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AGRICULTURAL DEVELOPMENT IN PAKISTAN

LESSONS FROM THE SECOND-PLAN PERIOD

by

Walter P. Falcon[1]
Carl H. Gotsch

I. INTRODUCTION.

In contrast to earlier writings on economic growth which concentrated mainly on industrialization, there is now an almost universal acceptance of the key role that agriculture must play in the development process.[2] Yet in spite of this emphasis, there are startingly few agricultural success stories among the less-developed countries. The agricultural bottleneck remains, unfortunately, as one of the largest and most widespread development problems of the 1960's.

It is both the comparison and contrast with the general stagnation in the agricultural sector of the most underdeveloped countries which makes the recent growth of rural Pakistan an extraordinary case study. For Pakistan, in the first dozen years of her separate existence (1947-1959), was typical of much of the underdeveloped world. Many of the initial difficulties can be traced to the political and social upheavals accompanying Partition.

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[1]The authors are Development Advisor, Harvard University and Instructor, Harvard University, respectively.

[2]See, for example, Johnston and Mellor (48) and Nicholls (52). (Numbers in parentheses refer to the references listed at the end of this essay.)

The remainder, however, involved the familiar pattern of reliance on an age-old agricultural technology and of constraints on key agricultural inputs such as water and fertilizer. The result was that the agricultural sector, which comprised some 80 percent of the population and which contributed about 55 percent of the GNP, grew at a rate less than the expansion of population.

During the Second Plan period of 1960/61 to 1964/65, the agricultural picture changed radically. (See Table 1.) The annual agricultural growth rate nearly tripled, rising from 1.2 to 3.2 percent, agricultural exports expanded rapidly, and there was a surge in rural private investment. A closer examination of Pakistan's rural transformation is therefore important not only for understanding the past and prospective development of the world's fifth largest country, but also for the lessons it provides for other countries.

In the sections that follow, a detailed analysis is made of the magnitude and sources of the recent rural growth. The analysis, which focuses on the Second Plan period, is by necessity on a Provincial basis. The monsoon rice-jute agriculture of East Bengal is radically different from the irrigated wheat-cotton-rice culture of West Pakistan, and, in addition, the factors which accounted for growth in the two regions appear to be quite dissimilar. In both regions, however, Government policy has played a key role and particular attention is paid to the policy variables that made the rapid changes possible. The final portion of the paper consolidates the lessons learned in Pakistan's two Provinces during the First and Second Plan periods and indicates their implications for Pakistan's Third Plan and for the rest of the developing countries.

Table I.

Growth in Agricultural Value Added, 1947/48 to 1964/65, All Pakistan (in 1959/60 prices)

	Trend Rates of Growth per Annum*	
	1949/50 to 1958/59	1959/60 to 1964/65
Total Agriculture	1.1	3.2
Major Crops	1.0	3.6
Minor Crops	-1.1	3.6
Livestock	2.2	1.9
Forestry	2.3	3.2
Fishery	6.2	4.9

* Least squares estimate of "b" in the equation: $\log Y = a + b \cdot \text{time}$

Source: Statistical Bulletin (27), August, 1965, pages 932-3.

II. WEST PAKISTAN -- MAGNITUDES AND SOURCES OF RECENT GROWTH.

Magnitude of the Growth

The general growth in West Pakistan agriculture has been an integral part of the two-period national agricultural performance described above. During the years 1947/48 to 1958/59, there were considerable year to year fluctuations, but few of the major crops showed significant increases. "Stagnant" was the adjective most often used to describe the rural environment, and to have predicted a sudden upturn in production would have appeared very rash.

But a sudden upturn did, in fact, take place in the 1959/60 to 1964/65 period. One indication of the surge is given by the trends in the National Account's data shown in Table II. From these series it is clear that the 4.9 percent annual expansion of "major crops" played the decisive role. Because of their growth and absolute level of importance, and also because the data are much more reliable, most of the West Pakistan analysis will focus on the major crops produced in the Indus Basin.[3]

A more disaggregated picture of the widespread improvements within the crop portion of GNP is given in Table III. The computations show that virtually all commodities recorded a sizable and consistent growth during

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[3]Data for the livestock sectors of both East and West Pakistan are particularly suspect. (See Falcon and Gotsch (11) and (13).) The fact that livestock contribute as much to the GNP as combined large and small-scale manufacturing underscores the importance of improving information about the animal-product sector. (See Falcon (5) and (6), for a further discussion of data reliability for the major crops.)

Table II

Growth of Agricultural Value Added,

1959/60 to 1964/65, West Pakistan

(in 1959/60 prices)

	Percent per Year*
Total Agriculture	3.8
Major Crops	4.9
Minor Crops	4.8
Livestock	1.9
Forestry	3.9
Fishery	9.7

* Least squares estimate of "b" in the equation: $\log Y = a + b \cdot \text{time}$

Source: Computed from Interim Report of the National Income Commission (28), page 106. 1964/65 data obtained directly from the Central Statistical Office.

Table III

Crop Production in West Pakistan, 1959/60 to 1964/65,

Average Levels and Rates of Growth

Crop	Average Production (thousand tons)	Annual Rate of Growth*
Rice	1,127	7.8 per cent
Wheat	4,021	3.7
Bajra	375	6.9
Jowar	247	3.7
Maize	485	3.4
Barley	120	-6.2
Gram	614	(b)
Other Pulses	180	(b)
Sugarcane	14,757	10.6
Rape and Mustard	236	(b)
Cotton Seed	682	7.6
Potatoes	123	9.0
Onions	129	12.0
Other Vegetables	730 (c)	(a)
Fruits	980 (c)	(a)
	(thousand bales)	
Cotton Lint	1,934	7.1
	(million pounds)	
Tobacco	152	6.7

* Least squares estimate of "b" in the equation: $\log Y = a + b \cdot \text{time}$

(a) Insufficient data for trend calculation

(b) No significant trend at the 5 percent level.

(c) For the years 1960/61 to 1963/64.

Source: Computed from Handbook of Agricultural Statistics(31), pages 70 ff. 1964/65 data supplied by the West Pakistan Department of Agriculture.

the six-year period. While these averages and trends are in themselves impressive, they serve mainly to pose the major question which must be answered in later sections: Was the 27 percent trend growth in crop output during the Second Plan period a weather phenomenon, or was there a more fundamental structural transformation which accounted for most of the growth? In attempting to answer this question it is useful to examine first the increased use of improved inputs which might explain the growth, i.e., to provide a rather crude and descriptive agricultural production function for West Pakistan.

Sources of Growth

Water

Any analysis of agriculture in West Pakistan must begin with a study of the irrigation system. For except in the relatively small rainfed area in the northern portion of West Pakistan, the agriculture of the region is directly dependent on irrigation water from the world's largest irrigation network. This system, the northern portion of which was installed between 1880 and 1930, delivers some 59 million acre feet of irrigation water (m.a.f.) annually to a cultivated area of about 26 million acres. However, production in the Indus Basin area is hampered by water deliveries that are low relative to the area commanded, and by the considerable variation in canal discharges. As a result, water is the key input in the Basin region which produces about 80 percent of the total Provincial output.[4]

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[4] See following page, for note 4.

Prior to 1957/58, there was little that individual farmers could do to supplement their meager water supplies. The public canal system was outside the purview of individual decisions, and traditional means of supplementing water supplies, such as the Persian wheel, were too inefficient for large scale water development. Furthermore, there was relatively little increase in public water supplies at the field level between 1947/48 and 1957/58. To be sure, there were marginal improvements in the existing canal system, several canals were run somewhat above their designed capacity, and a start was made on several major barrage areas in southern West Pakistan.[5] But these were in part offset by the vagaries in canal flows resulting from the Indus Basin dispute with India.

There is one irrigation program in the earlier period, however, which does deserve special comment. For approximately 30 years the Department of Agriculture had been sinking a limited number of small mechanical tubewells for private farmers.[6] These wells were designed to tap the high-quality underground acquifer (reservoir) filled by the leakage of water from canals and rivers. While the water actually delivered by these wells was only marginally important -- the Department drilled only 600 wells between 1950/51 and 1954/55 -- these installations helped to spread a new water technology

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[4]The importance of irrigation water as an input to production is developed at length in Falcon and Gotsch (12). Only about 25 percent of the wheat, 1 percent of the cotton, 7 percent of the rice, and 2 percent of sugarcane are grown on a rainfed basis in former Punjab. (Report of the Northern Zone (20), Statement V.)

[5]While the Guddu and Ghulam Mohammed Barrage projects were begun earlier, little of their agricultural development took place before the Second-Plan period. Indeed, most will not occur until the Third Plan.

[6]See Ghulam Mohammed (49), pages 3 ff. for this history.

which was to play a critical role in the Second-Plan period.[7]

Private Ground-water Development: The very brief description of irrigation in West Pakistan set forth above gives only the broadest picture of a very complicated system. Nevertheless, it suggests two important points: (a) that irrigation water was an input with a very high marginal value product (especially in certain critical periods), and (b) that a tubewell technology which had been known for years on the sub-continent had begun, in the First-Plan period, to be disseminated in West Pakistan to farmers and to private firms in the business of sinking wells.

Both of these factors were probably necessary conditions for what was one of Pakistan's most amazing developments during the Second-Plan period -- the surge in private tubewell installations.[8] In 1959/60, about 1350 tubewells were installed, of which approximately two-thirds were sunk by private drillers using a simple precussion technique.[9] By 1963/64, the number of annual installations had accelerated to 6,600. (See Table IV.) As of July 1, 1965, it was estimated that a total of over 31,500 private tubewells had been installed, primarily in the cotton and rice regions of the former Punjab. Of this total, about three-fourths were powered by diesel engines and the

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[7]For an excellent non-technical discussion of tubewells in West Pakistan, see Scientific American, (56).

[8]Another important factor in the surge of private installations was the liberalized import policy. While most of the pumps and engines were manufactured locally, the freeing of such basic commodities as pig iron meant that the small shops which produced the equipment could acquire the necessary inputs. This point is dealt with at length in Falcon and Lewis (14).

[9]Ghulam Mohammed (49), page 12.

Table IV

Location of Private Tubewells by District, Summer, 1964

District (1)	Total No. of Tubewells Installed (2)	Total Electric Tubewells (3)	Total Diesel Tubewells (4)	No. installed in the year 1963/64 (5)
Actual				
Gujrat	719	299	420	274
Sargodha	352	181	171	109
Lyallpur (a)	1,063	291	772	301
Jhang	1,540	448	1,092	304
Mianwali	228	107	121	60
Sialkot	2,458	434	2,024	503
Gujranwala (b)	4,234	1,270	2,964	1,170
Lahore	1,607	856	751	504
Montgomery	4,055	1,175	2,880	1,049
Multan	5,148	624	4,524	1,345
Mozaffagarh	443	-	443	142
D.G. Khan	220	-	220	40
Bahawalpur	398	26	372	122
Bahawalnagar	273	3	270	87
Rahimyar Khan	443	9	434	177
Sheikhupura (c)	460	117	343	125
SUB-TOTAL	23,641	5,840	17,801	6,312
Estimated				
FORMER NORTHWEST FRONTIER PROVINCE	359	310	49	88
TOTAL NORTHERN ZONE	24,000	6,150	17,950	6,400
SOUTHERN ZONE	1,000	50	950	200
TOTAL PRIVATE TUBEWELLS	25,000	6,200	18,800	6,600

(a) Excludes Jaranwala Tehsil which falls in SCARP I.
(b) Excludes Hafizabad Tehsil which falls in SCARP I, but includes Ferozwala Tehsil of Sheikhupura district.
(c) Estimated number of private tubewells in Sangla Hill and Sheikhupura tehsils of Sheikhupura district, Hafizabad tehsil of Gujranwala district, and Jaranwala tehsil of Lyallpur district. The major parts of these tehsils are included in the SCARP I project area.

Source: Institute of Development Economics Survey, completed by Department of Agriculture field staff.

remainder by electricity.[10]

The private tubewells that were installed were of various shapes and sizes, and while from a technical engineering point of view many of them were not very efficient, they all had one point in common -- they were extraordinarily profitable. Installation costs ranged between Rs. 5,000 and Rs. 12,000, with the more shallow electric wells in the rice area at the lower end of the scale, and the deeper diesel wells in the cotton area being relatively more expensive. Most of these wells were installed by cultivators with 25 acres or more, but there were important exceptions. In the Gujranwala area, for example, perhaps 20 percent of the installations were made by investors in the towns who had little or no land.[11] In addition, there was widespread selling of water as smaller farmers attempted to utilize more fully the capacity of their tubewells.

