Hyderabad and Tharparkar Districts, where due to the proximity to the sea, the ground watertable was much closer to the surface before perennial irrigation was started.

The area under cotton in the old canal colonies of the Punjab has been declining from the year 1935/36 at an average rate of about 20,000 acres a year. The actual area under cotton and area according to the calculated straight-line trend is shown graphically in Figure I along with the area under other *kharif* crops and the corresponding trend line. The area under competing *kharif* crops nearly doubled from about 1200 thousand acres in 1935/36 to about 2400 thousand acres in 1962/63: an increase of about 1200 thousand acres compared with a decline of about 540 thousand acres in the area under cotton.

The area under cotton in the former Bahawalpur State and the Multan District of the Punjab shows a gradual increase during the last 28 years. A straight line has also been fitted to these data and the results are shown in Figure II. The area under cotton in this region has been increasing at the rate of 13,900 acres a year, reaching a maximum of 1153 thousand acres in 1962/63. There was an increase of about 375 thousand acres in area under cotton in the last 27 years. The superiority of the Multan-Bahawalpur region as a cotton-growing area is brought out clearly by a look at the area under competing *kharif* crops, also shown in Figure II. Two facts should be noted: *i*) except during 1953/54, the area under competing *kharif* crops has always remained lower than that under cotton; and *ii*) the slope of the two trend lines indicates that cotton acreage has increased *pari passu* with other competing crops.

A straight-line trend fitted to the acreage figures for former Sind shows that the area under cotton increased at an average rate of 6,100 acres a year, showing a gain of about 165 thousand acres in 27 years (Figure III). The area under all other *kharif* crops has been higher than that under cotton but is showing practically no trend whereas the area under cotton has shown a definite increase. If this trend continues, the area under cotton is likely to become equal to and ultimately exceed the area under all other competing crops unless a rising ground watertable interferes with this trend.

To sum up, our analysis of the development in the cotton-growing areas shows that whereas, on the whole, the total acreage has been stationary, there have been significant upward and downward trends in individual regions. The

FIGURE I

AREA UNDER COTTON AND COMPETING KHARIF CROPS, ACTUAL AND TREND: OLD CANAL COLONIES OF THE PUNJAB

1935/36 TO 1962/63

COMPETING KHARIF CROPS, ACTUAL & TREND
Y = 1161 + 43.3 X

COTTON, ACTUAL & TREND
Y = 1592 − 20 X

Ghulam Mohammad: Determinants of Cotton Production
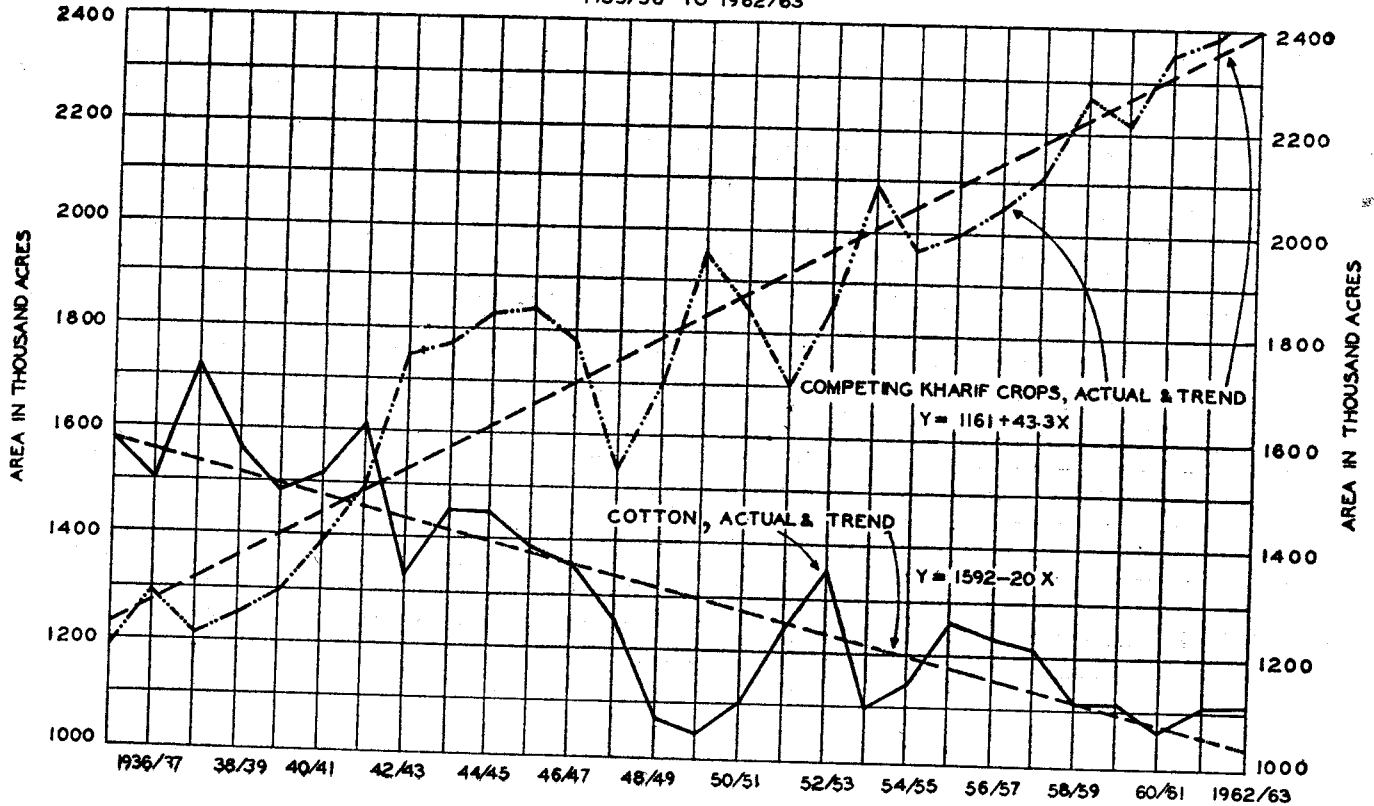
FIGURE II