By any standard, the benefits produced by the tubewells were large -- both to the individuals who installed them and to the entire economy. A typical well averaged about one cusec in delivery, i.e., it could produce about 2 acre feet of water in a twenty-four hour day.[12] Annual utilization averaged about 2400 hours,[13] or about 200 acre feet per well. In total, therefore, the

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[10]The rapid acceleration in installations was largely unexpected and unnoticed. As a result, there was some initial controversy about the tubewell data cited above which were acquired in a census undertaken by the Institute of Development Economics in conjunction with the Department of Agriculture. Later recounts in proposed public tubewell project areas and cross checks with land revenue and electrical connection records have verified generally the accuracy of the original I.D.E.survey. These checks are described at length in Ghulam Mohammed (49).

[11]See Tipton and Kalmbach (23), page II-3.

[12]See Harza (22), Appendix Table I.

[13]See Ghulam Mohammed (49), page 15.

estimated 25,000 wells installed during the Second-Plan period increased the annual rate of irrigation water available at the field by about 5 million acre feet.

These 25,000 wells represented an initial investment on the order of Rs. 250 million, a sum thought impossible in West Pakistan's traditional agriculture. Moreover, this investment was an important stimulus to the small-scale machine industry. Whole streets in such cities as Multan, Lyallpur, Lahore, Gujranwala, Sialkot, and Daska have been devoted to the manufacture of pumps and engines, and the skill, ingenuity, and training demonstrated in these shops have been impressive.[14]

Measured in value terms, the returns from these wells were very large. Assuming Rs. 1,100 per year as average depreciation charges, and approximately Rs. 3,000 per year operating expenses, the cost per acre foot of water averaged about Rs. 20. In the case of cotton, for example, where approximately 2.5 acre feet of water per acre were typically used, the total water cost approximated Rs. 50 per acre. The gross return was on the order of Rs. 240 per acre[15] clearly a profitable venture even if the other small costs of production were included.[16] In several more detailed sets of calculations,

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[14]Daska is a particularly interesting town in this respect. A visit in 1961 revealed only very few machine shops. By mid-1965, Daska had become one of the main diesel-egnine centers. Over 120 shops were engaged in production, and total output was about 250 engines per month.

[15]Assuming 8 maunds of seed cotton per acre x Rs. 30 per maund = Rs. 240.

[16]An alternative calculation of the marginal revenue product of tubewell waters has been made by Tipton and Kalmbach (23), page F-26. Using a linear programming framework, Tipton and Kalmbach estimated (continued on following page)

Ghulam Mohammed estimated[17] the annual net income from tubewell installations to range between Rs. 3,000 and Rs. 17,000, depending on the size of farm and the type of installation; he also reported that, in general, the investment pay-out period was less than two years.

General profitability was one major reason for the rapid spread of tubewells. The acceleration in numbers in the 1960's was also aided by public policy. Rates of return, always considerable, were increased by relatively higher and more stable prices for agricultural products; by lower cost power as a result of the Government's electrification program; and by increased availability of pump materials due to the import liberalization program. One might have expected some acceleration in tubewell numbers in any case, if tubewells followed the typical pattern of innovation in agriculture, but the increase in profitability speeded the process, as did the demonstration effect of the public tubewell development program.

The exact contribution of the private tubewells to the growth of

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[16](Continued from preceding page) the value of an additional acre foot of water distributed from October to May and November to April to be worth Rs. 106 and Rs. 97 respectively. The Revelle Report (61), page 428, also using a programming technique estimated the value of water at Rs. 66 per acre foot for Kharif season. In their Tarbela report for Priority Area 1, Harza obtained even higher estimates of value -- 188 rupees per acre foot at the dam, or about 270 rupees at the head of the watercourses. While it should be emphasized that there are some differences in assumptions surrounding these estimates, all of these calculated benefits greatly exceed the capital and operating charges of pumping water cited above.

[17]Ghulam Mohammed (49), page 38 ff.

aggregate agricultural GNP is very difficult to measure.[18] At the start of the Second-Plan period, the revised Master Plan[19] indicated that the total field availability of irrigation water (wells plus surface) in the Indus Basin was approximately 59 million acre feet -- 34 m.a.f. in the Northern zone and 25 m.a.f. in the Southern. Therefore, private tubewells alone during the Second Plan accounted for about a 9 percent increase in irrigation water supplies. This increase in water supplies probably had an equally direct impact on irrigated crop production. It thus appears that private tubewells accounted for about one-fourth of the total 27 percent increase in the value of crop output.[20]

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[18]The difficulty is primarily one of sorting out from short series of aggregated data the three main effects of tubewells: increasing the intensity of cultivation by decreasing fallow, improving the yields per acre, and changing the composition of output -- generally towards higher valued products. Ideally, a measure for each component would be as follows:

In the base year t for the ith crop:

$$\text{Production}_{ti} = I_{ti} \cdot C_{ti} \cdot Y_{ti} \cdot A_t \text{ where:}$$

P = gross production of crop i
I = overall intensity of cultivation (in percent)
C = composition of the cropping pattern (in percent)
A = commanded area
Y = yield per acre

After the installation of the tubewells, and considering year t + 5:

$$P + \Delta P = (I + \Delta I) \cdot (C + \Delta C) \cdot (Y + \Delta Y)\ A$$

$$\Delta P = (\Delta I \cdot C \cdot Y \cdot A) + (\Delta C \cdot I \cdot Y \cdot A) + (\Delta Y \cdot I \cdot C \cdot A)$$

ΔP: t to $t+5$

$(\Delta I \cdot C \cdot Y \cdot A)$: Intensity Effect

$(\Delta C \cdot I \cdot Y \cdot A)$: Composition Effect

$(\Delta Y \cdot I \cdot C \cdot A)$: Yield Effect

[19]Water and Power Master Plan (21), page 41. (Later revised by Harza Engineering Co. to the figure cited above.)

[20]This calculation assumes that 80 percent of gross value of crop production comes from irrigated lands. Thus, .80 x .09 = .072, or about 1/4 of the 27 percent.

The last assumption, of course, implies a constant marginal productivity of water with increased supplies. Such a proposition appears reasonable over a 10 percent range given the large amounts of uncultivated lands and under-employed labor and bullocks that were available in both seasons, the low yields, the cropping pattern changes that this water allowed, and the increased flexibility in total water use that was possible with tubewells. For example, the application of water at certain critical stages made possible by a tubewell installation was likely to have had a very high return. These factors should have been more than sufficient to offset any tendency towards diminishing returns that might have been expected if water supplies had been increased without changing the time distribution of water.[21] Survey work now in progress in West Pakistan by the World Bank should provide more light on this subject, but pending its completion, the proportionality assumption appears to be an appropriate approximation.

In summary, private tubewells played a critical role in the increased agricultural performance of West Pakistan. During the Second Plan, private tubewells probably accounted for about one-fourth of the 27 percent gain in the value of major crops, and their concentration in the cotton and rice area of the Northern zone were major reasons for the spectacular recent growth of these commodities.[22] Moreover, these wells gave tangible evidence

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[21]For a more detailed discussion of the use of increased water see Falcon and Gotsch (12).

[22]Multan Division, for example, produces about 40 percent of Pakistan's total cotton. The 10-15 percent annual rates of growth in cotton during the Second Plan were highly correlated with the installation of over 10,000 private tubewells in the region. The rapid growth of rice in the Gujranwala area can be accounted for similarly. (See Falcon and Gotsch (9), pages 14-16 and Appendix D.)

of the rural resources that were available for high-return, non-traditional investments in agriculture.[23]

Public Ground-Water Development: While the private tubewell development is especially interesting because of its large and unplanned nature, it was definitely not the only element in the water-improvement program of the Second Plan. Indeed, the combined public tubewell and surface water development were almost of equal importance.

The first Salinity Control and Reclamation Project, covering some 1.2 million acres (SCARP I), was completed in 1961. It was the first of many contemplated projects in a wide-spread public program in the field of water development and salinity control that has already attracted world-wide attention.[24]

The SCARP I project consisted of approximately 2000 deep turbine tubewells which averaged about 3 cusecs in delivery. In 1963/64, these wells supplied more than 2.5 m.a.f. of supplemental water to the area. This water was pumped in part for the leaching of salts, and in part for the consumptive use of plants. The increased acreage, the improved yields, and the changes in the composition of output which the public tubewells permitted were the main factors which made for an approximate doubling of output at constant prices. (See Table V)[25] These changes in output had a profound influence on the incomes of cultivators,

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[23]For a provocative discussion of investment in traditional agricultures, see Schultz (57).

[24]See, for example, The Revelle Report (61), Karpov and Nebolsine (43), and Scientific American (56).

[25]See U.S. Agency for International Development (59) for a fuller discussion of progress in SCARP I. This report is particularly good on the impact of extension activities in the project area.

Table V

Increase in Net Value of Production Resulting

from Tubewell Installations, SCARP I[a]

Crops	Irrigated Crops		Net Value of Production		
	Before Tube-wells[b]	1963/64[c]	Before Tube-wells[b]	1963/64[c]	Net Change
	(000 acres)		(000 Rs.)		Percent
Rabi[d]					
Wheat & Barley	179.2	381.3	8,958	24,787	+ 178
Pulses	13.4	9.3	323	327	+ 1
Oilseeds	25.4	14.5	330	305	- 8
Berseem	83.2	181.5	29,129	71,642	+ 146
Fruits & Vegetables	5.0	11.3	3,250	7,359	+ 126
Misc.	8.0	3.2	144	58	- 60
SUB-TOTAL	314.2	601.1	42,134	104,478	+ 148
Kharif					
Rice	104.2	157.3	8,339	14,465	+ 74
Cotton	106.5	91.2	5,964	6,749	+ 13
Sugarcane	61.5	78.9	12,316	23,681	+ 92
Maize	9.3	57.1	547	5,312	+ 870
Kharif Fodder	84.9	134.7	12,308	22,494	+ 82
Misc.	6.6	35.5	117	639	- 470
SUB- TOTAL	373.0	554.7	39.591	73,340	+ 85
GRAND TOTAL	687.2	1,155.8	81,725	177,818	+ 118

(a) This table implicitly assumes that weather and other factors were the same in the before and after calculations. Although not strictly true, the "before-after" differences do not appear to be large.

(b) Progress of Reclamation in SCARP I (18).

(c) Progress Report for the Period October, 1963 to September, 1964. SCARP I (19).

(d) The proportionately large increase in winter crops is due primarily to the fact that a substantial part of the area received only summer water prior to the installation of tubewells.(See Ghulam Mohammed (49).)

though the suddenness and concentration of the water input, severely strained the marketing, storage and transportation facilities of the area. In addition to SCARP I, approximately 0.5 m.a.f. of irrigation water was delivered in the last year of the Second Plan by public wells in Chaj Doab (SCARP II).

There were also a few public tubewells operative in the Southern zone near Khaipur; however, neither public nor private tubewells were significant factors in the former Sind. There were several reasons for this, the most prominent being the limited area (approximately 15 percent) underlain with non-saline ground water directly suitable for irrigation purposes. Also important was the fact that much of the former Sind suffers from regressive tenure arrangements which tend to discourage investment by the individuals who actually cultivate the land.

The contribution of the public tubewells to agricultural growth, as in the case of the private wells, cannot be determined precisely; however, the SCARP I data indicate that increases in output were somewhat less than proportional to improvements in water supplies. There appear to be several reasons for this non-linearity. First, the project was under-designed and tubewell capacity did not exist for the critical sowing periods to permit the planting of maximum acreages. This factor, coupled with the pricing of tubewell water on an acreage, rather than volume, basis gave rise to extremely high seasonal applications of water per acre. Studies by the World Bank consultants indicated that irrigation deltas of as much as 100 inches per acre were being applied to rice, 60-70 inches to berseem, etc. With these high deltas, strongly diminishing returns were present. Second, the SCARP I area

was a severely waterlogged and saline area and that portion of the water used primarily for reclamation purposes had a very low direct effect on production. Therefore, even though public tubewells increased total irrigation supplies in West Pakistan by about 5 percent, they increased output by only about 3 percent during the Second Plan period.

Public Surface-Water Development: Between 1960 and 1965, some progress was also made on a number of surface water projects. Included in this category are the Guddu, Ghulam Mohammed and Taunsa barrage developments and a number of smaller schemes outside the Indus Basin. Preliminary estimates[26] indicate that approximately 0.8 million acres of new area were affected. In addition, some 2 million cropped acres received increased irrigation deltas. It is estimated that, in total, an increase of about 3 m.a.f. of water was utilized for crop production from these sources; however, a firm conclusion must await the final updating of irrigation data.

While the 3 m.a.f. represents approximately 6 percent of the total irrigation supply of the Indus Basin, it is clear that this water also had a less-than-proportionate effect on output. Unlike tubewell installations in settled areas, the development and settlement of new agricultural lands involve relatively long time periods. In the Ghulam Mohammed Barrage area the problems have been particularly difficult, and reported yields in that area are much lower than yields in other irrigated areas of West Pakistan. In addition, increased canal supplies have the same time distribution as the

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[26]Planning Commission (32), Table II.

existing canal water, and thus lack the flexibility of tubewells in meeting critical water demand periods. Hence, the increase in agricultural production from surface water development between 1960 and 1965 was probably on the order of 3 to 4 percent.

If this 3-4 percent is added to the 10 percent increase in output estimated to have resulted from ground water development, additional irrigation water accounts for approximately half of the increase in crop production during the Second Plan period. In addition, the larger and more flexible water supplies helped to "induce" the use of other improved inputs, especially fertilizer, and permitted a greater utilization of underemployed land, labor and bullocks.[27]

Fertilizer

Fertilizer ranks second only to water as an explanatory variable for the increased agricultural growth of the Second Plan, and performance in this field was also influenced profoundly by Government policy.[28] From a base of 31 thousand nutrient tons[29] in 1960/61, consumption more than doubled during the Second Plan period. In 1964/65, it was estimated that about 75,000 nutrient tons were distributed, and the widespread black-marketing of fertilizer that existed throughout the countryside indicated that consumption would have been much greater had more adequate supplies been available.

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[27] See Ghulam Mohammed, (49), pages 9 ff. for a discussion and empirical verification of this point.

[28] See pages 75 ff. for a discussion of policy issues surrounding fertilizer.

[29] Nutrient tons refer to the tons of N, K_2O and P_2O_5 in the various fertilizers.

A comparison of the annual rates in 1965 and 1960 shows an increase of about 45,000 nutrient tons. This amount, although smaller than what might have been hoped for, made an important contribution to growth. A rough idea of the contribution of this quantity to crop production can be obtained by distributing the fertilizer over the major crops and multiplying by the estimated response factor of each crop. These calculations, given in Table VI, indicate that the 45,000 nutrient tons added approximately Rs. 200 million of output. When compared with the estimated gross value of major crops in 1960/61 (Rs. 4290 million), it can be seen that fertilizers contributed about 5 percent to the gross increase in crop production during the Second Plan.

Other Sources

The rough calculations of the previous sections indicate that about 14 percent and 5 percent of the 27 percent Second Plan growth in major crops can be attributed to water and fertilizer development, respectively. Several other categories of improved inputs remain -- plant protection, improved seeds, improved cultural practices, and interaction effects -- and it appears that their combined contributions are on the order of 7-8 percent for the past five years.

Plant Protection: By the last year of the Second Plan, approximately 6 million acres of crops were covered annually by preventive and/or curative plant protection measures.[30] It is estimated that on this acreage the average increase in yield was approximately 10 to 20 percent, with the exact contri-

[30] Planning Commission (34), page 421.

Table VI

Increase in the Value of West Pakistan Agricultural Output During the Second Plan Period from Fertilizer

Crop	Distribution Among Crops (a)	Increment in Nutrient Tons	Tons of Output/ Ton of Nutrient (b)	Value of Output/ Ton of Nutrient (c)	Total increase in Value
	Percent (1)	Tons (2)	Tons (3)	Rs. (4)	Million Rs. (5)
Wheat	35	15,750	9	3700	58.3
Rice	8	3,600	8	4300	15.5
Minor Grains	2	900	10	3360	3.0
Oilseeds	1	450	6	4030	1.8
Sugarcane	22	9,900	150	6720	66.5
Fruits & Vegs.	4	1,800	20	6500	11.7
Cotton (unginned)	28	12,600	4	3580	45.1
	100	45,000			Rs.201.9

(a) Essentially the distribution provided by the Ministry of Agriculture.

(b) These estimates are based largely on Pakistan farm trials conducted by Wahhab and Vermott. (See Wahhab (60)). Results are also summarized in the Revelle Report (61), pages 118 ff.

(c) Subsidized costs of fertilizer to the farmers are about Rs. 900 per nutrient ton. Crop prices are those of the National Income Commission for the year 1959/60.

bution dependent on the particular crop, the intensity of infestation, and the number and timeliness of sprayings.[31,32]

Thus a small part of the 27 percent growth in Second Plan crop production is due to the 4-5 million acre increase in the area treated with plant protection (1965 relative to 1960). When a 15 percent yield factor is applied to the approximately 15 percent of additional cropland covered, the conclusion is that over 2 percent of the growth in gross production is directly attributable to plant protection measures. In addition, these measures helped to "save" increases obtained from the other factors.

Seeds: Much has been written about the necessity of, and potential for, improved seed varieties which are fertilizer responsive.[33] While the future looks quite promising in West Pakistan, especially in the case of wheat,[34] most observers agree that improved seeds have been only marginally important in explaining the recent growth performance. This failure was due to several factors, which include a lack of good foundation stock for many commodities, bureaucratic difficulties in getting good seeds multiplied, and several

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[31] At a "Third Plan" meeting held in Karachi during December 1964, a group of Pakistan agricultural experts suggested the following effects on yields from plant protection: rice, 15 percent; wheat, 10 percent; minor grains, 15 percent; pulses, 10 percent; sugarcane, 20 percent; oilseeds, 10 percent; fruits and vegetables, 20 percent; cotton, 20 percent; tobacco, 15 percent; and other, 10 percent. More research is obviously needed on this important topic.

[32] The drop in cotton production in 1964/65 was thought to be directly related to insect infestations.

[33] See, for example, Borlaug (3), McClung (46), and Herdt and Mellor (39).

[34] Experiments with Mexican varieties have indicated a possible doubling of yields under farm conditions. See Borlaug (3). The past results were sufficiently impressive that about Rs. 0.5 million were sanctioned in 1965 for the importation and disbursement of approved Mexican varieties to leading West Pakistan farmers.

transfers of the responsiblity for distribution among Government Agencies.[35] As a result of all these difficulties, most of the seed improvements came from farmer to farmer transfers of relatively better desi (local) varieties.

Limited survey work indicates that some 3 million additional acres (1965 vs. 1960) were sown with locally-improved seeds during the Second Plan. If a 10 percent yield factor[36] is applied to the approximately 6 percent of the total area affected, slightly less than 1 percent of the five-year growth is explained. It should be stressed that measuring increases from farm to farm seed sales is extraordinarily difficult, and that the data presented here are probably conservative and of the roughest variety. Nevertheless, even if the data are off by a factor of 200 percent, which seems unlikely, the conclusion must still remain that "improved" seeds were not a major element in West Pakistan during the Second-Plan period.

Residual

Several other types of factors were potentially important in explaining the increase in output not attributable directly to "hard" inputs. Among the most important were (1) interaction effects between the various inputs discussed in the previous paragraphs and (2) improved agricultural techniques, and more intensive use of traditional factors of production such as man and bullock labor.

Both types of factors are, of course, difficult to quantify. However, with

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[35] See Planning Commission (34), page 423.

[36] See Planning Commission (32), Table 6.

regard to interaction effects, experimental studies indicate that the increase in yield resulting from the simultaneous application of fertilizer and water are significantly more than additive. For example, the results of various trials throughout the subcontinent show approximately a 25 percent gain in fertilizer response as a result of an adequate water supply. Such evidence, coupled with Ghulam Mohammed's finding that private tubewell farmers used significantly more fertilizer than non-tubewell farmers, leads to the conclusion that the interaction effects from these two inputs alone may have been substantia

Given the low level of extension efforts during the period, it was unlikely that much of the residual output could be attributed to new methods of plowing, weeding, harvesting, etc. In most cases, improvement would have required the adoption of better and more expensive implements; and the failure of all but the very large farmers to move in this direction is a matter of record. Except for the tubewell, therefore, the technology factor was probably overshadowed by production increases attributable to a more intensive use of man and animal labor.

There were two reasons for expecting increases in output from a more intensive use of the traditional factors. The first is the effect of an increasing man-land ratio. Population growth for the Second-Plan period has been estimated at about 2.5 percent per annum, well above the rate of increase in the availability of new cultivatable area. A second reason for expecting a greater commitment of man and animal labor is the significant improvement in the prices received by farmers relative to prices paid. This point is discussed in a subsequent paragraph, but it is worth noting here that economically motivated farmers would respond to the improved terms of trade by moving

upward along their "traditional" production function and hence along the aggregate supply curve. Such an increase in output should be distinguished from increases which result from an upward shift in production functions due to the previously discussed investment in inputs such as water, fertilizer, etc. In summary, the factors mentioned above seem capable of accounting for the residual growth of approximately one-half percent per year.

In addition to interaction effects and movement along the traditional production function, many other forces were at work. Some of these, such as soil conservation, improvements in livestock breeds, etc. undoubtedly had a positive effect on production; others, such as the increase in water-logging and salinity acted negatively. But five years is not a very long period for these variables, which are generally of the slow-affecting, trend variety, and on balance probably tended to cancel one another out. That, at least, is the general assumption of this paper.

A few additional comments are needed about this assumption, and particularly the effect of waterlogging and salinity. Much has been written about the severity of these problems; however, waterlogging and salinity have been building up for from 50 to 100 years and a clear distinction must be made between the absolute levels which are a partial explanation of the present low yields in West Pakistan, and the changes in effect that are likely in a five-year period. It is commonly estimated[37], for example, that the equivalent of from 50,000 to 100,000 acres are being lost due to waterlogging and salinity

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[37] Revelle Report (61), page 63.

each year. Over a five year period, this loss would amount to at most 500,000 acres, which would in turn have the effect of reducing the gross value of crop production by a total of only about 3 percent. (See Table VII.) While this discussion is not intended to minimize the difficulty of waterlogging and salinity problems, it does point out that in the short-run, their effect was small relative to the vast short-run improvements in irrigation.

Summary

Thus it is possible to explain in broad quantitative terms the twenty-seven percent trend growth in major crop output during the Second Plan period. The public and private groundwater development increased irrigation water availability by over 8 million acre feet and also improved the time distribution of water to farmers. These qualitative and quantitative improvements helped to increase the utilization of underemployed land, labor, and bullocks and were directly responsible for more than one-third of the increase in crop output. Moreover, the groundwater development program, and the control which it gave farmers over critical water supplies, helped to "induce" the use of other improved inputs such as fertilizer. In addition to the 10 percent growth from groundwater, approximately 4 percent of the growth came from surface water development, 5 percent from fertilizer, and approximately 8 percent from improved seed, plant protection, and other residual factors. Obviously these percentages, presented rather precisely here, should be viewed only as broad orders of magnitude.

Although there can be differences of opinion about some of the assumptions used in the preceding computations, it is clear that the sustained West Pakistan

Table VII

Estimates of the Effects of Waterlogging and Salinity

in the Second-Plan Period

Crops	Composition (a) of Cropping Pattern	Acres	Yield	Decrease in Production	Prices (b) 1959/60	Decrease in Gross Production Value
	Percent	(000)	mds	(000) tons	Rs/ton	(million) Rs.
Rice	4	20	10	7.3	545	4
Wheat	28	140	11	56.4	410	23
Minor Grains	10	50	9	16.5	350	6
Pulses	15	75	8	22.0	390	9
Sugarcane	6	30	380	417.6	50	21
Oilseeds	9	45	6	9.9	670	7
Fruits & Vegetables	9	45	70	115.4	325	38
Cotton	19	95	9	31.3	900	28
	100	500				Rs. 130 (c)

(a) Cropping patterns and yields are representative of average data for the Northern Zone. See Water and Power Master Plan (21).