AREA UNDER COTTON AND COMPETING KHARIF CROPS, ACTUAL AND TREND: MULTAN—BAHAWALPUR

1935/36 TO 1962/63

COTTON, ACTUAL AND TREND

$Y = 765 + 13.9 X$

COMPETING KHARIF CROPS, ACTUAL AND TREND

$Y = 455 + 11.1 X$

AREA IN THOUSAND ACRES
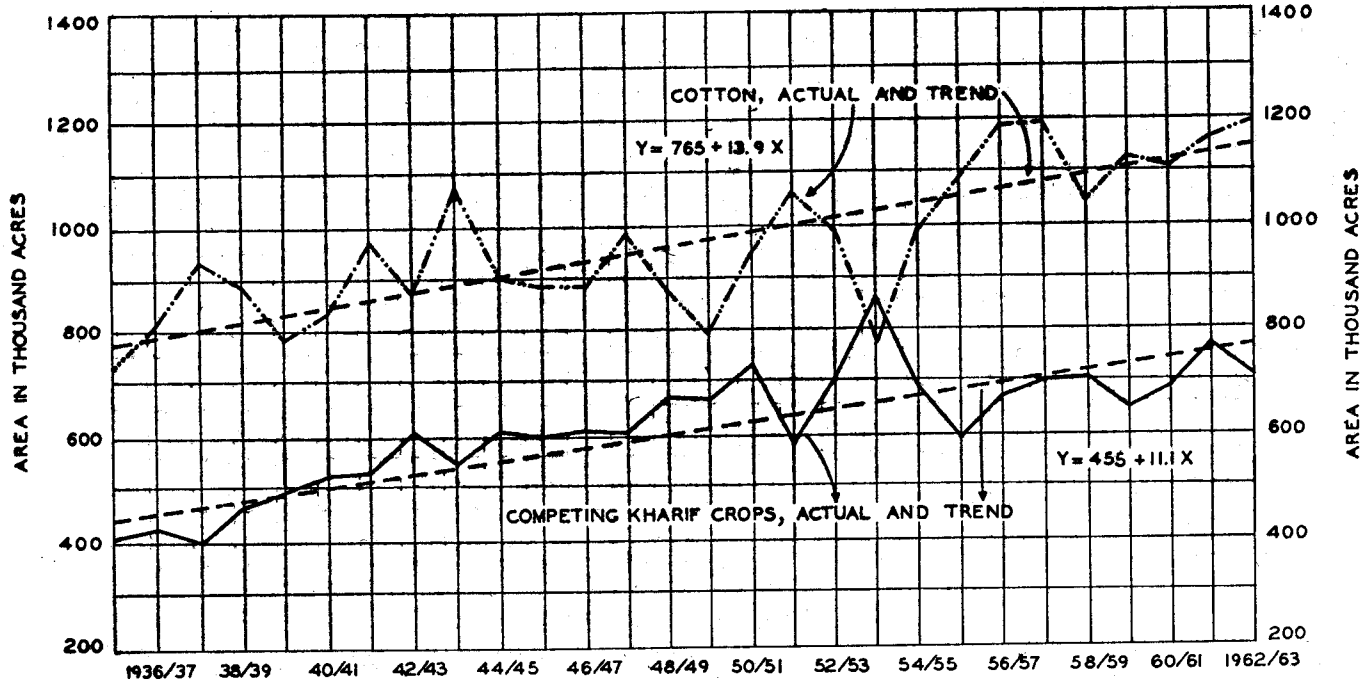
FIGURE III

AREA UNDER COTTON AND COMPETING KHARIF CROPS, ACTUAL AND TREND, SIND
1935/36 TO 1962/63

COMPETING KHARIF CROPS, ACTUAL AND TREND

$Y = 1250 - 2.7X$

COTTON, ACTUAL AND TREND

$Y = 810 + 6.1X$
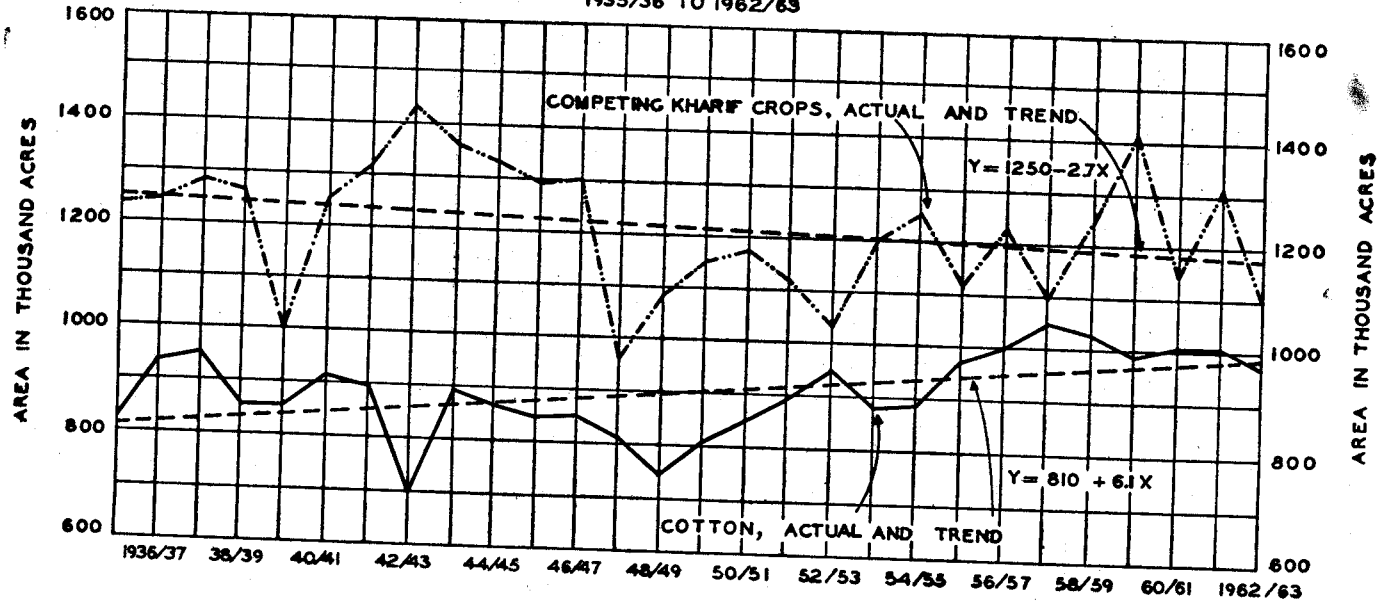
decline in cotton acreage in the old canal colonies of the Punjab was compensated by a corresponding acreage increase in the Multan-Bahawalpur and Sind regions.

It is evident, therefore, that the fall in cotton acreage in the old canal colonies of the Punjab is due to the fact that watertables have been rising in that area for a much longer time than in other areas of the province.

Cropping Pattern in Different Watertable-Depth Zones in the Punjab

To test further the influence of rising watertables in the areas under cotton, detailed *tehsil*[6] figures of the area under other competing crops have been collected for the year 1947/48 to 1962/63. *Tehsil* data for earlier years are not available for all *tehsils* of the Punjab. A watertable-depth map[7] prepared by the West Pakistan Water and Power Development Authority was superimposed on a Survey-of-Pakistan map showing *tehsil* boundaries; and with the help of annual watertable-depth records[8], the main cotton-growing *tehsils* have been grouped according to watertable depth as follows:—

  i) Areas with watertable 15 feet or more

  ii) Areas with watertable 10 to 15 feet

  iii) Areas with watertable 5 to 10 feet

  iv) Areas with watertable 0 to 5 feet

The results are shown in Figure IV.

As the rise in the ground watertable and the corresponding fall in cotton acreage has been greatest in the old canal colonies of the Punjab, the areas under cotton and other competing crops in different watertable-depth zones within that region have been analysed. The sixteen years after Independence have been divided into 4 periods of 4 years each, and the area under cotton and competing crops was averaged for each period. The results are presented in Table II.

In the areas free from waterlogging, cotton still forms more than 50 per cent of the *kharif* acreage as it did throughout the old canal colonies of the Punjab some 20 to 30 years ago, although there is a consistent fall in this ratio all through the 16-year period. In areas with watertable between 10 to 15 feet of the ground surface, the area under cotton is about 5 per cent less than in the zone free from waterlogging. In areas where watertable has risen within

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6 The term *tehsil* is used in the Punjab, Multan and Bahawalpur for a territorial unit of civil administration, the subdivision of a district.
   7 *Programme for Waterlogging and Salinity Control in the Irrigated Areas of West Pakistan, op. cit.,* plate IV.
   8 *Basic Data Release Nos. 3 and 5, op. cit.*

FIGURE IV
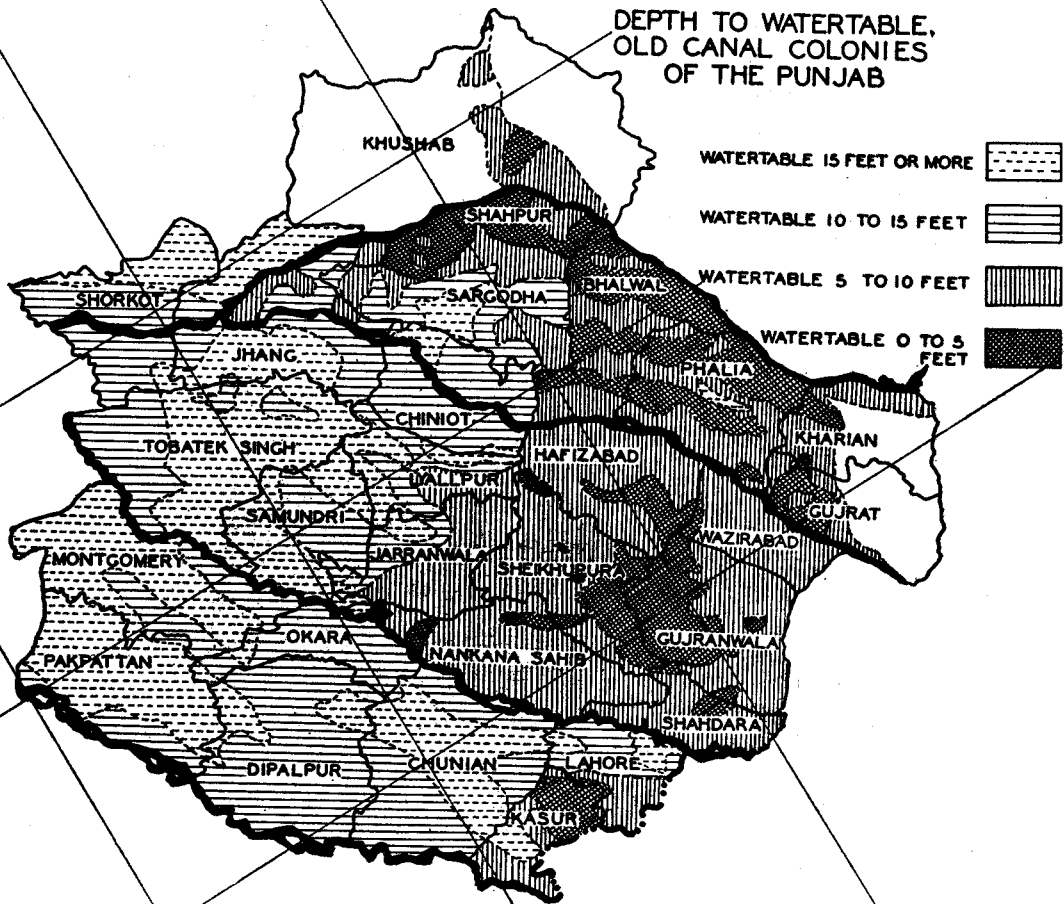
DEPTH TO WATERTABLE,
OLD CANAL COLONIES
OF THE PUNJAB

WATERTABLE 15 FEET OR MORE
WATERTABLE 10 TO 15 FEET
WATERTABLE 5 TO 10 FEET
WATERTABLE 0 TO 5 FEET

TABLE II

AREA UNDER *KHARIF* CROPS AND PERCENTAGE UNDER EACH CROP IN DIFFERENT WATERTABLE-DEPTH ZONES IN OLD CANAL COLONIES OF THE PUNJAB: 1947/48 to 1962/63

Annual average for 4 years	15 ft. or more					10—15 ft.					5—10 ft.					0—5 ft.					Total				
	Cotton	Rice	Sugarcane	Jowar, Bajra Maize	Total	Cotton	Rice	Sugarcane	Jowar, Bajra Maize	Total	Cotton	Rice	Sugarcane	Jowar, Bajra Maize	Total	Cotton	Rice	Sugarcane	Jowar, Bajra Maize	Total	Cotton	Rice	Sugarcane	Jowar, Bajra Maize	Total
Area in Thousand Acres																									
1947-50	202	24	30	77	333	414	99	82	229	824	362	178	97	378	1015	15	166	21	164	366	993	467	230	848	2538
1951-54	206	30	49	89	374	456	106	115	245	922	388	207	129	341	1065	21	208	23	165	417	1071	551	316	840	2778
1955-58	217	30	67	96	410	470	102	138	250	960	418	218	192	369	1197	29	269	39	184	521	1134	619	436	899	3088
1959-62	231	43	85	99	458	462	150	177	246	1035	385	325	245	411	1366	17	350	39	175	581	1095	868	546	931	3440
Percentage of the *Kharif* Acreage																									
1947-50	60.7	7.2	9.0	23.1	100.0	50.2	12.0	10.0	27.8	100.0	35.7	17.5	9.6	37.2	100.0	4.1	45.4	5.7	44.8	100.0	39.1	18.4	9.1	33.4	100.0
1951-54	55.1	8.0	13.1	23.8	100.0	49.5	11.5	12.5	26.5	100.0	36.4	19.5	12.1	32.0	100.0	5.0	49.9	5.5	39.6	100.0	38.6	19.8	11.4	30.2	100.0
1955-58	52.9	7.3	16.4	23.4	100.0	49.0	10.6	14.4	26.0	100.0	34.9	18.2	16.0	30.9	100.0	5.6	51.6	7.5	35.3	100.0	36.7	20.1	14.1	29.1	100.0
1959-62	50.4	9.4	18.6	21.6	100.0	44.6	14.5	17.1	23.8	100.0	28.2	23.8	17.9	30.1	100.0	2.9	60.3	6.7	30.1	100.0	31.8	25.2	15.9	27.1	100.0

Source: Compiled from data supplied by:
  i) Director, Bureau of Statistics, West Pakistan, Lahore.
  ii) Director, Land Record, Northern Zone, Lahore.
  iii) Director of Agriculture, Lahore Region, Lahore.
  iv) Deputy Directors of Agriculture, Lahore, Multan and Sargodha.
  v) Extra Assistant Directors of Agriculture, Gujranwala, Gujrat, Jhang, Lahore, Lyallpur, Montgomery, Sargodha and Sheikhupura.