(b) Prices are those of the National Income Commission for 1959/60.

(c) The gross value of total production in 1960/61 was Rs. 4290 million.

agricultural growth summarized in Table VIII was more than a weather phenomenon. This conclusion is important for several reasons: first, because it provides a picture of what has happened in rural areas of West Pakistan; second, because it draws attention to the major inputs which have been the quick contributors to agricultural growth; and third, because it suggests a general technique for projecting future growth. It should be added, however, that the investments directly responsible for growth in the Second Plan depended on the public policy towards agriculture, discussed in Section IV.

Table VIII

Sources of Increased Crop Output, West Pakistan

	Percent per Year
Private Tubewells*	1.4
Public Tubewells	0.6
Surface Water	0.7
Fertilizer	1.0
Plant Protection	0.4
Seeds	0.2
Residual: Interaction, Improved Practices, Increased Labor Intensity, etc.	0.6
TOTAL GROWTH	4.9 percent per year

* Cropped area increased about 3 percent per year during the Second-Plan period. This increase has been included under the water categories, since water, not land is the binding resource in most parts of West Pakistan.

Source: As indicated in text of Section II.

III. EAST PAKISTAN -- MAGNITUDE AND SOURCES OF RECENT GROWTH.

Given the great differences between the irrigated Indus Basin and the monsoon rice agriculture of East Bengal, it is striking that the general performance in agriculture in the two regions coincides so closely. From a stagnant era between Partition and the end of the First Plan period, the rural sector in the East, as well as the West, grew quite remarkably during the Second Plan. In recent years, East Pakistan has been nearly self-sufficient in terms of rice, and this performance again raises the question: Was it a climatic phenomenon, or a structural change in agriculture?

Magnitude of Growth

Although the recent agricultural growth has been fairly widespread in East Pakistan (See Table IX), the major contributor to growth has been rice. Hence, most of the present section will concentrate on this commodity which contributes nearly 70 percent[38] of the crop value added. Most of the analysis will be made on the basis of trends, but one general point should be made at the outset: Analysing the growth rate for agriculture in East Pakistan is far more difficult than for the Western Province. In East Pakistan, the general knowledge about agriculture is more limited, and the effect of weather is much more dominant. Floods, droughts, and hurricanes are common occurrences, and the different permutations and combinations of weather effects are almost infinite. As a result of these weather factors, fluctuations about trends in production are very large, and in successive years, variations

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[38] See, Falcon and Gotsch (10), page 52.

Table IX

Growth of Value Added in Agriculture, 1959/60 to 1964/65, East Pakistan (in 1959/60 prices)

	Percent per Annum*
Total Agriculture	3.0
Major Crops	3.2
Minor Crops	2.7
Livestock	2.0
Forestry	3.1
Fishery	2.9

* Least squares estimate of "b" in the equation: $\log Y = a + B \cdot \text{time}$

Source: Computed from the Interim Report of the National Income Commission (28), Appendix XIV. 1964/65 data supplied directly by the Central Statistical Office.

have been as much as 20 percent. These large, weather-induced variations in production make it difficult to estimate with assurance the magnitude of growth in short periods, and even the use of trends or averages over longer periods are not without their difficulties. Given these caveats, however, what can be said quantitatively about agricultural growth between Plan periods, and about progress within the Second Plan period?

Interplan Growth

Table X provides information on rice for three periods. It indicates the stagnant nature of rice production during the 1950's, a period in which the decline in production in the Aman season offset the gains in Aus and Boro seasons.[39] To be sure, Aman production during the First Plan period was marked by floods of record proportions,[40] but the net impression that emerges for the period 1950/51 to 1959/60 is one of large fluctuations about a rather steady level. The Second-Plan period indicates a marked difference, with average production approximately 30 percent greater than during the First Plan, with gains in production for all types of rice.

A 3.4 Percent Growth -- Myth or Reality?

It has sometimes been implied (although usually without supporting evidence)[41] that the reported growth in East Pakistan rice production during

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[39] Aus, Aman and Boro refer to the different seasonal types of rice. They are harvested in July, December, and March, respectively.

[40] 1955 is, in fact, one of the "maximum flood" bases which is used by the East Pakistan Water and Power Development Authority in calculations for flood and drainage projects.

[41] See, for example, Griffen and Glassburner (35), page 3.

Table X

Five-Year Annual Average of Rice Production

in East Pakistan, by Seasons

	"Pre-Plan" 1950/51 to 1954/55 (1)	"First-Plan" 1955/56 to 1959/60 (2)	"Second-Plan" 1960/61 to 1964/65 (3)
		(Thousand Tons)	
Aus	1,829	1,939	2,437
Aman	5,345	5,231	6,765
Boro	335	344	500
TOTAL	7,509	7,514	9,702

Source: Handbook of Agricultural Statistics (31), page 72 ff.

recent years represents nothing more than statistical manipulation. While the agricultural data do have definite limitations, such a charge does not appear warranted.

In the first place, there have been significant improvements in data collection. The start of cluster-sampling for the area data and the beginning of crop-cutting experiments for yield calculations have provided important cross-checks on judgment methods and have generally verified their relative accuracy.[42] In addition, the production data are consistent with the price performance of the last five years. This conclusion is substantiated by the simple, yet revealing, price-quantity models for rice shown in Figures I and II. Figure I indicates the relationship between Aman rice production per capita, (the major type of rice, and the major contributor to production fluctuations) and the rice price prevailing in 40 retail markets between December and February. There is a very strong relationship between the variables, (R^2 = .90) and, if the production data had been artifically adjusted to any substantial degree, there would have been little reason to expect this close correlation and the reasonable price elasticity which it implies.[43] Figure II shows a similar strong relationship for average annual prices and total rice availability per capita. These models, although very crude, do help confirm the fact that a 3.4 percent annual growth in production did occur.

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[42] See, Sample Survey Operation (25).

[43] Neglecting certain problems of specification and statistical identification, Figure V indicates a mean price elasticity of demand for rice in East Pakistan of about -0.75 for the period 1959/60 to 1964/65.

Figure I. Relationship Between Per Capita Aman Rice Production and Average February to March Rice Prices

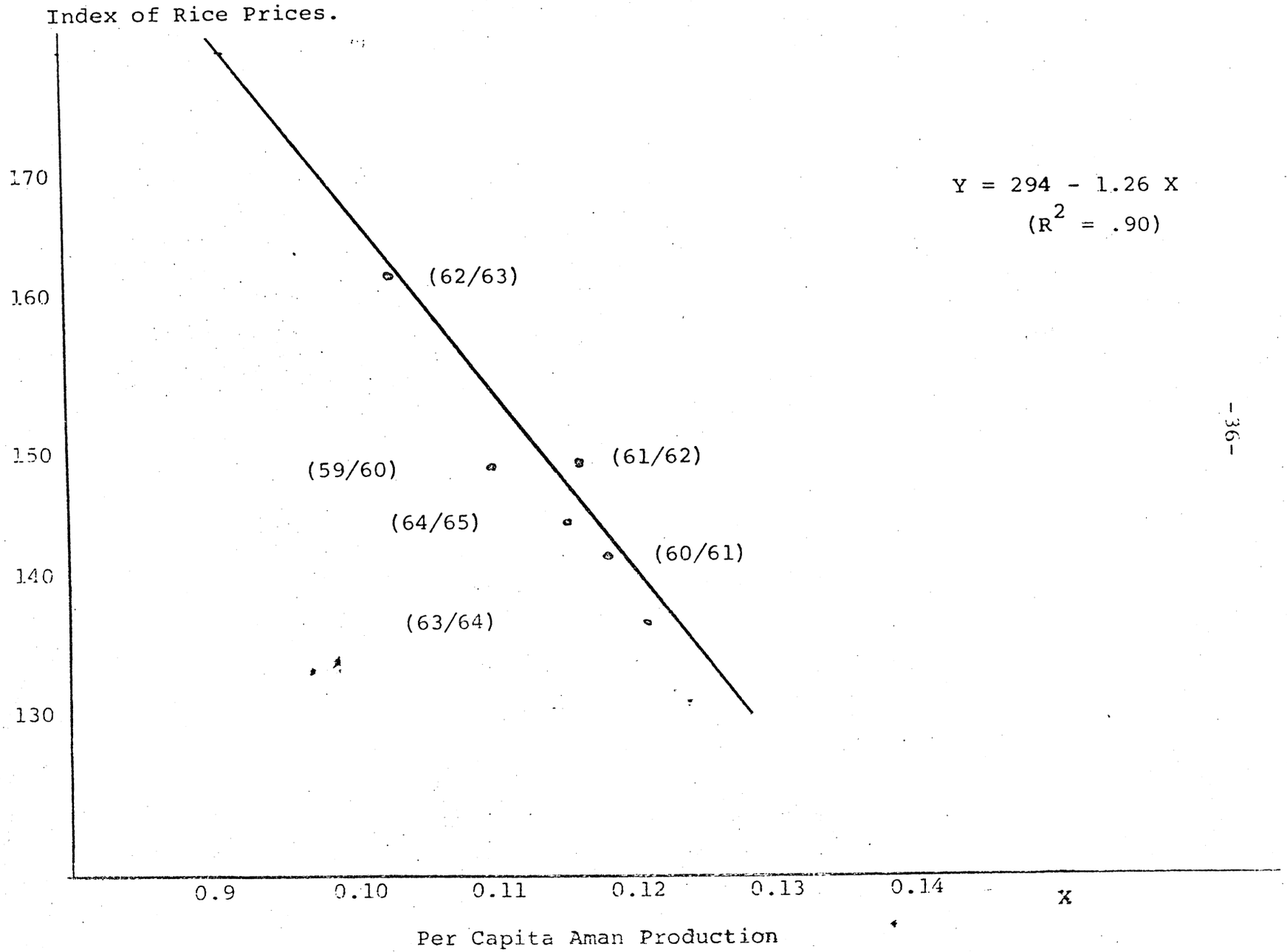
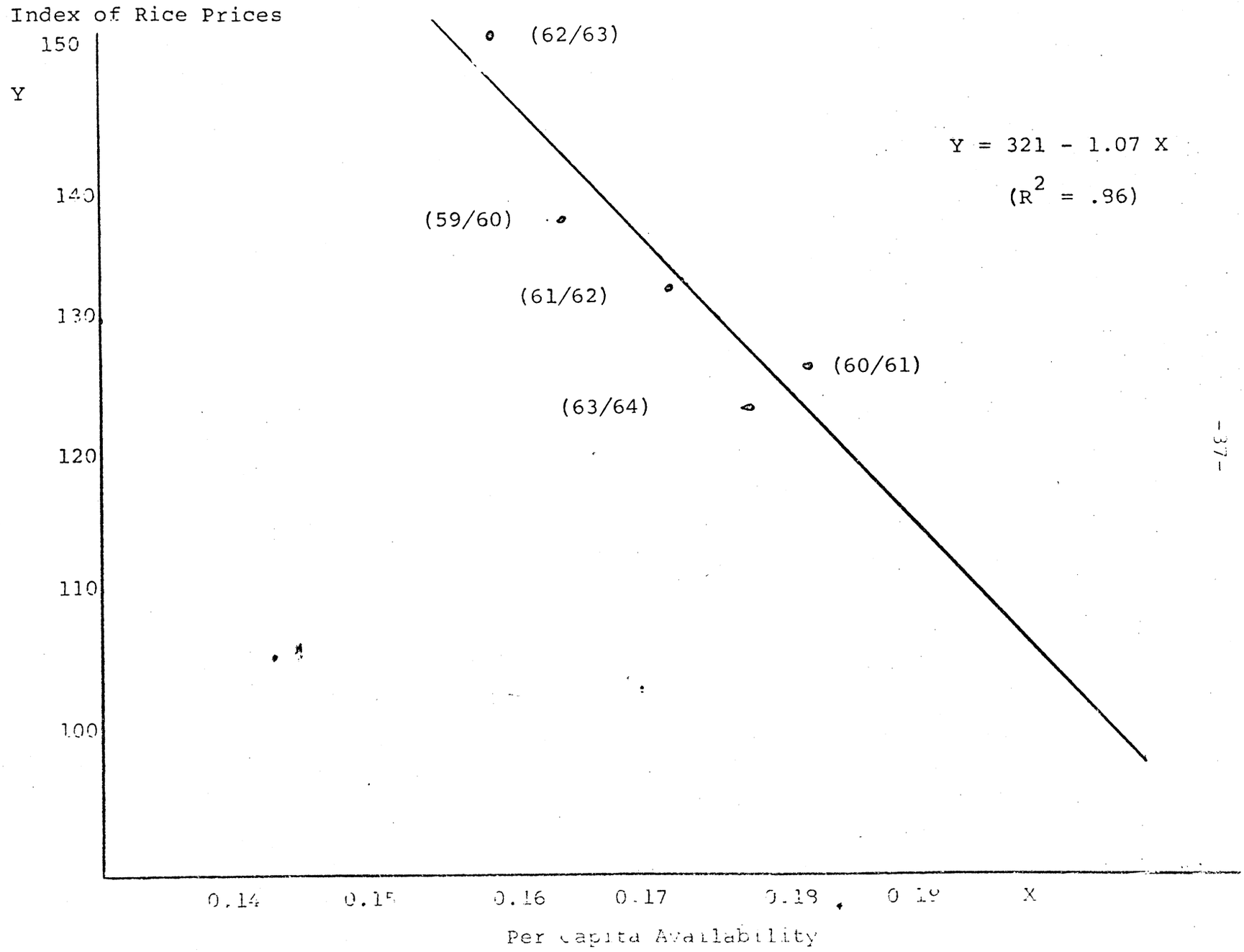


Figure II. Relationship Between Per Capita Rice Availability and Annual Rice Price



Components of Growth

In analyzing the growth in rice production, further insight is obtained by disaggregating total production figures by seasons, and by acreage and yield. Table XI indicates that in Aus season, the gain was primarily from acreage increases; that in Aman, the season when the acreage sown is already near the physical-maximum area, the gains came almost entirely from increased yield; and that in Boro, about 40 percent of the increase came from additional area, and 60 percent from higher yields. Overall, approximately two-thirds of the increase in rice production came from increased yield and about one-third from additional area. Moreover, even though the rate of growth in Boro rice was the most rapid, its contribution to the total growth in rice production was limited (10 percent) because of the relatively smaller size of the Boro harvest. In fact, over 50 percent of the total increase in rice production between 1960/61 and 1964/65 can be explained by improved Aman yields.

Sources of Growth

Acreage Effects

Boro Area: Boro acreage grew about 2.5 percent per year or about 25,000 to 30,000 acres annually during the Second Plan period. One important factor in this growth was the increased irrigation facilities for the winter season. For the seven years ending in 1964/65, the East Pakistan Agricultural Development Corporation (EPADC) supplied approximately 1,500 more power pumps which irrigated nearly 100,000 additional acres. (See Table XII) Since it is estimated that from 80 to 85 percent of the area affected by power pumps went into rice production, the EPADC power-pump program alone explains nearly 15,000

Table XI

Annual Growth Rates of Rice Yield, Acreage and Production by Season

(1959/60 to 1964/65)

	Percent per Annum*		
Season	Yield	Acreage	Production
Aus	0.8**	2.1	2.9
Aman	2.5	0.8	3.3
Boro	3.6	2.6	6.2
TOTAL	2.1	1.3	3.4***

* Least squares estimate of "b" in the equation: $\log Y = a + b \cdot \text{time}$

** No trend at the 5 percent level of significance.

***In terms of total contribution, Aus rice accounted for about 20 percent of the growth, Aman rice for 70 percent and Boro rice for about 10 percent.

Source: Computed from Handbook of Agricultural Statistics (31), page 72 ff.

Table XII

Low-Lift Pump Irrigation in East Pakistan

Year	No. of Pumps	Area Irrigated
1958/59	772	30,000
1959/60	1,130	49,000
1960/61	1,267	65,000
1961/62	1,543	98,000
1962/63	2,024	133,000
1963/64	2,456	156,000
1964/65	2,238	131,000

Source: Hendry and Hpu (38), page 15. 1964/65 data supplied by the East Pakistan Planning Department.

acres out of the annual increase of 25,000 acres in Boro rice. (In addition, this assured water supply on roughly 15 percent of the total Boro acreage was undoubtedly a cause for improved Boro yields). Most of these pumps went into the central region of East Pakistan where Boro area expanded most, and hence there is a simple and straight-forward explanation for much of the Boro expansion.

The remaining increase in area was due primarily to two factors. East Pakistan Water and Power Development Authority (EPWAPDA) schemes accounted for perhaps 3,000 additional acres on an average annual basis. The residual (about 10,000 acres per annum) very probably resulted from a continuation of a long, upward trend in Boro acreage from indigenous irrigation methods. This increase, which is more easily measured in the eight years immediately following Partition when there were few mechanical pumps, seems to have continued throughout the Second Plan period.

Aus Area: Since 1947/48, there has been a very steady long-run increase in Aus area of around one percent per year, or about 120,000 acres annually. One reason for this improvement in output involved the continued development of indigenous irrigation facilities which permitted cropping in the Aus season. A second reason was the strong push of population, and the resulting expansion of area into marginal lands -- marginal in terms of flooding, rainfall or soil characteristics. Finally, part of the increase in acreage was due to the reclamation of land along the coastal areas of southern East Pakistan. For example, some of the large increase in Barisal District was due to improvement in the coastal embankments. Many of these structures seriously deteriorated following Partition and the departure of a large number of Hindu Zamindars

(landowners) who had been instrumental in maintaining them. These dikes are gradually being replaced through large, public-investment programs, and they should be an even more important factor in increased production during the next five years.

Aman Area: As noted previously, there was very little growth in Aman acreage between 1959/60 and 1964/65. While this conclusion is partially dependent on the particular years chosen, it is clear that land use in that season was already "tight" in a physical sense.[44]

Nearly 15 million acres of Aman rice along were harvested each year, which compares with a provincial total of only about 22 million acres of cultivated area. When crop rotations are considered, and when other Aman crops are deducted, there was very little scope for extension of Aman area during the Second-Plan period. To the extent that there was an increase, it was probably due to the same factors mentioned above -- labor pressure, and to a limited extent, improvement in coastal embankments.

Summary of Area Effects: In total, slightly more than one-third of the growth in rice during the Second Plan was due to increased area under rice cultivation. The major causal factors for this increase were the extension of irrigation facilities, the push into marginal lands resulting from population pressure, limited reconstruction of coastal embankments, and some change in rice culture from a one to a two-crop system of Aus and transplanted Aman.[45]

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[44] This point is dealt with at length in Hendry and Hpu (38), page 2 ff.

[45] The acreage under other major crops such as sugarcane, jute and oilseeds also increased during the Second-Plan period. Hence the increase in the area under rice cannot be ascribed to a "substitution effect."

Yield Effects

Approximately 2.1 percent out of the total 3.4 percent increase in rice production during the Second Plan was due to yield improvements. Unfortunately it is impossible to distinguish by season the various inputs which were used to improve rice yields, and it is necessary to take up the various causal factors one at a time without regard to season.

Fertilizer: Fertilizer was one of the major inputs which had an effect on rice yields during the Second Plan period. In 1958/59, only 7,400 nutrient tons were distributed; by 1964/65 this figure had risen nearly six-fold. (See Table XIII.) It is estimated that approximately 75 percent of the total fertilizer was applied to rice,[46] and that on the average, each pound of fertilizer nutrient increased cleaned rice production by about 7 pounds.[47] Thus the 37 thousand ton increase in the annual use of fertilizer on rice probably accounted for an increase of about 260,000 tons of rice. On an annual basis, therefore, fertilizer alone accounted for almost a 0.5 percent increase per year in rice yields during the Second Plan period.

Plant Protection: Increased plant protection activities are another cause for the improved yield performance. As shown in Table XIV, the area treated with preventive and/or curative plant protection measures increased from 427,000 acres in 1959/60 to 4.8 million acres in 1964/65. Since about 75 percent of the pesticides were applied to rice,[48] approximately 3.3 million

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[46] Rashid (55), page 30.

[47] Mears and Hpu (47), Appendix 1.

[48] Monthly Progress Report (24).

Table XIII

Fertilizer Use in East Pakistan,

1958/59 to 1964/65

Year	N	P_2O_5	K_2O	Total
		(Tons)		
1958/59	7,141	244	0	7,385
1959/60	12,057	1,036	792	13,093
1960/61	19,423	3,122	492	23,337
1961/62	19,202	3,174	945	22,868
1962/63	23,657	1.936	1,979	26,537
1963/64	35,350	11,397	2,880	48,726
1964/65	33,740	8,610	1,965	44,315

Source: Mears and Hpu (47), Table 5.

Table XIV

Field Crops Treated with Plant Protection Measures, (1959/60 to 1964/65)*

	(Thousand Acres)
1959/60	427
1960/61	716
1961/62	919
1962/63	2.115
1963/64	2,811
1964/65	4,781

* Excludes Aerial Spraying

Source: Monthly Progress Report, Department of Plant Protection (24)

additional rice acres were protected during the Second Plan period. When a 10 percent yield factor[49] is applied to the 8 percent of the area covered, the net conclusion is that pesticides accounted for about a 0.3 percent per year increase in rice production.

Seeds: The development of new and improved seeds is potentially one of the most important means for increasing rice yields per acre. Although major improvements are yet to come in East Pakistan, the spread of relatively improved local varieties was an important contributor to growth during the Second Plan period.

The seed program was initiated in 1952, with a major emphasis at the beginning on seed selection by the specific-gravity method, and on seed treatment for fungus.[50] The Department also released a number of improved varieties of rice, and by 1964/65, it is estimated that farmer to farmer sales, plus very limited distribution by Government agencies, permitted about 20 percent of the rice area to be covered by the better-quality rice seed. It is estimated that these improved seeds produced yields about 15 percent greater than those from usual local varieties.[51] A combination of these yield and acreage factors suggests that, between 1959/60 and 1964/65, seeds accounted for an annual increase in rice production on the order of 0.5 percent per year.

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[49] Falcon and Gotsch (9), page 19.

[50] By 1964/65, over 3.2 million maunds of rice seed were treated in that year alone by the Department of Agriculture.

[51] See Alim (1), page 42.

This calculation may, in fact, be conservative. Certainly, the potential for seed development was very large, and as Rashid states:[52]

> "No less than sixty improved varieties have been successfully introduced by the Directorate of Agriculture in the last 15 years...the improved Aus and Shail transplanted Aman varieties yield about 20 percent more than the majority of local varieties. In 1957/58, the improved varieties really caught on ... and very soon covered big areas...By 1961/62, there was a definite increase in production, at least half of which is attributable to seeds."

The Residual -- Increased Labor, Changed Technology, and Rural Works: The combined effects of fertilizer, plant protection, and improved seeds have been estimated above to account for about 1.3 percent per year out of the total 2.1 percent yield increase. If another 0.1 percent yield effect is added as a result of more controlled water supplies from irrigation and drainage facilities, there still remains about 0.7 percent per year to be explained by other factors.

One of the explanations for this residual growth centers around the expanding population and the increased ratio of agricultural labor force to cultivated acreage. During the last 15 years average farm size showed a significant decline. The 1960 census of agriculture indicates that over 50 percent of the farm-holdings now fall in the less than 2.5 acre category. When coupled with a larger number of workers per farm, this decline in acreage per farm significantly increased the labor intensity per acre. The general

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[52] Rashid (55), page 26.

increase in labor intensity in turn affected crop production in several ways. First, it was an impetus towards higher cropping intensities on the smaller farm. Such a tendency is illustrated (at least cross-sectionally) in Table XV which shows that farms in the 1 to 2.5 acre category generally have about a 15 percent higher cropping intensity than those of 5 to 7.5 acres.[53] Second, the increased pressure of population probably meant larger quantities of traditional[54] labor per cropped acre, and consequently higher yields. This relationship has been emphasized in several reports. For example, A.K.M.G. Rabbani in his definitive study on jute states:[55]

> "In the major jute-producing areas...the coefficient of labor was found to be highly significant...The input of labor was found to account for nearly 50 percent of the total variation in the yield of jute fibre...The elasticity of labor production...was found to be 0.88, and was not statistically different from unity. This suggested that a 10% variation of labor input per acre accounted for nearly 10% variation of yield rate of jute fibre..."