Note: Totals exclude area under *Kharif* fodder and minor crops.
Names of the *Tehsils* falling in different watertable-depth zones, along with the names of the districts shown in parenthesis, are given below:—
Watertable 15 ft. or more: Pakpattan (Montgomery), Toba Tek Singh (Lyallpur) and Jhang (Jhang).
Watertable 10-15 ft. deep: Dipalpur, Okara, Montgomery (Montgomery), Samundri (Lyallpur), Sargodha (Sargodha), Chiniot, Shorkot (Jhang) and Chunian (Lahore).
Watertable 5-10 ft. deep: Lyallpur, Jaranwala (Lyallpur), Bhalwal, Shahpur, Khushab (Sargodha), Lahore, Kasur (Lahore), Sheikhupura, Nankana Sahib (Sheikhupura), Phalia, (Gujrat), and Hafizabad (Gujranwala).
Watertable 0-5 ft. deep: Shahdara (Sheikhupura), Gujrat, Kharian (Gujrat), Gujranwala and Wazirabad (Gujranwala).

5 to 10 feet of the ground surface, cotton is now grown only on 28 per cent of the *kharif* acreage. In areas where the watertable is within 5 feet of the ground surface, cotton has practically disappeared and now forms only 3 per cent of the *kharif* acreage. This cotton is grown mainly for home use by the cultivators for manufacture of coarse cloth in the villages and is not a commercial crop.

Agricultural conditions in 1947/48 through 1949/50 were abnormal on account of political disturbances which followed the partition of the sub-continent in 1947. These disturbances affected various areas differently. Area under cotton and other crops in these 3 years, therefore, does not represent a true picture of actual condition which would have existed without these dis-turbances. If the period 1947-50 is omitted and only the remaining 12 years are considered, we find that cotton acreage as a percentage of the total *kharif* acreage has decreased as shown in Table III below:

TABLE III

DECREASE IN COTTON ACREAGE IN DIFFERENT WATERTABLE-DEPTH ZONES OF THE PUNJAB BETWEEN 1951-54 AND 1959-62

Watertable-depth zone	Decrease in cotton acreage (per cent)
Free from waterlogging	8
Watertable 10-15 feet	10
Watertable 5-10 feet	23
Watertable 0-5 feet	42

Source : Calculated from Table II.

Reduction of 8 to 10 per cent in the cotton acreage even in the zones free from waterlogging and with watertable between 10 and 15 feet from the ground surface may be the result of unfavourable relative prices of cotton, but the reduction of 23 per cent in cotton acreage between 1951-54 and 1959-62 in the zone with watertable between 5 and 10 feet from the ground surface and of 42 per cent in the zone with watertable within 5 feet of the ground surface was mainly due to waterlogging which affected cotton more than any other crop.

Rice is grown in standing water and can withstand waterlogging conditions better than any other crop. It is not surprising, therefore, that rice now forms 60 per cent of the *kharif* acreage in areas with a watertable at less than 5 feet

from the ground surface and 24 per cent of the *kharif* acreage in areas with a watertable between 5 and 10 feet from the ground surface, compared with 14 per cent of the *kharif* acreage in areas with watertable 10 to 15 feet from the ground surface and only 11 per cent of the *kharif* acreage in areas free from waterlogging.

Sugarcane is another crop which has gained at the expense of cotton during the last 16 years. It is often stated[9] that area under sugarcane is increasing due to the rise in watertable. This however does not seem to be correct. Sugarcane is now grown on 18 per cent of the *kharif* acreage in areas free from waterlogging and in the same proportion in areas with watertable at 10-15 feet depth or in areas with watertable at 5 to 10 feet depth. Similarly, the increase in the proportion of area devoted to sugarcane in the zone free from waterlogging and the zone with watertable at 5-10 feet depth has been practically the same during the last 4 years, an increase of about 12.5 per cent (that is, from 16 per cent of the *kharif* acreage in 1955-58 to 18 per cent of the *kharif* acreage in 1959-62). This may mean that the factor causing the increase in sugarcane acreage is not the rising watertable but rather rising prices for sugarcane and gur.

Extinction of Cotton on the Right Bank of Indus in Sind

The Sukkur Barrage, opened in 1932, feeds 3 canals on the right bank of the Indus. One of them, called the Rice Canal, provides water only in summer and almost entirely for rice. The other two, called Dadu Canal and Northwest Canal, are perennial and were designed for an intensity[10] of 54 per cent in *rabi* and 27 per cent in *kharif*. The Dadu-Canal area was meant for development into a cotton- and wheat-growing region. The basic plan was, however, complicated by the fact that areas which had been accustomed to rice cultivation were permitted to continue to grow rice. Total rice area, thus, permitted on the Dadu-Canal area was 68,000 acres against 95,000 acres of 'dry' *kharif* crops (cotton, jowar, bajra, sugarcane, fodders, *etc.*). The actual area under cotton, rice and other *kharif* crops on the Southern Dadu Division[11] which forms the major

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9 *a*) Ministry of Food and Agriculture, Government of Pakistan, *Report of the Pakistan Sugar Commission, 1957-59*. (Karachi: Manager of Publications, July 1959), p. 21.
   b) W. P. Falcon, *Farmer Response to Price in an Underdeveloped Area: A Case Study of West Pakistan*. (Unpublished Ph. D. Thesis, Harvard University, July 1962).

10 The term intensity of cropping is used to denote the areas of land cropped in a given year as a percentage of the cultivated land that could be cropped in one year. For example a canal in which one-half of the fields are sown to winter (*rabi*) crops, one-quarter to summer (*kharif*) crops and remainder left fallow, has an intensity of 50 per cent in *rabi* and 25 per cent in *kharif*, or an annual intensity of 75 per cent.

11 Canal-irrigated districts in Pakistan are called Divisions.

TABLE IV

DEVELOPMENT OF *KHARIF* CULTIVATION IN SOUTHERN DADU DIVISION OF DADU CANAL : 1932/33 to 1962/63

Year	Area under				Percentage area under			
	Cotton	Rice	Jawar, Bajra, Sugar-cane	Total area sown	Cotton	Rice	Jawar Bajra Sugar-cane	Total
	(.........thousand acres.........)				(............percentage............)			
1932/33	1.7	18.9	29.2	49.8	3	38	59	100
1933/34	6.0	23.4	26.9	56.3	11	42	47	100
1934/35	8.4	21.7	21 7	51.8	16	42	42	100
1935/36	14.9	22.2	23.6	60.7	24	37	39	100
1936/37	36.8	24.7	22.4	83.9	44	29	27	100
1937/38	39.0	25.1	23.7	87.8	44	29	27	100
1938/39	23.8	27.5	25.8	77.1	31	36	33	100
1939/40	24.1	28.3	23.9	76.3	32	37	31	100
1940/41	33.8	26.7	25.3	85.8	39	31	30	100
1941/42	26.0	27.8	27.8	81.6	32	34	34	100
1942/43	11.5	28.1	30.0	69.6	17	40	43	100
1943/44	8.8	18.0	27.9	54.7	16	33	51	100
1944/45	14.3	27.1	16.2	57.6	25	47	28	100
1945/46	6.4	32.8	25.8	65.0	10	50	40	100
1946/47	8.6	40.3	19.8	68.7	12	59	29	100
1947/48	8.0	40.1	18.9	67.0	12	60	28	100
1948/49	3.3	35.9	22.1	61.3	5	59	36	100
1949/50	2.1	36.6	22.8	61.5	3	60	37	100
1950/51	2.1	46.0	16.6	64.7	3	71	26	100
1951/52	4.5	43.3	16.5	64.3	7	67	26	100
1952/53	5.6	37.0	27.5	70.1	8	53	39	100
1953/54	1.8	41.0	30.9	73.7	2	56	42	100
1954/55	1.5	44.9	25.9	72.3	2	62	36	100
1955/56	3.9	41.4	27.2	72.5	5	57	38	100
1956/57	3.5	33.1	17.7	54.3	6	61	33	100
1957/58	2.8	44.3	20.2	67.3	4	66	30	100
1958/59	1.8	49.4	22.3	73.5	2	67	31	100
1959/60	1.6	52.6	26.1	80.3	2	66	32	100
1960/61	1.7	49.3	22.6	73.6	2	67	31	100
961/62	2.0	53.0	26.5	81.5	2	65	33	100
62/63	0.9	49.5	25.9	76.3	1	65	34	100

Source: Communication from Executive Engineer, Irrigation Department, Southern Dadu Division, Dadu, September 1963.