Similarly, Nurul Islam[56] presents data that show greater yields per acre for smaller farms, and Habibullah[57] states that:

> "Labor plays an inseparable role in agricultural production. The volume, variety and efficiency, of labor is an important determinant of output."

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[53]The intensity effect has already been included in the area expansion discussed earlier. It is presented here only to give a more complete picture of the labor-pressure effect.

[54]"Traditional" is used here to mean an increase in common cultural practices requiring additional labor, e.g., more weeding. The term does not imply a radical change in technology which may also require more labor, e.g., a shift to the "Japanese Method."

[55]Rabbani (54), page 346.

[56]Nurul Islam (41), page 254.

[57]Habibullah (36), page 38.

Table XV

Farm Size, East Pakistan, 1960

Size of Farm	No. of Farms	Cultivated Area	Cropping Intensity	Family Working Members per cultivated acre
	Percent	Percent	Percent**	
Less than 0.5 acres	13	165	1	11.8
0.5 to 1.0	11	170	2	3.7
1.0 to 2.5	27	165	13	1.6
2.5 to 5.0	26	156	27	0.9
5.0 to 7.5	7	148	20	0.6
7.5 to 12.5	7	141	19	0.5
12.5 to 25.0	3	134	14	0.3
25.0 to 40.0	*	128	3	0.2
Greater than 40.0	*	115	1	0.1
Total Number of Farms:	6,139,480			
Total Cultivated Area:	19,138,109 Acres			

* Less than 0.5 percent.

** Complete double cropping would give a 200 percent intensity.

Source: Census of Agriculture (30), page 29.

Finally, the importance of increased traditional labor has been emphasized by Alim.[58] He presents empirical data that show the difference in yield as a result of one versus three weedings of Aus rice may be as much as 7.5 percent and that line sowing (and other related operations) versus broadcasting of Aman rice can improve yields from 8 to 18 percent.

A third factor, which is related yet distinct, involved changes in technology and corresponding increases in labor per acre. For example, the shift to the "Japanese Method" of rice culture involves a series of labor intensive operations that increase yield per acre substantially. Alim reports experiments that show the Japanese Method gives 38 percent greater output per acre. Similarly, the Japanese team at Comilla indicated 94 percent greater Aman yields (involving about 19 percent more labor) from improved methods of cultivation, including fertilizer.[59]

Undoubtedly, the most important cause of increased labor intensity was the decline in the land-man ratio. Not to be overlooked, however, is the effect on traditional labor inputs of a radically altered "terms of trade" for agriculture. In the study by Lewis mentioned earlier, calculations are presented which show that prices received by farmers in East Pakistan between 1951-54 and 1961-64 rose 30 percent while the index of prices paid fell nearly 20 percent. Although the quantitative effects of such a change in relative prices on agricultural output is difficult to establish, the notion that some upward movement along the "traditional" production function has

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[58] Alim (1), page 27 and 45.

[59] Seventh Annual Report (42).

taken place is entirely consistent with the observed increase in labor intensity.[60]

A final group of production effects which are included in the "residual" are those associated with the Rural Works Program.[61] The most important direct effects from this labor-intensive program were from improved drainage.[62] Over 5,000 miles of drainage canals were renovated in both 1963/64 and 1964/65, and these improvements helped in reducing flood losses.[63]

Thus, there is little question that increased labor intensity (brought about by population pressure, changed technology, changes in agricultural terms of trade, and the Rural Works Programme) was an important element in the recently improved yields. Whether it accounted for 0.7 percent of the 2.1 percent growth in rice yields during the Second Plan period can be questioned; nevertheless, that figure is certainly within the range of possibility given that the rural population was growing at over 2.5 percent per year.

Summary

Progress in East Pakistan agriculture during the Second Plan period was encouraging. Unlike the stagnant era of the previous ten years, rice production grew on a trend basis at about 3.4 percent per year. Moreover,

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[60] See S.R. Lewis (44).

[61] General features of the Rural Public Works Programme are discussed in Gilbert (16).

[62] The Works Program is discussed in more detail on pages ff.

[63] On the other hand, the new roads probably deterred drainage in several areas.

this measured growth was real, not a mere statistical manipulation. Approximately one-third of this growth was due to extension of area, the remainder from increased yields, especially during the Aman season. Important factors in the area expansion included the shift into marginal areas as a result of population pressure; the extension of low-life irrigation facilities; some improvement in coastal embankments; better drainage and hence less loss due to flooding; and increased indigenous irrigation facilities. Major elements in the 2.1 percent per year increase in production coming from improved yields were increased fertilizer use, better plant protection, improved seeds and more extensive irrigation and drainage facilities. Quantitative estimates of these contributions are summarized in Table XVI.

Table XVI

Sources of Increased Crop Output, East Pakistan

(percent per year)

Area Expansion (including the effects of low-lift pumps, WAPDA projects, and population pressure)	1.3
Yield Improvement	
Fertilizer	0.5
Plant Protection	0.3
Seeds	0.5
Irrigation and Drainage	0.1
Residual: Increased labor intensity, Improved technology, Rural Works.	0.7
TOTAL GROWTH	3.4 percent per year

Source: As indicated in text of Section III.

IV. THE IMPACT OF AGRICULTURAL POLICY DURING THE SECOND PLAN

The preceding two sections have dealt at length with the physical aspects of the recent increase in agricultural production. But the physical analysis is only a part of the story, and probably the lesser part in terms of the lessons it provides to other countries. Of greater importance, were the rural institutions and agricultural policies that have evolved since the late 1950's. For it was the latter which created the economic climate that permitted or induced the use of improved physical inputs.

"Pragmatic" is a word heard very often in discussions concerning Pakistan's recent economic policy, and indeed, it probably best conveys the attitude of the Pakistan Government on a broad range of issues. Since the late 1950's there were a number of bold Government policy actions in agriculture, most of which were aimed directly or indirectly at improving the price and income incentives to farmers. While it is not possible to go into the history and complete details of all these actions, three examples covering the major steps will indicate the general direction of policy during this period. These examples will also serve to show the extent to which farmers responded to the improved economic climate.

Export Duties

The reduction of export duties on cotton and jute was a relatively simple measure for improving prices to farmers on two of the most important export crops.[64] The duty system of taxation, which was really a revenue measure, had long had the adverse effect of altering internal price ratios against export

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[64]Similarly, the provision of an export bonus on fine-quality rice was another means for improving incentives.

commodites in which Pakistan appeared to have a comparative advantage. These duties were sizable and with the relatively large price responses which farmers had historically demonstrated in the cases of cotton and jute,[65] their effects on production were substantial. In short, these duties produced rupee revenue, but at a considerable cost in terms of lost production and lost foreign exchange.

In the case of cotton, for example, the export duty on American varieties was Rs. 115 per bale in 1958. The negative effect of this duty on the cotton prices which farmers received was on the order of 25 percent.[66] In the post-1958 era, there were several duty reductions, and by 1964/65 the cotton duty had been lowered to a nominal Rs. 25 per bale.[67] The farmer-incentive argument played an important role in these reductions, and certainly harvest cotton prices were much stronger than they would have been in the absence of the policy of lowering duties.[68] These reductions were clear cases, therefore, where government policy had a direct impact on raising the absolute

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[65] See Falcon and Gotsch (12). The price elasticity of supply for cotton and jute have been estimated at 0.4 and 0.7, respectively.

[66] This calculation assumes that it takes 15 maunds of seed cotton to produce one bale of 392 pounds, that the export demand was elastic, and that the harvest price was Rs. 30 per maund of seed cotton.

[67] In one sense, the drop in duty since 1958 was a continuation of an earlier policy. However, the early changes were more the result of an attempt at internal trade stabilization during and after the Korean War, rather than a concern with farmer incentives.

[68] Despite many outcries to the contrary, it appears that most of the reductions in duty were passed back to producers. In any event, cotton harvest prices to farmers remained an almost constant ratio of the Liverpool price minus the duty.

and relative price of cotton, and where policy acted as a contributor to the rather spectacular growth in cotton production.

In the case of jute, the duty-reduction policy was initiated only late in the Second-Plan period. In December 1964 export taxes were halved from Rs. 20 to Rs. 10 per bale. Because of the nature of export demand for raw jute, and because of the lack of information on jute prices received by farmers in East Pakistan, much less can be said about the specific effects of the duty reduction. It is clear, however, that internal wholesale jute prices were much stronger in 1964/65 than they had been in the two previous years. Moreover, the change in jute prices altered relative price ratios in favor of jute. In 1964/65, for example, the average wholesale jute to rice price ratios were about 25 percent and 40 percent greater than they had been in 1963/64 and 1962/63, respectively. Since there is a strong relationship between this price ratio and jute production the following year,[69] the recent downward trend in jute production was reversed in 1965/66.[70] Hence, even though the price policy on jute was too little and too late (given the normal lagged response) to affect the Second-Plan production of jute, Government policy in the final year was one of the factors which helped set the stage for a large expansion during the first year of the Third-Plan period.

Decontrol, P.L. 480 and the Works Program

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[69] See Rabbani (54) for extensive evidence on this point.

[70] This analysis takes, as given, the desire on the part of the Government to expand jute production. Whether expansion is the proper policy given (a) the duopoly position of Pakistan in the world jute trade and (b) the competitiveness of jute with local rice production, would, in itself, be the subject of a lengthy paper.

A second policy centers around the general decontrol of agriculture that took place since 1958. This decontrol is particularly interesting because of the way in which the Government of Pakistan used surplus agricultural commodities provided under U.S. Public Law 480 as an effective instrument of agricultural policy.

The bureaucratic controls that existed in Pakistan in 1958 can only be described as extensive and cumbersome. Many of the regulations, such as the restrictive zoning of surplus areas and non-voluntary government procurement of foodgrains at below market prices in these regions, were introduced during World War II. These had continued through Partition, and were still in effect to varying degrees at the start of the Ayub regime. In addition, there was strict acreage zoning of cotton varieties in West Pakistan to prevent the mixing of staple lengths, and acreage licensing of jute in East Pakistan in an attempt to restrict output and to take advantage of the presumed inelastic export demand for jute and jute products.

Even more controls were added under Martial Law Regulations, and as Haq states:[71]

> "Price and profit controls imposed by the Martial Law regime seems to have sprung from the belief that [the] free market invariably tries to 'exploit' and there is some unique level of price and profits which is 'fair' both for producers and consumers. This showed a fundamental lack of understanding of [the] market mechanism coupled with an excessive faith in administrative efficiency and benevolence. These medieval ideas of a 'just' price naturally led to several absurdities."

By November, 1958, 14 "essential" commodities were under price regulation,

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[71] Haq (37), page 9.

and 87 other items were regulated through various profit laws.[72] While many of the regulations were not totally enforced, they nevertheless had a net negative influence on agriculture. One of the glaring absurdities was that the prices of food grains were held down in the surplus regions. In addition, the Government, always a body of concern and suspicion among villagers, contributed to uncertainty about prices and deliveries through its forced procurement system.

The first effect of these regulations was to lower prices and to provide strong disincentives in the most productive agricultural regions. Second, because of the inadequacy of the rationing procedure, prices were inordinately high and wildly fluctuating in urban and deficit areas. The contrast in the case of wheat in West Pakistan can be seen vividly in Figure III. The plot of prices between Lyallpur, a surplus area, and Peshawar, a deficit region, shows a close correspondence prior to the Martial Law regulations in 1958. This close c orrelation was to be expected in the absence of effective controls because of the good rail connection between these two cities. However, with the militarily enforced controls in late 1958. Lyallpur prices were depressed and Peshawar prices quickly rose and the seasonal pattern of price movement was aggravated. It was thus the worst of both worlds.

Much to the credit of President Ayub, the control system in the economy did not last long. Beginning in February 1959, distribution and export controls were relaxed and controls on profit margins were drastically reduced. In January 1960, rice rationing was virtually abolished in East Pakistan and rice

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[72] Much of the historical discussion of controls presented above is based on Husain (40).