FIGURE V

DEVELOPMENT OF CULTIVATION ON SOUTHERN DADU DIVISION, DADU CANAL

1932/33 TO 1962/63
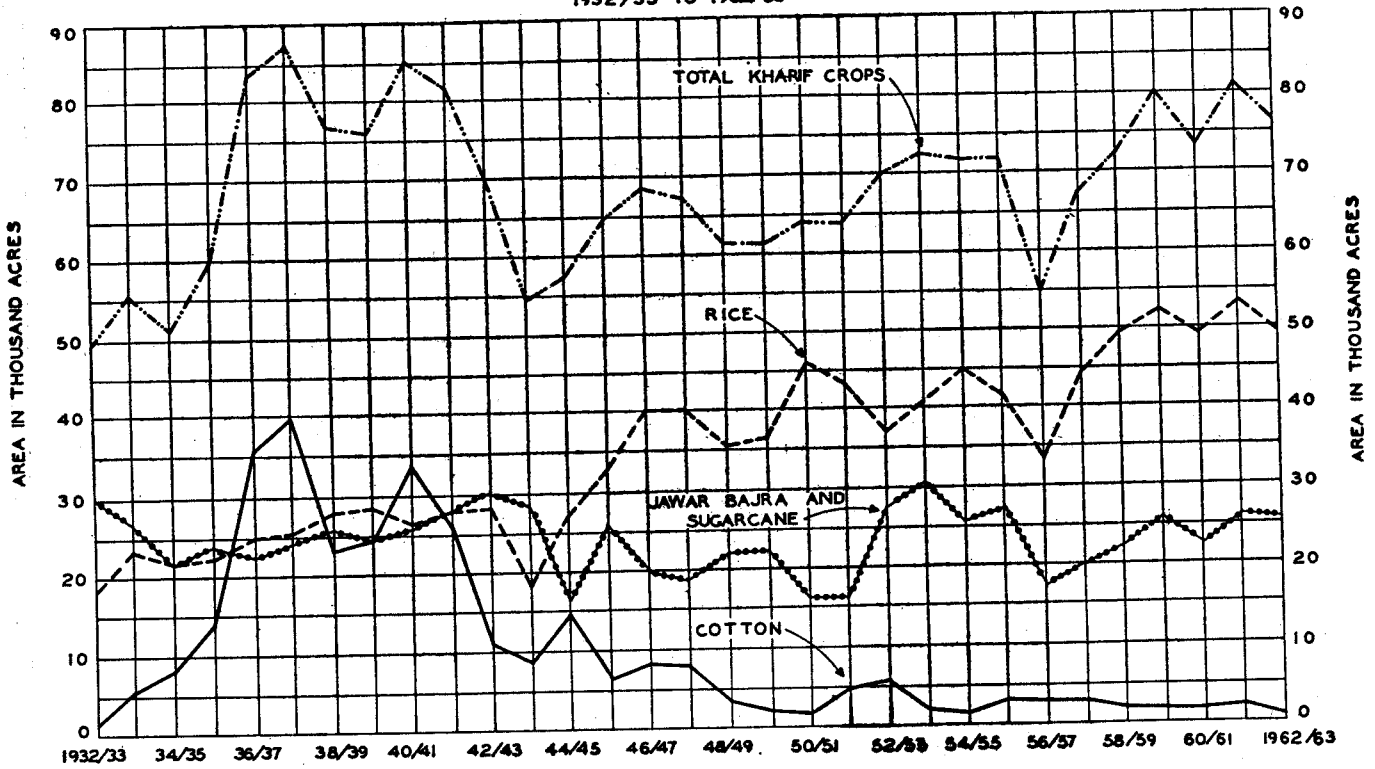
parts of the Dadu-Canal area, from 1932/33 to 1962/63, is given in Table IV and is shown graphically in Figure V. From 1932/33 onward, the area under cotton continued to increase with the expansion of canal irrigation till it reached the designed level of 39,000 acres or 44 per cent of the *kharif* acreage in 1937/38. After 1941/42, however, there was a rapid decline in cotton acreage and it now forms less than 2 per cent of the *kharif* cultivation. Against this, the area under rice has continued to increase from less than 20,000 acres in 1932/33 to more than 50,000 acres in 1962/63. The area under other *kharif* crops, namely, jawar, bajra and sugarcane has shown no trend. The most probable reason for the disappearance of cotton crop on the right bank of Indus after 1941/42 is the rise of watertable in this region brought about by the extension of rice cultivation in a perennial-canal area. Before the opening of Sukkur Barrage, the area was served by inundation canals which carried huge volumes of water to the fields during the high river-flood season and enabled a rice crop to be raised. The canals remained dry throughout the winter and part of the summer season when water was low in the rivers. The ground watertable rose every year during the rice season and went down every year during winter and spring. After the introduction of perennial irrigation in 1932/33, the ground watertable did not go down as much as previously. The mean depth of watertable on the right bank of Indus in 1934 and 1959 is given in Table V.

TABLE V

WATERTABLE DEPTH ON THE RIGHT BANK OF INDUS: 1934 and 1959

Year	Ground water depth	
	April	September
	(.........in feet.........)	
1934	10.4	5.4
1959	8.1	2.2

Source: West Pakistan WAPDA, *Sukkur-Guddu-Ghulam Mohammad Drainage and Salinity Control Project*. Internal Report No. 5, Vol. I. (London: Hunting Technical Services, October 1961), p. 92.

In 1934, the ground watertable did not come within the active root zone of the cotton crop from April to August. After 1941/42 the watertable had begun to come within the active root zone of cotton crop by August and began to kill

the cotton plant. Extension of rice cultivation in perennial canal and the consequent rise of watertable which caused the disappearance of cotton crop from the right bank of Indus after 1941/42, can now cause a similar disappearance of cotton crop from the old canal colonies of the Punjab particularly in areas where watertable has come within 10 feet of the ground surface unless steps are taken to lower the watertable.

III. THE RELATIONSHIP BETWEEN PRICES AND COTTON ACREAGE

There appears to be a general relationship between the prices received by the cultivators for cotton in any year and the area under this crop in the following year. Usually when the prices increase (decrease), the area under the crop increases (decreases) in the following year. The relationship is, however, not consistent; in some years the area increases after the prices decrease while sometimes the area declines after the prices increase.

It is likely that the decisions of the cultivators to increase or decrease the cotton acreage are determined by price of cotton in relation to price of the competing crops and not by the price of cotton alone. Principal crops competing with cotton in the irrigated areas of West Pakistan are sugarcane, rice, jowar, bajra and maize. If, in a particular year, the price of cotton falls by say 20 per cent, but the prices of sugarcane, rice and other competing crops fall more than that, say by 40 per cent, the cotton crop would become comparatively more profitable for the cultivators and, therefore, the area under cotton would increase even though the absolute price of cotton had decreased. Similarly, if in a particular year, the price of cotton increases, say by 20 per cent, but the prices of competing crops increase by a bigger margin, say 40 per cent, cotton would become relatively less profitable, and there would be a decrease in the area under cotton even though absolute price of cotton had increased. We have, therefore, to consider the price of cotton in relation to the prices of competing crops in order to see the effect of prices on the area. Similarly, the area under cotton has to be considered in relation to the area under competing crops. We will test this hypothesis by examining the changes in the ratio of cotton acreage to the area under competing crops and by comparing this with the changes in the ratio of price of cotton to the price of other crops.

Area under cotton and the competing *kharif* crops in the 17 cotton-growing districts of West Pakistan during 1950/51 to 1962/63 and the ratio between these areas is given in Table VI. Similarly, indices of average prices[12] received by the cultivators for cotton and competing *kharif* crops have been prepared and given in the same table. The results are shown graphically in Figure VI.

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12 These are constant-weight indices using the average 1953-55 production of the different varieties of cotton and the various competing *kharif* crops as weights.

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FIGURE VI

PRICE-AREA RELATIONSHIP, COTTON AND COMPETING KHARIF CROPS, WEST PAKISTAN
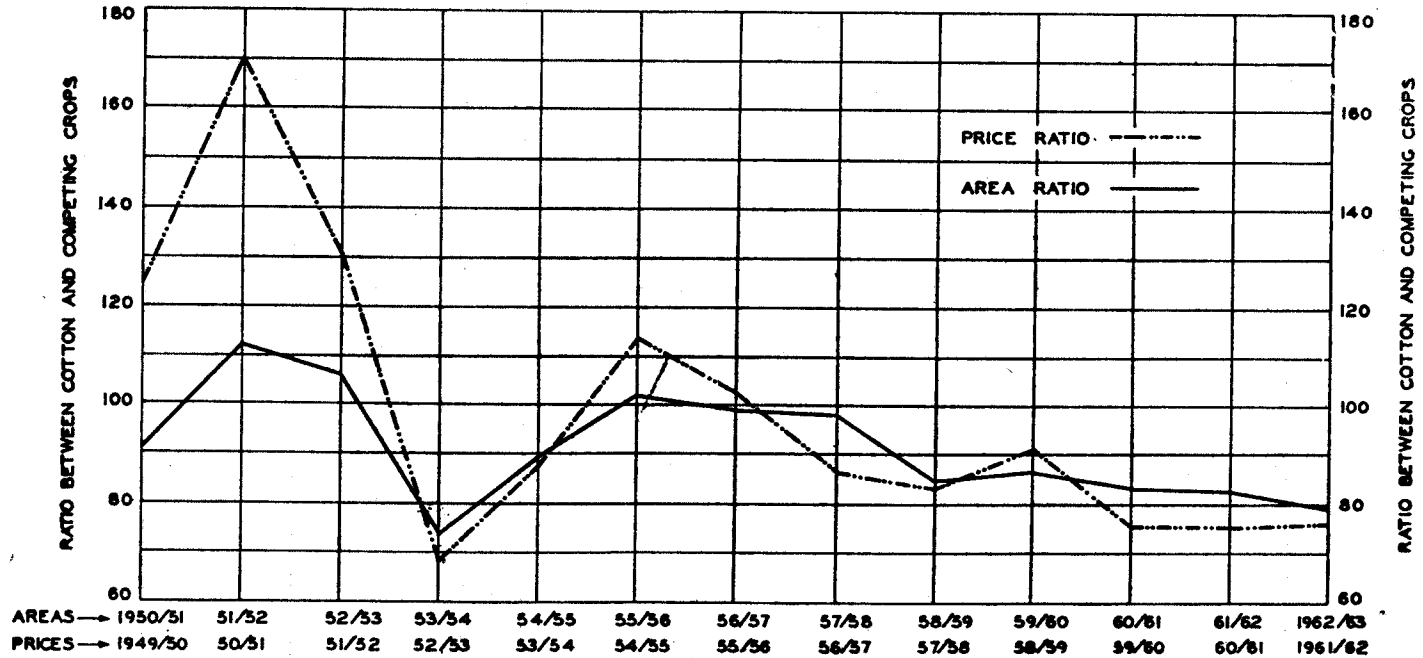
1950/51 TO 1962/63

TABLE VI

RELATION BETWEEN AREA AND PRICE OF COTTON AND COMPETING *KHARIF* CROPS IN WEST PAKISTAN: 1950/51 to 1962/63

	Price indices (1953/54 to 1955/56=100)			Area				Percentage change from previous years in	
Year	Cotton	Competing *kharif* crops	Ratio Col. (2) ÷ Col. (3)	Year	Cotton	Competing *kharif* crops	Ratio Col. (6) ÷ Col. (7)	Price ratio	Area ratio
						(...000 acres...)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1949/50	97.6	78.2	124.8	1950/51	2900	3199	90.7		
1950/51	151.1	88.8	170.1	1951/52	3178	2840	111.9	36.3	23.4
1951/52	153.6	117.9	130.6	1952/53	3279	3095	105.9	—23.2	—5.4
1952/53	82.0	121.1	67.7	1953/54	2676	3667	73.0	—48.2	—31.1
1953/54	92.2	106.1	86.9	1954/55	2997	3352	89.4	28.4	22.5
1954/55	99.3	87.6	113.4	1955/56	3312	3262	101.5	30.5	13.5
1955/56	108.5	106.3	102.1	1956/57	3405	3465	98.3	—10.0	— 3.2
1956/57	119.1	138.1	86.2	1957/58	3456	3539	97.7	—15.6	— 0.6
1957/58	108.0	130.8	82.6	1958/59	3172	3756	84.5	— 4.2	—13.5
1958/59	88.4	97.6	90.6	1959/60	3227	3747	86.1	9.7	1.9
1959/60	112.7	149.0	75.6	1960/61	3169	3805	83.3	—16.6	— 3.3
1960/61	121.1	161.7	74.9	1961/62	3264	3948	82.7	— 0.9	— 0.7
1961/62	119.6	159.1	75.2	1962/63	3272	4172	78.4	0.4	— 5.2
1962/63	109.9	114.3	96.2	1963/64				27.9	

Source: Prices from *Markets and Prices*, 1949 to 1963
Areas from: *a*) *Statistics of West Pakistan, Data by Divisions and Districts. b*) Data supplied by West Pakistan Bureau of Statistics and Regional Directors of Agriculture, Lahore and Hyderabad.

Apparently there exists a close relationship between the ratio of price of cotton to the price of competing *kharif* crops in any particular year and the ratio between the area under cotton and competing *kharif* crops in the following year. This is brought out clearly in Table VI and Figure VI. In 12 years out of 13, between 1950/51 and 1962/63, ratios between the prices and the areas moved in the same direction. In 7 years, the price of cotton in relation to the price of competing crops decreased when compared with the previous year. In all these cases, the area under cotton in relation to the area under competing *kharif* crops decreased in the following year. The average annual decrease in price of cotton in relation to other *kharif* crops was 17·0 per cent over these 7 years. This resulted in an average annual decrease of 8·3 per cent in cotton acreage in these years or 0·49 per cent decrease in area for every 1-per-cent decrease in price. In the remaining 5 years, the relative price of cotton increased compared with the previous year. In the following year, there was an increase in the area under cotton after 4 out of these 5 years. Average annual increase in the relative price of cotton in these 5 years was 21·1 per cent. This resulted in an average annual increase of 11·2 per cent in the area under cotton or 0·53 per cent increase in the area for every 1-per-cent increase in price. We may, therefore, conclude that every one-per-cent rise or fall in the relative price of cotton will bring about an increase or decrease of about 0·5 per cent in the relative area under cotton in the following year. This corresponds closely to results by Walter Falcon[13] who worked with the area and price of cotton in relation to area and price of competing *kharif* crops for 8 districts of the Punjab and estimated an elasticity of supply of 0.42.

During 1962/63, the price of sugarcane (gur) decreased because of the import of sugar on Bonus Vouchers. Further, the export duty on cotton was reduced from Rs. 75 to Rs. 25 per bale. Therefore, the relative price of cotton has shown an increase of roughly 28 per cent over 1961/62. This is likely to bring about an increase of about 14 per cent in the relative area under cotton. If the total area under cotton and other *kharif* crops is the same in 1963/64 as that in 1962/63 (7.4 million acres) the area under cotton in 1963/64 is likely to be 3.5 million acres and that under other *kharif* crops 3.9 million in the 17 cotton-growing districts against 3.3 million acres under cotton and 4.2 million acres under other *kharif* crops in 1962/63. Thus, the area under cotton in 1963/64 is likely to increase by 200,000 acres compared with 1962/63.

Over the longer period, the price of cotton in relation to the price of other competing crops decreased by about 40 per cent from 1949/50 to 1961/62. This has been mainly due to the reduction in the world-market price of cotton and

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[13] Walter P. Falcon, *op. cit.*

an increase in the price of competing crops particularly sugarcane and rice. Restrictions on the import of sugar, export of superior rice under the Export Bonus Scheme and export duty on cotton have all helped to make cotton less profitable compared with the competing *kharif* crops.

Effect of Changes in Cropping Pattern on Value of Agricultural Production

Sugarcane and rice are main crops which have gained in acreage at the expense of cotton.

Irrigation-water supply is the main limiting factor in crop production in West Pakistan. Water requirements of cotton are estimated at 28 to 37 acre-inches per acre while those of sugarcane are estimated at 64 to 80 acres inches per acre by various workers[14]. The farmers are, therefore, able to grow two acres of cotton or one acre of sugarcane with the same quantity of irrigation water.

Price of sugarcane (gur) has increased much more than that of cotton and, therefore, sugarcane has become much more profitable as will be seen from Table VII.

TABLE VII

YIELD, PRICE AND INCOME FROM COTTON AND SUGARCANE

	1955-58		1959-62	
	2 acres of cotton	1 acre of sugarcane	2 acres of cotton	1 acre of sugarcane
Average yield (maunds)	14.0	31.0	15.0	32.2
Average price (rupees per maunds)	26.5	17.8	29.4	25.7
Average value (rupees)	370	550	440	830

14 *a*) Hary F. Blaney and Wayne D. Criddle, *Report on the Irrigation Water Requirements for West Pakistan.* (Denver: Tipton and Kalmbach, April 1957).

  b) Mohammad Shafi Gill, *Fifty Years of Research in Agronomy, Dairy, Poultry, Farming, Water Requirements of Crops, Mechanical Farming and Agricultural Extension.* (Lahore: Department of Agriculture, Government of West Pakistan, 1960).

  e) West Pakistan WAPDA, *Salinity Control and Reclamation Project Number One; Investigations and Background Information.* (Lahore: WAPDA, January 1959).

Gross income from one acre of sugarcane was more than that from 2 acres of cotton and difference has continued to increase in favour of sugarcane. It was, therefore, profitable for the farmers to grow one acre of sugarcane rather than two acres of cotton; hence a part of the area from cotton was switched over to sugarcane. But this reduced the total value (at world-market prices) of cotton and sugarcane produced in West Pakistan. Two acres of cotton yield 15 maunds of seed cotton which gives 1.05 bale of cotton lint, 1·4 maunds of cottonseed oil and 8·6 maunds of cottonseed cake. In foreign exchange, these are equal to Rs. 470, Rs. 85 and Rs. 95 respectively or a total of Rs. 650 in the international market. Against this one acre of sugarcane produces about 332 maunds of cane of which about 300 maunds is crushed. At 8.5 per cent recovery this gives 25.5 maunds or 0.94 tons of white sugar. The value of this sugar in the international market on the basis of the average prices during the 5 years ending April 1963 is Rs. 400 at Rs. 425 per ton, C & F Karachi. Pakistan, thus, loses Rs. 250 in foreign exchange (Rs. 650 *minus* Rs. 400) for every two acres of cotton diverted to raise one acre of sugarcane. Moreover, the cost of setting up sugar mills is much higher than the cost of setting up cotton-ginning factories. If all these factors are taken into account, Pakistan can import nearly twice as much sugar by producing cotton and exporting the same to pay for imports of sugar rather than producing its own sugar.

Rice is another crop which has gained in acreage during recent years as will be seen from Table VIII.

TABLE VIII

INCREASE IN RICE ACREAGE AS PERCENTAGE OF *KHARIF* CROPS
1951-54 to 1959-1962

Watertable-depth zone		1955-58 over 1951-54	1959-62 over 1955-58
		(.........per cent.........)	
Free from waterlogging		—9	29
Watertable 10-15 feet		—8	37
Watertable 5-10 feet		—6	31
Watertable 0-5 feet		3	17
	All areas	1	26

Source: Calculated from Table II.

There was no increase in rice acreage as a percentage of *kharif* crops during 1955-58 compared with 1951-54. Actually, there was a decrease in rice acreage in

areas with watertable at 5 feet or deeper. However, there was a marked increase in the rice acreage during 1959-62 in all watertable-depth zones. This increase appears to have started after the Export Bonus Scheme for superior rice was introduced in the beginning of 1959. This can have serious effects on the agricultural economy of West Pakistan. Rice is a plant of the humid regions, and requires an abundance of water because rice plants must be submerged in standing water during most of growing season of 3 to 4 months. Seepage losses from rice fields are much more than those from fields under any other crop, and therefore, rice cultivation raises the ground watertable. This affects first the cotton crop and ultimately all other crops. Extension of rice cultivation in cotton-growing districts is, therefore, not desirable.

, In terms of foreign exchange earned from the use of a given amount of irrigation water, superior rice does not compare with cotton, even though it is more profitable for the individual cultivator on the basis of value per acre. The average yield, average price, total value of produce and foreign exchange earned from one acre and from one cusec of water when used for cotton and rice are given in Table IX.

TABLE IX

YIELD, PRICE AND VALUE OF COTTON AND RICE FROM ONE ACRE AND ONE CUSEC OF WATER

	1955-58			1959-62		
	Cotton	Coarse rice	Fine rice	Cotton	Coarse rice	Fine rice
(1) Yield (maunds per acre)	7.0	9.2	9.2	7.5	10.6	10.6
(2) Price (rupees per maund)	26.5	16.8	27.4	29.0	20.0	42.4
(3) Income (rupees per acre)	185	145	252	218	212	449
(4) Foreign exchange earned or saved (rupees per acre)	308[a]	—	—	325[a]	—	318
(5) Value in the home market of 84 acres of cotton and 47.5 acres of rice (rupees)	15,500	7,400	12,200	19,700	10,100	21,300
(6) Export value of 84 acres of cotton and 47.5 acres of rice (rupees)	25,800	—	—	27,300	—	15,000

Source: Row (1) Ministry of Food and Agriculture.
          Row (2) *Markets and Prices*, 1955-63.
          Row (3) From Row (1) and (2).
          Row (4) Export price from C.S.O. *Bulletins* and yield per acre from Row (1).
          a) Includes price of cotton, cottonseed cake and cottonseed oil.

During 1955-58, one acre of coarse rice gave a little less and that of fine rice a little more income than that of one acre of cotton. During 1959-62, one acre of coarse rice gave nearly as much income as that of one acre of cotton, but fine rice gave practically twice that income. Therefore, the cultivators diverted a part of the area from cotton to rice, and proportion of

kharif acreage devoted to rice increased by 17 to 37 per cent in different water-table zones (Table VIII).