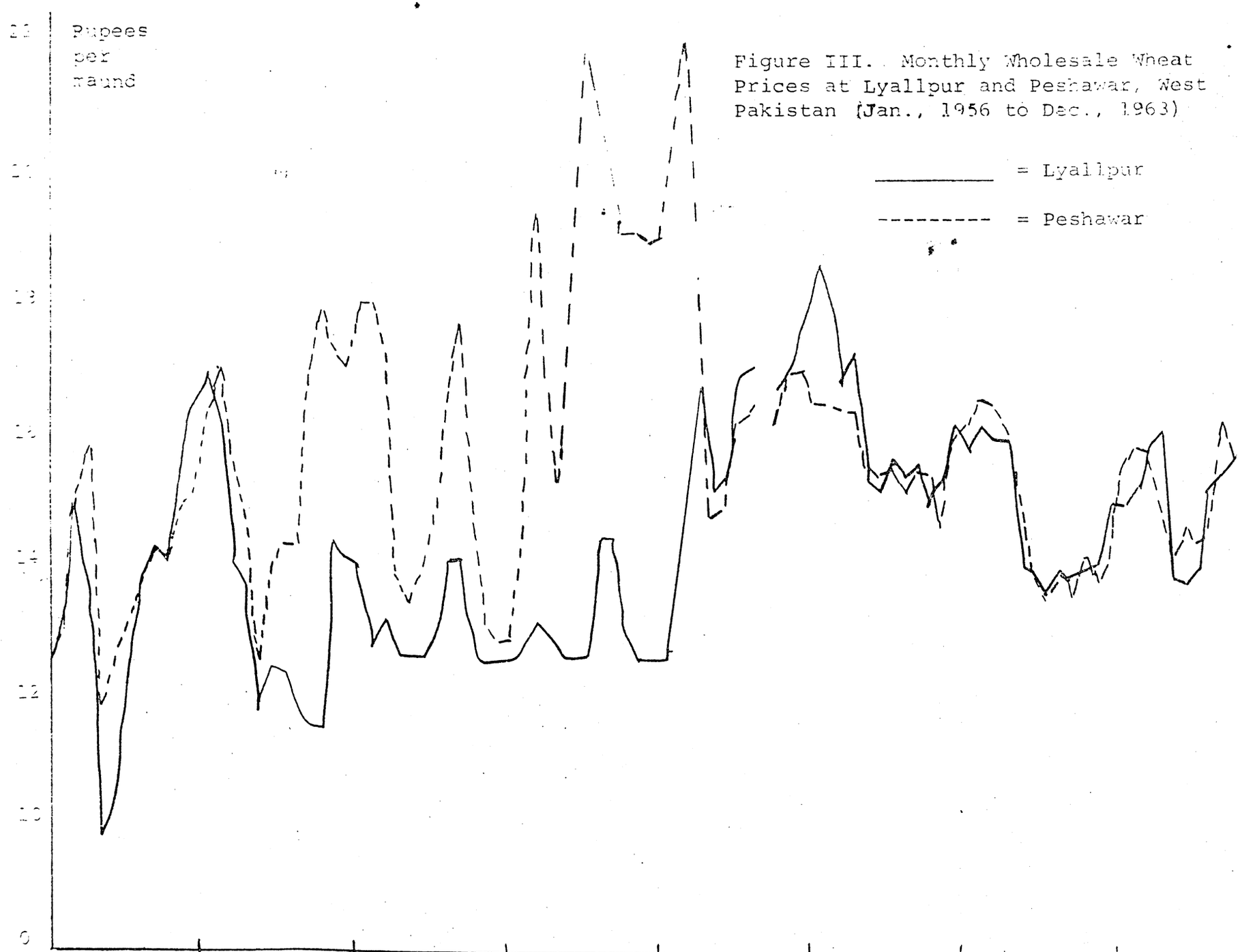

Figure III. Monthly Wholesale Wheat Prices at Lyallpur and Peshawar, West Pakistan (Jan., 1956 to Dec., 1963)

_____ = Lyallpur

--------- = Peshawar

Source: Statistical Bulletin (27)

procurement, except in a five mile border belt, was placed on a voluntary basis. At that time arrangements were also made with Burma for the import of up to 300,000 tons of rice annually to serve as a buffer in the event of short crops and rising prices.

An even larger decontrol action took place in April 1960. In spite of many dire predictions, the direct controls on wheat movements, wheat prices, and wheat rationing were abolished in West Pakistan.[73] Distribution was left instead to the private trade without any of the previous licensing restrictions. A buffer-stock system was initiated which has continued to the present. Under this system, the Government guaranteed farmers a minimum price of Rs. 13.50 per maund of wheat. Sales to the Government were voluntary, and the Government entered usual market channels only when prices dipped below the statutory minimum. A ceiling was also placed on wheat price movements by establishing a release price of Rs. 16 per maund.[74] When prices rose above that level, the Government released wheat into the market. In part these stocks came from Government wheat procured from the support operation, but since the Government was never very vigorous in the implementation of its support activities, the bulk of this wheat came from wheat supplied under the expanded P.L. 480 program. Because P.L. 480 was so critical to the entire decontrol policy, and because

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[73] To a considerable extent, this decontrol in the whole of West Pakistan was made possible by the one-unit rule passed in October, 1955. Under this provision, the former States and Provinces of West Pakistan were consolidated into the one large Province. This unity is in marked contrast to India, where individual states still exercise considerable control over foodgrain movements and prices.

[74] The release price was raised to Rs. 17.25 in the summer of 1966.

it has always been a source of considerable controversy, a few additional notes on P.L. 480 seem warranted.[75]

On balance, there can be no doubt about the importance of P.L. 480 to the development of Pakistan's total economy during the Second-Plan period. In the first place, approximately 15 percent of West Pakistan's wheat was supplied under Title I[76] auspices. This import permitted a stabilization of wheat prices in the Rs. 14 to 18 per maund range, which in turn provided industry with the key wage good at stable prices. This stability, along with import liberalization, were two important factors in permitting West Pakistan industry to grow at about 15 percent per annum in the 1959/60 to 1964/65 period.[77]

In several other respects P.L. 480 commodities were important, and indeed, were almost indistinguishable from hard-currency assistance. Certainly P.L. 480 transfers helped relieve the critical foreign exchange bottleneck, for without them,[78] either (a) foreign exchange would have been required for food imports, thereby decreasing the availability of producer imports in both Provinces, or (b) the threat of inflation would have required a rather drastic reduction in the size of the development plan. Either of these alternatives could have seriously impaired the development of the general economy.

The effect of P.L. 480 on the agricultural sector per se, was less clear, but probably also positive in the long run. First of all, substantial investments

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[75]For a fuller discussion of P.L. 480 in Pakistan see Beringer (2), Gilbert (15), Falcon (4), and Ghulam Mohammed (50).

[76]Sales of U.S. surplus commodities for non-convertible currencies.

[77]Interim Report of the National Income Commission (28), page 104.

[78]Assuming that the P.L. 480 assistance was an addition to total foreign assistance, and that in its absence, other types of aid would not have substantially increased.

within the agricultural sector were offset against P.L. 480 imports. Top priority use went into the Indus-Basin program for the necessary irrigation replacement works on which the future of much of the rural economy of West Pakistan is dependent. Second, the P.L. 480 program was a critical element in the decontrol movement mentioned above. Without the expanded P.L. 480 program, it seems doubtful whether the relaxation of controls would have occurred, or at least whether the decontrol would have survived. It is possible only to speculate about such a consequence, but the disincentive and uncertainty aspects of a continued control system could have been disastrous.

The disincentive aspects of the existing control system also highlight another aspect of the P.L. 480 program. Much has been written about the negative price effects and hence the disincentives to agricultural production of P.L. 480 shipments. However, these arguments generally have started with a basic assumption that perfect competition (in terms of product flows) prevailed initially. But in West Pakistan, the shift from a very low controlled price in surplus area, to a P.L. 480 buffer-stock system, did not lower and perhaps even increased prices and incentives for wheat production in "surplus" regions. (See Figure III)

The P.L. 480 program also aided agricultural development in West Pakistan in a more subtle way. Many observers[79] have rightfully argued that farmers could increase incomes from shifting from lower-valued subsistence crops (such as wheat and sorghums) to cash crops. However, because of uncertainty in prices and yields, farmers in Pakistan had long known that it made good sense to grow

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[79]See, for example, Ghulam Mohammed (49), and Gilbert (15).

sufficient food for home consumption rather than to specialize and depend on the market (or the Government) for foodgrains.[80] Since P.L. 480 wheat added an important element of stability to the foodgrain market, farmers soon learned that they could purchase foodgrains at reasonable prices in the market. The P.L. 480 program thus added an impetus for farmers to move into the higher-valued cash crops. While this shift did not make the foodgrain self-sufficiency proponents in either Pakistan or the United States particularly happy, it made good sense from a broader economic point of view, and was no doubt a contributing factor in the higher relative rates of growth in cash crops shown in Table III.

In East Pakistan, the net effect of P.L. 480 on the rural sector was also positive, though the mechanism was quite different. As was noted in Section III, P.L. 480 commodities were used primarily in support of the Rural Works Program.

This program had several remarkable features.[81] First, it represented one of the initial attempts of Government policy to reduce the severe seasonal unemployment and underemployment that existed in the rural areas of East Pakistan. This problem was (and is) of major consequence since over half of the 7.5 million man-year equivalents of unemployment estimated for 1964/65 were in East Bengal.[82] Second, the program relied heavily on local initiative and organization. Plans of surprising complexity were developed and implemented by farmers and by officers at the lowest levels of Government. Finally, the

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[80] This point is developed at length in Falcon (6), Chapter I.

[81] Much of this discussion is based on Gilbert (16).

[82] Third Plan (34), page 153.

financial support of the program came from the sale of a number of P.L. 480 commodities, primarily wheat. The financing of the program was a particularly revolutionary idea, for everyone "knew" that the rice eaters of East Bengal would never eat wheat.

The Works Program was tested on a pilot basis in Comilla thana in 1962/63 and expanded to the entire Province in succeeding years. The program's primary emphasis was on drainage, and in 1963/64 and 1964/65 a combined total of over 10,000 miles of drains were excavated. Though insufficient research has been conducted on the effects of the program, the net result seems to have been quite beneficial. For these drains, while they did not prevent flooding per se, did increase the velocity of the flood runoff, and thus helped to reduce flood losses.[83]

In addition to drainage, farm-to-market roads were also emphasized. Over 25,000 miles of kutcha (secondary) roads were constructed in both 1963/64 and 1964/65. These connected many heretofore isolated villages, which in turn reduced factor costs and increased product prices. Roads therefore, helped to provide incentives for a substantial number of East Pakistan farmers. Finally, the Works Program helped to put increased purchasing power into the hands of villagers. The combined inflow of some Rs. 450 million into rural areas between 1962/63 and 1964/65 -- particularly to part-time farmers -- made sizable funds available for further agricultural investments. In many respects, these funds helped to substitute for the very inadequate system of organized rural credit.

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[83] Rice plants can withstand total submersion for about 48 hours. Thus reducing the time of flooding from say 3 to 2 days can have a very significant effect on production.

To the surprise of many, the financing of the Works Program also proved successful. After considerable debate, the decision was made to pay Works Program laborers in cash, rather than in wheat. The great fear of the time was that this procedure would prove inflationary: Rupees would be put into circulation, there would be no effective demand for wheat since the East Pakistanis were rice eaters, and hence excess demand would be generated for rice and other commodities not supplied under P.L. 480. Documents going back to the Bengal Famine Report of 1943 were cited as proof of this reasoning.

The Works Program proved, however, that rice eaters would eat wheat <u>if the price were right</u>. With an internal subsidy of approximately one-third, considerable wheat was sold in the open market and more than sufficient rupees were generated to finance the Works Program. Though East Pakistan consumers had shown no willingness to substitute wheat for rice when wheat was non-subsidized, they were quite responsive to the favorable change in the relative price of subsidized wheat. One crude piece of empirical research estimated the marginal elasticity of substitution between rice and wheat to be greater than two when the ratio of wheat to rice prices was about one-half.[84]

Thus for the first time, a Government policy was designed to attack seasonal underemployment.. The Works Program created about 50 million man days of employment in both 1963/64 and 1964/65;[85] it created productive investments which directly and indirectly aided agriculture; it was largely planned and implemented at the local level where it had been claimed that no administrative

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[84]See Falcon and Gotsch (7).