One cusec of water is used to raise 45 to 50 acres of rice and 80 to 100 acres of cotton and other *kharif* crops in different irrigation projects in West Pakistan[15]. Taking an average figure of 47.5 acres for rice and 84 acres for cotton, we find that cotton is nearly twice as profitable as coarse rice and practically as profitable as fine rice in the Pakistan market.

In terms of foreign exchange earned, cotton gives nearly as much income as fine rice when compared on acre-to-acre basis. However, when compared on the basis of area grown with a unit of irrigation water, cotton earns nearly 70 to 80 per cent more foreign exchange than does fine rice. Shift of area from cotton to rice is, therefore, undesirable not only because it raises the water-table in cotton-growing areas but also because it yields less in terms of foreign-exchange earnings.

Rice is considered important for reclamation of saline lands in West Pakistan by agricultural and irrigation workers and consequently cultivation of rice is prescribed as a necessary condition for provision of extra water for reclamation purposes. Actually, cotton is more resistant to salt than rice and if the ground watertable is lowered, there is no reason why cotton cannot be grown as successfully as rice in such lands. The Salinity Laboratory of the U.S. Department of Agriculture (Riverside, California), working on soils similar to those in West Pakistan, has estimated the increases in yield of various crops that may be expected as a result of desalination of salty lands. This is shown in Table X.

TABLE X

INCREASE IN YIELD OF CROPS FROM DESALINATION

Salt content of the soil before desalination (per cent)	Estimated yield increase from desalination[a]				
	Maize and sugarcane (.......	Rice	Wheat	Cotton	Barley ......per cent......)
0.1	2	2	2	0	1
0.2	185	54	11	3	4
0.3	—	—	33	21	8
0.4	—	—	100	52	18
0.5	—	—	—	100	67

Source: President Kennedy's Science Advisory Committee, *Draft Report on Waterlogging and Salinity in West Pakistan, op. cit.,* p. 49.
a) The values are based on two assumptions: i) that the saturation water percentage of soil is 45, and ii) that good varieties, adequate fertilization and pest control are employed.

15. a) West Pakistan Board of Revenue, *Master Plan for Colonization and Development of the G.M. Barrage Area.* (Lahore: 1961), pp. 24-26.
   b) Salinity Control and Reclamation Project Number One, *op. cit.*

Growing of cotton should, therefore, be encouraged in all perennial-canal areas and cultivation of rice should be discouraged as it raises the subsoil water-table and earns much less foreign exchange as compared with cotton.

IV. CONCLUSIONS

Our analysis of the data relating to cotton acreage has shown that both physical and economic factors have affected cotton production in West Pakistan during the last 25 to 30 years. Over the long-term period, physical factors such as waterlogging have had pronounced influence on the relative decline or growth of cotton acreage in different regions of West Pakistan. In the former Punjab where watertable had come to within 10 to 15 feet of the ground surface by 1940, cotton acreage has decreased by more than half a million acres in the 8 cotton-growing districts of Lyallpur, Sargodha, Montgomery, Jhang, Sheikhupura Lahore, Gujrat and Gujranwala. If the extension of canal irrigation is taken into account, the loss in cotton acreage in these districts since 1935/36 may be put at about 800 thousand acres. Against this, there has been no decline in cotton acreage in Multan and Bahawalpur which are served by nonperennial canals and where there has been very little rise in ground watertable. Similarly, there has been no decline in cotton acreage in Sind where there has been much less rise in watertable. The implication of this conclusion is this: what is needed most is a programme to rapidly lower the watertable and reclaim the waterlogged lands if the former cotton-producing areas of the Punjab are to be brought back into production. At present about 10 million acres in the *Rechna, Chaj* and *Bari Doabs* have watertables within 5-15 feet of the ground surface. Out of these more than 5 million acres have watertable between 5 and 10 feet deep. These are the areas where cotton has suffered the most. These areas are underlain by an aquifer which is comparatively better in quality than the aquifer underlying other parts of West Pakistan. Cost of reclamation of these areas is also much less[16] than the cost of reclamation of other areas which are underlain with a saline aquifer. The greatest increase in cotton production and production of other crops can, therefore, result if salinity control and reclamation projects during the third-plan period are concentrated in these areas rather than being spread over different parts of West Pakistan.

A second conclusion of our analysis is that extension of rice cultivation in areas served by perennial canals completely eliminates the cotton crop after some years. This is because rice is grown in standing water and percolation losses from rice fields are much more than from fields under other crops. This ·

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[16] According to *Revelle Report* cost of reclamation of these areas is estimated at $ 54.5 million per project area of one million acres against $ 135—$165 million in the Southern Zone. For detailed discussion of this problem, *see* "Waterlogging and Salinity in West Pakistan: An Analysis of the Revelle Report", *op. cit.,* p. 264.

raises the ground watertable. Rising ground water first affects the cotton crop and then other crops. Our analysis further shows that increase in rice acreage in the perennial-canal areas of the Punjab has been most marked since 1959/60 when procurement of total marketable crop of superior rice and its export under the Export Bonus Scheme was started. This is probably because the price of coarse rice also increased after the procurement of superior rice started and cultivators found it profitable to switch over from cotton to rice. This can have serious consequences. Cotton was once grown on 44 per cent of *kharif* acreage in the Dadu-Canal area. With the extension of rice cultivation, cotton has practically disappeared from this area. This process may repeat itself in the perennial-canal colonies of the Punjab where cotton once formed 56 per cent but now forms less than 33 per cent of the *kharif* acreage. Extension of rice cultivation is also undesirable because it yields less foreign exchange than cotton from the use of a unit of irrigation water.

A third conclusion of our study is that in the Punjab sugarcane is grown in the same proportion in areas not yet affected by waterlogging (with watertable more than 15 feet deep) as in areas affected by waterlogging (with watertable 5 - 10 feet deep). Furthermore, the rate of increase in sugarcane acreage has been practically the same in areas free from waterlogging as in areas with watertable 5 - 10 feet deep. This shows that contrary to general belief, sugarcane is increasing in the former Punjab not because of a rise in watertable and consequent waterlogging, but because of an increase in relative prices. This results in loss of foreign exchange by diversion of cotton acreage to sugarcane. Pakistan can probably import nearly twice as much sugar by producing cotton and exporting the same to pay for imports of sugar rather than producing its own sugar.

The next important conclusion emerging from this study is that over the short run, that is from year to year, cotton acreage is affected by changes in the price of cotton in relation to the price of competing *kharif* crops. It has been found that every one-per-cent increase or decrease in the price of cotton, relative to the price of competing *kharif* crops, results in an increase or decrease of about 1.5 per cent in the area under cotton. The price of cotton in relation to the price of competing crops will, therefore, have to be increased if a substantial increase in cotton acreage is desired.

In Pakistan, the price of cotton is being kept lower than the world-market price by imposition of export duty, whereas the price of sugar is being kept at 2 to 3 times the world-market price by restrictions on the import of sugar and imposition of import duties. Similarly, the price of rice has been increased in recent years by giving a bonus on the export of superior rice. All these factors

have combined to make the relative price of cotton and of competing crops quite out of line with their prices on the world market. This has resulted in shift of acreage from cotton to sugarcane and rice which results in lower value of total agriculture produce. Best use of agricultural resources—water and land—will result if prices of cotton, sugar and other *kharif* crops are brought, as much as possible, in line with their prices on world market. One way of doing this might be to bring cotton under the Export Bonus Scheme and to link the export bonus on cotton with the import of sugar.

Appendix A

Cotton in the Economy of Pakistan

Cotton has been grown in Pakistan since times immemorial. At present the two principal species grown are the Asiatic and the American upland varieties. The Asiatic cotton, usually called *desi* cotton, is short-stapled and is used mostly for hand spinning; the yarn is used for handloom weaving of coarse cloth in the villages. This type of cotton is also exported to Japan and the United States of America where it is mixed with wool to manufacture carpets and blankets; it is also used as padding for matresses and coverlets and in the manufacture of absorbent cotton.

American upland cotton was introduced into the Indo-Pakistan subcontinent by the British East India Company in the beginning of the nineteenth century, probably to make England independent of foreign supplies of long-staple cotton. However, efforts at growing American cotton in the subcontinent did not succeed until the beginning of this century when a variety known as "4-F Punjab-American" was selected from stray plants growing in cotton fields from seeds originally imported in 1854. By 1925, it had covered more than one million acres, roughly two-thirds of the cotton-crop area of the Punjab. With the expansion of irrigation facilities in the Punjab, Bahawalpur and Sind, the area under cotton continued to increase and reached a level of 3.7 million acres under both the American and *desi* varieties in the late thirties. Since then, the area under cotton has fluctuated between 3.2 and 3.6 million acres and appears to have stabilized at this level. Area under *desi* varieties has continued to decrease so that at present it is only 400 to 500 thousand acres.

The main commercial varieties of American cotton grown at present are 4-F, L.S.S., N.T. Sind, 289-F, AC-134 and *Lasani*. East Pakistan grows cotton on about 40 to 50 thousand acres which yields about 15 to 20 thousand bales. All of it is of *desi* variety.

The annual area sown and production of cotton in Pakistan since Independence is shown in Appendix Table 1-A. In the five years preceding the First Five-Year Plan (1955-60), the average annual area under cotton was 3.21 million acres and the average annual production 1.54 million bales[17]. The average annual yield was 188 pounds per care. During the first-plan period (1955-60), the area under cotton increased to 3.49 million acres and the production to 1.67 million

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[17] Unless otherwise stated, all quantities expressed in bales refer to the Pakistan bale of 392 pounds net as against the 478 pounds net used in the international cotton trade.

bales, the yield remaining constant at 188 pounds per acre. During the first three years of the Second Plan (1960/61 to 1962/63), the area under cotton was 3.39 million acres but the production increased to 1.85 million bales on account of a small increase in the yield to 210 pounds per acre.

Domestic Consumption

No industry in Pakistan has grown faster than cotton textiles. The number of spindles increased from less than 200,000 at the time of Independence in 1947 to more than 2 million at the end of 1962 whereas the number of looms increased from less than 5,000 to more than 30,000 during the same period. Naturally, this led to an increase in the domestic consumption of cotton from approximately 130 thousand bales in 1950/51 to more than 1,300 thousand bales in 1962/63 (Appendix Table A-2). Over the period of the First Five Year Plan, there was an increase of more than 700 thousand bales in the annual consumption of cotton by domestic mills. Production of cotton increased by only 170 thousand bales during this period.

Exports

On account of these developments, exports of raw cotton declined from an annual average of 1,200 thousand bales during 1950-54 (Appendix Table A-3) to about 650 thousand bales during the first-plan period and about 600 thousand bales during the first three years of the Second Plan.

During 1950-54, exports of raw cotton yielded foreign-exchange earnings of Rs. 65 crores a year (Appendix Table A-4). This was 38 per cent of the total export earnings. There were practically no exports of textiles at that time. During the First Five-Year Plan, foreign-exchange earnings from raw cotton and cotton manufactures declined to an average of about Rs. 38 crores a year equal to 24 per cent of the total export earnings. During the first three years of the Second Plan, 1960/61 to 1962/63, foreign-exchange earnings from raw cotton and cotton manufactures declined further to Rs. 27 crores a year, equal to only 14 per cent of total export earnings.

There is no doubt that the reduction in the export of cotton and its consumption by domestic textile mills has substantially reduced the expenditure previously incurred on the imports of cotton textiles. During the five years ending 1954/55, import of cotton textiles and raw cotton averaged Rs. 29 crores a year. These were reduced to about Rs. 4 crores a year during the first-plan period and have continued at this level during the second-plan period. If net earnings from cotton, *i.e.*, cotton exports *minus* expenditure on cotton imports, are considered, these were Rs. 37 crores a year during 1950-54, Rs. 34 crores a year during the first-plan period, and Rs. 23 crores a year during the first three years of the Second Plan.

Possibilities of Increasing Exports

Qualitatively, the Pakistan American varieties of cotton which make up the bulk of our crop range in staple length from 7/8 inches to 1-1/8 inches and are amongst the most popular medium-staple cottons in the world. Pakistan staple cotton varieties, being grown under irrigated conditions, have a marked qualitative superiority over corresponding foreign cottons particularly with respect to uniformity, maturity and fibre tensile strength. In view of these characteristics these cottons are in great demand all over the world; they generally sell at a premium over cottons of the same staple length grown elsewhere. This can be seen from Appendix Table A-5 which shows prices of cotton C.I.F. Liverpool from 1951/52 to 1961/62 for '289-F Punjab-American' and 'N.T. Sind', the two Pakistan varieties[18] commonly exported and compares them with similar cottons grown in the USA, Mexico, Brazil, Syria, Iran and USSR. Only cottons with much greater staple length like those grown in Uganda, the Sudan and Egypt sell at higher price in the world market than the Pakistan cottons.

Annual world trade[19] in cotton, during 1959/60, 1960/61 and 1961/62 was 16.8 million bales[20] of 478 pounds each. Cotton exports from Pakistan during these years were less than half a million bales a year and constituted less than 3 per cent of the world trade in cotton. Cotton exported from Pakistan is, thus, so small a proportion of the supply in the world market and they are in such great demand on account of their qualitative characteristics that even a doubling or trebling of exports would not create any problems for its disposal at world-market prices. This would be clear from the fact that in 1960/61 when cotton production in the country was 1.6 million bales we could export only 350 thousand bales (Appendix Table A-3). In 1962/63 when cotton production in the country was 2.1 million bales we exported 945 thousand bales without any difficulty. Carryover at the end of both seasons was practically insignificant. In the near future (by 1970) world demand for cotton is likely to increase by only 10 to 20 per cent[21] over 1957-59, and cotton prices in the world market are likely to remain weak and will probably decline[22] somewhat due to growing competition of synthetics. However, the continued increase in world population and rising incomes together with the hoped-for improvement in the standard of living, especially in those countries where cotton is particularly well suited for climatic reasons may, still provide ample opportunity for a growth in the demand for raw cotton in the long run.

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[18] For prices of these and other varieties of cotton in the Karachi market, *see,* Appendix Table A-6.
[19] International Cotton Advisory Committee, *Cotton World Statistics*, January 1963, p.16.
[20] Equal to 20.4 million bales of 392 pounds each.
[21] Food and Agriculture Organization, *Agricultural Commodities Projections for 1970.* (Rome: Food and Agriculture Organization, 1962), p. II.72.
[22] *Ibid.*

TABLE A-1

AREA AND PRODUCTION OF COTTON (*DESI* AND AMERICAN)
EAST PAKISTAN, WEST PAKISTAN, AND ALL PAKISTAN : 1948/49 to 1962/63

Year	AREA							PRODUCTION						
	East Pakistan	West Pakistan			All Pakistan			East Pakistan	West Pakistan			All Pakistan		
	Desi	*Desi*	American	Total	*Desi*	American	Total	*Desi*	Desi	American	Total	*Desi*	American	Total
	(.................................000 acres.................................)							(.................................000 bales.................................)						
1948/49	55	403	2196	2599	458	2196	2654	18	132	832	964	150	832	982
1949/50	55	325	2419	2744	380	2419	2799	16	105	1134	1239	121	1134	1255
1950/51	55	415	2601	3016	470	2601	3071	18	160	1246	1406	178	1246	1424
1951/52	56	494	2824	3318	550	2824	3374	18	148	1249	1397	165	1249	1414
1952/53	58	481	2941	3422	539	2941	3480	17	175	1609	1784	192	1609	1801
1953/54	58	376	2494	3870	434	2494	2928	17	161	1264	1425	178	1264	1442
1954/55	58	569	2566	3135	627	2566	3193	17	215	1367	1582	232	1367	1599
5-year average	57	467	2685	3152	524	2685	3209	17	172	1347	1519	189	1347	1536
1955/56	52	528	2950	3478	580	2950	3530	15	222	1456	1678	237	1456	1693
1956/57	53	513	3042	3555	566	3042	3608	14	217	1494	1711	231	1494	1725
1957/58	51	543	3047	3590	594	3047	3641	14	218	1490	1708	232	1490	1722
1958/59	51	457	2797	3254	508	2797	3305	18	159	1370	1529	177	1370	1547
1959/60	52	457	2861	3318	509	2861	3370	18	193	1446	1639	211	1446	1657
5-year average	52	500	2939	3439	551	2939	3491	16	202	1451	1653	218	1451	1669
1960/61	47	406	2789	3195	453	2789	3242	19	172	1520	1692	191	1520	1711
1961/62	39	476	2973	3449	515	2973	3488	17	208	1615	1823	225	1615	1840
1962/63	40	434	2961	3395	474	2961	3435	17	203	1776	1979	220	1776	1996
3-year average	42	439	2908	3346	481	2908	3388	18	194	1637	1831	212	1637	1849

Source: Department of Marketing Intelligence and Agricultural Statistics, Ministry of Food and Agriculture, Rawalpindi.

TABLE A-2

PRODUCTION, DOMESTIC CONSUMPTION, EXPORTS AND IMPORTS OF COTTON IN PAKISTAN: 1948/49 to 1962/63

	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63
	(.... in thousand bales ....)														
(1) Carry forward of stock	18	85	35	102	365	203	151	77	116	111	152	52	22	84	121
(2) Production[a]	959	1310	1373	1655	1699	1429	1503	1801	1583	1605	1557	1632	1625	1764	2083
(3) Imports[b]	4	6	2	6	5	5	4	18	24	4	6	6	6	51	34
(4) Total supply (1 + 2 + 3)	981	1401	1410	1763	2069	1637	1658	1896	1723	1720	1715	1690	1653	1899	2238
(5) Exports[c]	746	1216	1175	1221	1584	994	821	829	614	520	474	462	247	406	847
(6) Domestic consumption[d]	150	150	133	177	282	492	760	951	998	1048	1189	1206	1322	1372	1336
(7) Carryover	85	35	102	365	203	151	77	116	111	152	52	22	84	121	55

a) Trade estimates, *Karachi Cotton Annual No. 20 and Karachi Cotton Annual No. 24.* (Karachi: Karachi Cotton Association, 1957 and 1963).
b) International Cotton Advisory Committee, *World Cotton Statistics*, January 1963.
c) Trade estimates for export of American cotton and *desi* cotton only. Excludes export of cotton waste, linters and yellow.
d) Trade estimates, Karachi Cotton Association.

TABLE A-3

EXPORT OF COTTON FROM PAKISTAN BY DESTINATION : 1948/49 to 1962/63

Year[a]	Japan	UK	Western Europe	Eastern Europe	USSR	USA	China	Hong Kong	Austra-lia	India	Others	Total
	(.. 000 bale ....)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1948/49	75	102	100	34	11	10	56	—	2	339	3	732
1949/50	194	74	333	56	107	5	32	255	41	5	89	1191
1950/51	363	126	316	63	—	1	166	168	49	1	53	1306
1951/52	299	87	202	78	—	1	436	82	12	1	17	1215
1952/53	704	140	435	—	75	12	28	149	33	1	26	1601
1953/54	264	120	240	—	—	24	192	91	40	1	39	1011
1954/55	275	73	158	—	—	26	204	89	23	—	23	871
Average 5 years	381	109	270	28	15	13	205	116	31	1	32	1201
1955/56	360	75	228	—	—	41	96	65	21	1	17	904
1956/57	324	22	143	—	18	39	54	48	3	—	19	670
1957/58	255	25	129	20	11	28	41	45	2	—	20	576
1958/59	297	33	29	24	4	31	80	37	3	—	28	566
1959/60	203	32	33	30	—	42	99	62	6	40	19	566
Average 5 years	288	37	112	15	7	36	75	51	7	8	21	656
1960/61	135	13	17	2	—	31	46	86	4	3	18	355
1961/62	171	34	56	1	—	43	13	72	7	114	13	524
1962/63	335	49	100	16	39	17	79	232	8	46	24	945
Average 3 years	214	32	58	6	13	30	46	130	6	54	18	608

Source: Karachi Cotton Association, Karachi.

a) Cotton Tradeyear = September to August.