[85]Works Program (26).

capability existed; and finally, it was paid for by a commodity which was thought inedible in the East Pakistan context.

All this is not to say that P.L. 480 was perfectly administered in either Province or that it caused no problems. On the administrative side, some of the early regulations on flour mills concerning the proportion of P.L. 480 wheat purchased to total wheat milled were superfluous.[86] Since for historic reasons many mills were in wheat surplus areas of West Pakistan these restrictions had the effect of impairing the market for locally produced wheat. At other times, the Government was reluctant to support the minimum price or to release adequate P.L. 480 stocks to prevent prices from rising above the established ceiling. In East Pakistan there were difficult problems of storing wheat in a monsoon climate. Moreover, the "like commodity" clause of the P.L. 480 agreement caused Pakistan considerable difficulties in recent years.[87] The basic problem was that although Pakistan was deficit in wheat, she had a surplus in rice. However, Pakistan coarse-rice exports were not permitted by the United States under the P.L. 480 re-export restriction because the U.S. ruled that wheat and rice were "like" commodities.

Nevertheless on balance the expanded P.L. 480 program played a positive role in Pakistan's Second Plan performance. It was a critical ingredient in the decontrol movement and the Rural Works Program, which are considered by most to be two of the major highlights of the improved agricultural performance.

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[86] These restrictions were later changed.

[87] This point is discussed at length in Falcon (4).

Input Subsidies and Input Distribution

A third illustration of the incentive policy of the Government was on the pricing of improved agricultural inputs. Major subsidies were provided on fertilizer, plant protection, irrigation water, etc. by the Central and Provincial Governments, and the net result was to make the price of these inputs very low by world-price standards.

In the case of plant protection activities, the Government provided the service at no charge to farmers, and the extension staff of the Department of Agriculture spent a large portion of its time (perhaps 60 percent) on plant-protection activities. While there were obvious limits on the extent to which the extension personnel could directly cope with the problems of pest control, and also a large opportunity cost in using the staff in this manner, this program did spread the pesticide technology throughout large portions of both East and West Pakistan.

The subsidy on fertilizer, another key input, averaged about 50 percent during the Second-Plan period. In part, this compensated for the relatively high production costs of Government-operated factories; nevertheless, when there was a 50 percent subsidy in effect, the net result was an internal fertilizer price which was about 30 percent less than the world price at the official exchange rate.[88] With these subsidies, the average return on fertilizer as seen

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[88]Since the beginning of the fertilizer program in Pakistan, fertilizer was heavily subsidized. But it was only after 1957/58 that sufficient fertilizer was made available to make any real difference -- to the Budget or to the development of agriculture.

by the farmer was generally greater than 4 to 1 -- a very appealing investment.[89] These subsidies were borne on an equal basis between the Central and Provincial Governments, and were a major financial item in the Development Program. For example, in 1962/63, the middle year of the Second Plan, fertilizer subsidies amounted to about 15 percent of the entire development allocations for agriculture.[90]

During the early years of the Second Plan, the subsidy features of the fertilizer program, though important, were not sufficient to induce rapid utilization because of severe difficulties in distribution. In West Pakistan, fertilizer movement was the exclusive responsibility of the rural cooperatives, except in a few project areas under Agricultural Development Corporation jurisdiction. In East Pakistan, on the other hand, early distribution to the farmer was generally handled by the Department of Agriculture and later by the East Pakistan A.D.C.

For a variety of reasons, fertilizer distribution was rather inefficient. In West Pakistan, many cooperatives purchased fertilizer from Government factories on credit; and often these coops also sold to farmers on a credit basis. Collections at the farm level were not always easy, and at times, attempts at collection were not even very vigorous. Indeed, many of the cooperatives found it convenient for accounting purposes to carry fertilizer (which had actually been distributed) as stocks on hand rather than as accounts receivable. Since there were limits on the amount cooperatives themselves could purchase from the

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[89]See Table VI, Column 4 and footnote (c).

[90]Handbook of Agricultural Statistics (31), page 31.

factories (without payment of earlier orders), a curious anomaly arose. The reported stock position rose at the same time that a strong fertilizer black market was springing up in the countryside!

On January 1, 1964, fertilizer distribution in West Pakistan was changed. In an act which took considerable courage, and which indicates both the Government's pragmatism and the reliance on incentives stressed earlier, distribution was turned over to the private trade. Approximately 500 "stockists" were appointed by the West Pakistan Industrial Development Corporation to serve as dealers at the local level. An attempt was made[91] to keep some controls on pricing and markups, but the Government went most of the way in accepting implicitly the advice of a former agricultural advisor:[92]

> "The Government must learn to govern in areas in which it has competence -- and to stand by in a fatherly posture where it is less efficient than the private citizen in hot pursuit of a rupee!"

The results of this shift to the private trade were rather remarkable. Within eight months, the stock position went from a reported surplus of 250,000 tons[93] to a deficit position (unfilled orders) of 125,000 tons. While the reported surplus was probably greater than the actual supplies, the change was nonetheless spectacular. It was so rapid, in fact, that a lag in the placement of Government import orders coupled with a seasonally tight world fertilizer market, resulted in serious shortages in West Pakistan during much

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[91]Many of the restrictions were not enforced, and in fact, were not enforceable given the supply-demand situation that existed in the rural areas.

[92]Motheral (51), page 2.

[93]The surplus and deficit are expressed in terms of ammonium-sulphate equivalent.

of 1964 and 1965.[94]

In East Pakistan fertilizer distribution at the farm level was also opened to the private trade in the early 1960's. This too was an important element in the large spurt in East Pakistan fertilizer consumption, but in the East, as well as the West, rapid private sales coupled with a lag in Government procurement from abroad menat that fertilizer supplies were very tight in the last year of the Second Plan. In such situations the ~~confirmed~~ continued subsidy on fertilizer could be questioned; nevertheless, it was the import policy, rather than the subsidy which probably should be faulted.

Much more could be written about the incentive policy of the Central and Provincial Governments. There were, for example, subsidies provided for tractor rentals, for the digging of tubewells and for irrigation water, some of which were very controversial. Another policy area in which controversy still exists was that of land reform.. In neither Province were any really effective changes made in holding size or tenure conditions during the Second-Plan period. This is not to say that possibilities for improvement did not exist, particularly in such places as the former Sind. However, it could be argued that insofar as it was the large farmers who spearheaded efforts to

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[94]In late summer of 1965, first-priority fertilizer distribution was given again to the cooperatives -- although now on a cash basis. This about-face was due, in part, to aid difficulties, severe foreign-exchange pressures, and a tight world market for fertilizer. The Government felt (though it was seriously questioned by many) that control of black marketing and the rationing of fertilizer could be handled more easily through the cooperatives. Many of the cooperative chairmen were strong politically at the grass-roots level, and this undoubtedly was another factor in the switch. Given the existing demand situation in 1965 the cooperatives were probably capable of distributing the limited supplies. However, whether they can manage the expanded program called for in the Third Plan seems doubtful. This step backwards in fertilizer distribution in West Pakistan may therefore prove to be very costly.

increase production, the failure to undergo drastic land reform may have had a positive effect on agricultural growth. Clearly this aspect of Government policy awaits a more detailed and critical appraisal.

All things considered, however, the agricultural policy aspects of Pakistan's Second Plan must be considered a bright spot. For in the last analysis, nothing succeeds like success: the policies were designed to stimulate output by providing incentives for the use of improved inputs, and that they did.

V. LESSONS AND CONCLUSIONS

The highly successful Second-Plan performance in agriculture had a profound influence on the entire economy of Pakistan. The near tripling of the agricultural growth rate was a major factor in permitting the total economy to grow at over 5 percent per annum, in allowing exports to expand at 7 percent annually, and in providing sufficient jobs to prevent a rise in unemployment. Two immediate questions arise from this success story: What are the lessons that other countries should draw from the Pakistan experience? And, is the Second-Plan performance likely to be accelerated, or at least sustained, during the Third Plan?

To some, the Pakistan case shows only that a relatively large number of fair-sized, commercially-minded farmers plus 30 million acre feet of cheap groundwater can make agricultural development "easy". Such a statement is at best a half-truth. It overlooks the two much more basic lessons of Pakistan's Second Plan: (1) The importance of achieving the right "division" in the agricultural development program between the public and private sectors, and (2) the importance of incentives as a tool for inducing development activity in the agricultural sector.

All too often in the past, discussions about agricultural development have focused only on specific investment projects in the public sector. While these schemes may be very important in particular geographic areas, e.g., the SCARP I region, there are likely to be severe limitations on the increases in output than can be obtained by direct public investments in agriculture. This is particularly true when, as in the case of Pakistan, agriculture consists of millions of small decision-units. Thus the agricultural sector is vastly

different from the manufacturing sector where a decision to double or triple domestic output in the public sector can be made almost overnight. The latter is technically possible (though it may be very costly), whereas the former is not.

The limitations on increasing agricultural production via direct investment immediately underscores the importance of incentives for farmers who are not directly affected by public investments. One of the lessons from the Second Plan was that the Government of Pakistan did recognize the importance of these incentives. It used a variety of policy instruments -- export-tax policy, input subsidies, price support-stabilization policy, and P.L. 480 policy -- to create a favorable economic atmosphere. Furthermore, and to the surprise of a great many, the supposedly unresponsive farmers of Pakistan reacted to price and income opportunities.

The second important lesson of the Second Plan concerns the relative roles of the public and private sectors in agriculture. The private sector responded to the favorable economic climate especially in developing and using fertilizer and water. But the public sector was also vital -- both for what it did and for what it had the sense not to do.

Public investments in groundwater development, for example had a very high payoff, particularly with regard to the spreading of private tubewell technology. A similar effect can be expected from the public importation and distribution of new Mexican wheat varieties undertaken during the last year of the Second Plan. Finally, the Rural Public Works Program showed that something productive could be done with seasonally unemployed agricultural labor.

These positive contributions of the Government were important and impressive. But very high marks must also go to the Government for resisting the temptation

to do things which it probably could not have done as well as the admittedly imperfect market. Foremost in this category was the grain trade where quick and decentralized decisions were vital. The focus of the Government during the Second Plan period was in helping to improve the perfection in the market, rather than in taking over the extremely difficult marketing function. The move since 1964 to return the distribution of some improved inputs to the private trade was another case where the advantages of decentralization and the profit motive were recognized. While there were probably other fields (such as pesticide distribution) where scope still existed for a change in the public-private role, the Second-Plan period showed that the public and private sector contributions in agriculture could be complementary rather than competitive.

A third insight gained from the Pakistan experience involves the "package" of inputs required for an effective agricultural development effort. To be sure, improved inputs, when used simultaneously, yield a higher return than when used singly or even in pairs. But the difficulties of carrying out an integrated program involving all inputs are much greater than if efforts can be directed toward identifying and breaking a single major constraint. In the case of the former Punjab, water was the main bottleneck, and the large private and public investments made in irrigation were very profitable irrespective of the availability of fertilizer, plant protection or the improved seeds. While a package approach has much to recommend it, a growth-oriented agricultural policy must also consider the trade-off between technical efficiency and ease of focus and administration. The successful concentration on irrigation water (and to some extent fertilizer) in the former Punjab highlights the

necessity for evaluating this trade-off before embarking on a complex multi-factor program.

Finally, the Pakistan experience showed that it was possible to have a major P.L. 480 program without creating serious inflationary or disincentive problems. In West Pakistan, through foodgrain decontrol and cropping-pattern adjustments it was possible to accomodate without negative effects a program that provided about 15 percent of foodgrain supplies. And in East Pakistan it was possible, at appropriate prices, to offset labor-intensive development investments with P.L. 480 wheat in a "strictly" rice-eating society.

The above points are obviously not the only conclusions that might be drawn, nor are they likely to be lessons which can be applied to all countries at all times. Nevertheless, they are some of the major factors why Pakistan was able to exceed most of the Second-Plan targets. Moreover, if Pakistan continues to emphasize the quick-response inputs for agriculture and to follow the same sensible economic policies during the next five years, the future appears very bright.

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