EXPORTS AND IMPORTS OF COTTON AND COTTON MANUFACTURES IN RELATION TO TOTAL EXPORTS OF THE COUNTRY: 1950/51 to 1962/63

Year	EXPORTS			IMPORTS			Net trade in cotton	Total exports of the country	Cotton export as percentage of total exports
	Cotton raw and waste	Cotton manufactures	Total	Cotton raw and waste	Cotton manufactures	Total	Col. (4) minus Col (7)		Col. (4) ÷ Col. (9)
	(................................... in crores of rupees ....)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1950/51	98.7	—	98.7	—	48.2	48.2	50.5	255.4	39
1951/52	77.8	0.1	77.9	0.6	64.3	64.9	13.0	200.8	39
1952/53	69.4	0.1	69.5	0.2	15.3	15.5	54.0	151.0	46
1953/54	50.1	0.1	50.2	0.4	7.6	8.0	52.2	128.6	39
1954/55	30.3	0.1	30.4	0.2	6.9	7.1	23.3	122.3	25
Average:	65.2	.1	65.3	0.3	28.5	28.7	36.6	171.6	38
1955/56	47.3	3.6	50.9	1.3	9.1	10.4	40.5	178.4	29
1956/57	36.3	9.4	45.7	2.4	2.5	4.9	40.8	160.8	28
1957/58	22.2	3.3	25.7	.8	1.1	1.9	23.8	142.2	21
1958/59	20.0	5.4	25.4	1.3	.4	1.7	23.7	132.5	19
1959/60	20.7	23.1	43.8	.8	1.5	2.3	41.5	184.3	24
Average:	29.3	9.0	38.3	1.3	2.9	4.2	34.1	159.6	24
1960/61	15.4	11.8	27.2	.8	2.4	3.2	24.0	179.9	15
1961/62	15.0	4.0	19.0	1.8	1.7	3.5	15.5	184.3	10
1962/63	29.0	7.0	36.0	2.4	5.1	7.7	28.3	203.4	18
Average:	19.8	7.5	27.4	1.7	3.2	4.9	22.6	189.2	14

Source: Calculated from C.S.O. *Bulletin.*

TABLE

AVERAGE C.I.F. PRICE OF COTTON AT

Year		United States			Mexico	Brazil	Pakistan		Syria	Iran	Nicaragua
		Orleans Taxas M 15/16"	MemphisTerrit. SM 1-1/16"	California SM 1-1/32"	Matamoros SM 1-1/32"	San Paulo Type 5 1-1/32"	289-F Punjab SG	N. T. Sind RG	SM 1-1/16"	SM 1-1/16"	SM 1-1/16"
							...in U.S. cents per pound...				
1951/52	(1)	45.97	48.90	48.59	47.68	58.90	64.68	—	49.40	—	—
	(2)	43.46	46.16	46.04	43.67	55.75	58.21	—	49.69	—	—
1952/53	(1)	36.27	39.65	39.50	38.08	60.50	35.96	—	35.14	—	—
	(2)	38.36	41.14	41.20	39.66	50.47a	39.08	—	37.96a	—	—
1953/54	(1)	36.97	39.70	39.56	37.43	34.66	40.55	—	38.85	—	—
	(2)	36.99	39.62	39.75	38.01	34.31	39.63	—	38.54	—	—
1954/55	(1)	37.88	40.76	41.99	39.94	38.19	40.65	37.22	38.84	—	—
	(2)	37.59	40.48	41.91	39.10	37.31	40.09	—	38.24	—	—
1955/56	(1)	32.05	42.59	42.43	35.44	31.76	34.46	32.15	35.35	34.54	—
	(2)	32.95	39.75	40.28	35.03	32.53	34.95	32.37	34.76	34.79a	—
1956/57	(1)	28.84	33.64	35.96	33.51	30.99	36.77	32.70	33.07	34.18	—
	(2)	28.38	33.35	34.91	32.63	30.14a	34.24	31.06	32.41	33.08a	—
1957/58	(1)	31.27	36.91	37.68	35.27	—	33.49	30.19	34.03	34.22	32.84
	(2)	30.73	35.80	36.70	33·81	28.66a	33.89	30.15	33.65	33.44	32.28
1958/59	(1)	29.16	33.64	33.60	28.52	—	29.74	25.70	27.57	28.18	25.81
	(2)	28.18	32.70	32.95	28.97	—	30.64	27.05	28.85	29.18	27.63
1959/60	(1)	25.95	29.93	31.70	29.22	25.71	32.08	28.63	30.93	30.63	29.08
	(2)	26.45	29.75	30.75	28.91	—	30.55	27.25	29.43	29.56	28.43
1960/61	(1)	27.87	30.92	32.60	30.06	27.35	32.91	31.10	31.06	30.87	30.19
	(2)	28.15	31.08	32.80	30.07	27.80	32.02	29.31	30.82	30.58	29.81
1961/62	(1)	29.27	31.35	32.66	29.99	27.87	31.97	31.07	30.83	30.82	29.85
	(2)	28.95	31.22	32.74	30.08	27.53a	32.73	29.16	30.61	30.53	29.93
1962/63	(1)b	28.29	31.68	33.90	29.69	26.57	28.03	—	30.90	30.89	29.38

(1) Average for December, January and February.
(2) Average for the year.
a) Average for less than 12 months.
b) Average for February 1963 only.

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LIVERPOOL, ENGLAND: 1951/52 to 1961/62

Uganda	USSR	India	Peru		Sudan		Egypt				Year
B.P. 52	SM 1/1/32"	Punjab Desi Choice	Tanguis Type 5	Pima No. 1 1/9/16"	G5L	G5S	Ashmouni F.G.	Giza 30 F.G.	Karnak F.G.		
(....in U.S. cents per pound..)											
66.30	—	—	60.56	90.87	—	128.69	77.76	—	127.55	(1)	1951/52
56.40	—	—	48.55	72.34	—	88.63	67.85	—	105.04	(2)	
39.03	—	22.24	37.78	45.20	41.82	44.56	42.27	45.29	52.07	(1)	1952/53
42.10	—	25.88	39.54	46.74	—	48.16	44.20	47.79	55.51	(2)	
42.15	—	35.67	41.00	47.26	49.28	51.11	46.98	49.46	53.76	(1)	1953/54
43.64a	—	—	40.72	47.56a	—	—	47.35	99.98	55.06	(2)	
44.26	—	32.98	43.00	54.53	49.89	55.52	47.53	50.45	63.90	(1)	1954/55
44.19	—	—	41.28	50.95	48.09	53.54a	46.86	49.42	60.05	(2)	
44.12	34.94	23.16	37.58	49.73	43.25	50.86	42.26	49.66	65.86	(1)	1955/56
42.96	34.69a	23.50a	37.89	53.49a	46.84	54.41	46.60	52.95	64.65	(2)	
47.94	33.33	30.16	43.21	68.27	58.69	77.02	56.21	62.93	81.11	(1)	1956/57
43.65	32.75	—	42.44a	63.61a	55.22	69.33	49.59	54.76	72.11	(2)	
39.25	35.66	26.13	36.71	53.92	40.68	48.30	40.61	41.55	50.46	(1)	1957/58
37.93	34.60a	25.56a	37.98a	49.19	42.28	48.51	39.76	48.53	49.57	(2)	
29.90	27.43	22.01	29.89	36.09	30.34	32.48	31.31	32.95	34.19	(1)	1958/59
32.87	28.88a	22.73a	31.89	35.76	32.82	34.59	32.44	34.29	35.70	(2)	
39.21	29.83	25.95	38.80	45.42	41.69	43.25	45.54	40.73	47.32	(1)	1959/60
36.72	29.16	—	37.10	43.43	39.69	41.63	42.14	41.12	44.77	(2)	
37.60	30.91	—	33.90	45.67	41.36	45.25	41.13	41.72	47.92	(1)	1960/61
36.95	30.82	—	32.95	43.71	40.14	43.54	41.58	41.51	46.91	(2)	
36.39	30.73	24.11	32.76	43.40	38.32	38.79	—	—	44.13	(1)	1961/62
—	30.77	23.41	32.81	41.38	36.90	38.00	—	—	43.28	(2)	
—	—	—	34.38	39.71	34.86	36.68	—	—	41.11	(1)b	1962/63

Source : International Cotton Advisory Committee,
Cotton World Statistics, 1951 to 1962.

TABLE A-6

AVERAGE PRICE OF COTTON AT KARACHI : 1948/49 to 1962/63

Year	Sind desi	Punjab desi	Baha-walpur desi	4-F		L.S.S.		N.T. Sind		289-F		AC-134		Lasani	
				RG	SG	RG	SG	RG	SG	RG	SG	RG	SG	RG	SG
	(... in rupees per maund ....)														
1948/49	57.94	51.06	—	77.56	80.69	84.00	86.75	83.56	88.44	93.50	97.75				
1949/50	63.69	57.75		72.06	73.56	71.50	77.44	75.50	83.06	76.31	81.75				
1950/51	95.19	93.06		122.81	116.50	115.50	119.69	105.19	109.44	119.31	125.62				
1951/52	99.69	96.44		114.06	116.81	115.31	118.31	118.81	121.56	117.31	123.25				
1952/53	57.19	54.06		56.94	61.75	60.25	63.25	65.25	68.94	63.00	69.06				
1953/54	68.62	65.19	70.56	66.37	71.62	77.87	76.31	68.81	73.87	76.19	81.94				
1954/55	74.87	71.12	73.06	70.69	74.69	74.87	78.87	78.87	83.12	78.10	82.56				
1955/56	69.81	66.62	65.06	75.81	80.81	80.94	86.62	83.56	88.94	87.12	93.94				
1956/57	92.25	87.81	86.12	88.87	93.00	90.81	95.31	90.12	94.69	94.00	104.50				
1957/58	75.31	72.44	71.94	77.50	82.12	80.00	84.25	82.69	88.87	79.37	93.44				
1958/59	66.69	66.62	62.31	61.06	65.69	63.50	68.06	66.62	75.06	70.75	80.19				
1959/60	84.50	71.75	73.44	82.56	89.19	87.31		82.62	87.12	90.12	97.87				
1960/61	102.76	98.22	99.48	88.43	93.70	91.23	95.63	89.26	94.08	95.19	100.06	95.27	97.12	100.96	107.52
1961/62	77.43	75.87	76.31	87.46	94.25	89.16	95.77	88.18	94.68	101.29	109.62	101.51	109.84	104.65	114.65
1962/63	72.45	69.26	70.38	74.23	82.93	79.34	84.19	80.15	84.08	83.82	89.74	84.83	90.78	86.90	93.92

Source: Karachi Cotton Association.

a) For Sind *desi*, Punjab *desi*, Bahawalpur *desi* and N.T. Sind, average for November, December and January. For others average for December, January and February.