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**THE LAWS OF GRAVITY:
A STUDY OF RICE PRICE BEHAVIOR IN THE 1992
BORO SEASON**

by

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ACRONYMS

BADC	- Bangladesh Agricultural Development Corporation
BBS	- Bangladesh Bureau of Statistics
BD	- Bangladesh
BIDS	- Bangladesh Institute of Development Studies
BJC	- Bangladesh Jute Corporation
BJMC	- Bangladesh Jute Mills Corporation
BMD	- Bangladesh Meteorological Department
BB	- Bangladesh Bank (Central Bank)
BRRI	- Bangladesh Rice Research Institute
BSTI	- Bangladesh Standard and Testing Institution
CIF	- Cost Insurance and Freight
CSD	- Central Storage Depot
DAM	- Department of Agricultural Marketing
DGF	- Directorate General of Food
DWT	- Deep Tubewell
FAO	- Food and Agricultural Organization (of the United Nations)
FAQ	- Fair Average Quality
FM	- Flour Mill
FOB	- Free on Board
FS	- Free Sales
GDP	- Gross Domestic Product
GOB	- Government of Bangladesh
HYV	- High Yielding Variety
IFPRI	- International Food Policy Research Institute
LAC	- Lakh, (One Hundred Thousand)
LC	- Letter of Credit
LLP	- Low Lift Pump
LSD	- Local Storage Depot
MES	- Military Engineering Service
MIS	- Management Information Service
MO	- Marketing Operation
MOF	- Ministry of Food
NBR	- National Board of Revenue
OMS	- Open Market Sales
PFDS	- Public Foodgrain Distribution System
PR	- Palli (Rural) Rationing
PSI	- Pressure Per Square Inch
PWD	- Public Works Department
SR	- Statutory Rationing
STW	- Shallow Tubewell
TR	- Test Relief
USAID	- United States Agency for International Development
USDA	- United States Department of Agriculture
WB	- World Bank
WQSC	- Weight Quality and Stock Certificate

CONVERSIONS

CURRENCY

The exchange rate of Bangladesh currency, Taka (Tk) is tied to a basket of currencies, with prime linkage to United States Dollars. The official rate as on 6th June, 1992 was

US\$ 1	=	Tk. 39.4556
TK. 1	=	US\$ 0.0254

WEIGHTS AND MEASURES

1 maund (md)	=	0.03732 metric ton (MT)
1 quintal (Qt)	=	0.1 MT = 100 Kilograms (Kg)
1 long ton (British)	=	1.016 Metric ton (MT)
Lakh, Lac	=	Hundred thousand (00,000)
Crore	=	Ten Million (00,000,000)

FINANCIAL YEAR (FY)

July 1 - June 30

ACKNOWLEDGEMENTS

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In the analytical phases of the work, we received support from a wide range of IFPRI/Dhaka research staff. Imtiaz Ahmed, Jinnat Ali, Rafiqul Hasan, Javed Alam and Amin Khondakar all cheerfully worked long hours to unravel the relationships buried in a vast array of economic and meteorological data. Javed and Jinnat processed the bulk of the Boro Season Price Survey data. Javed prepared the survey summary which appears in Annex A. Naser Farid and Amin Khondakar painstakingly compiled the six years of Directorate of Agricultural Marketing (DAM) price data on which most of our price analysis is based. Imtiaz Ahmed and Javed Alam analysed these data and prepared key graphics as well as Annex B and C, summarizing those data. Jinnat Ali and Amin Khondakar collected and analysed banks of meteorological data to compose a series of graphics, only a few of which appear in this report. Jinnat contributed key inputs for the Annex F. He interacted closely with the historical section of Bangladesh Meteorological Department not only to discuss climatology but also in developing an IFPRI weather data bank. In times to come, we expect that this data-bank will be of immense value in many other research activities. For the dedication and devotion of all those mentioned above, and other IFPRI researchers who were always willingly helpful, we are exceedingly grateful.

Ultimately, this study is about people - ordinary people - who grow, process and market rice. Through their expectations, reactions and behavior, they steer and alter the course of the free market. If drama and poignancy grip the market, it is they who are the actors - we can at best be an appreciative audience. To breathe life into this account of a recent rice market drama, we have prepared a series of real-life interludes that aim to capture the strength and spirit of the men and women who operate the rice markets of Bangladesh. By including these vignettes, we acknowledge our final debt to all those people who operate the rice economy of Bangladesh, for it is they, who ultimately made this study possible.

Steven Haggblade
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Dhaka
8th June 1993

1. SUMMARY

The Boro season of 1992 was unusual. Rice prices, instead of rising as the season progressed, declined throughout much of the season. In a falling market, private millers and traders can only lose money. This undermines their confidence and their incentives for participating in the rice trade. Government's price stabilization efforts are also confounded by this reversal of normal price trends. In the rapidly changing cereal markets of Bangladesh, Government must track and understand these changes in market structure and behavior in order to shape appropriate policies.

To understand this unprecedented behavior in the rice market, the authors launched a rapid field survey of eight key rice markets. There, the study team interviewed traders and millers, recording their perceptions and transactions over the 1992 Boro season. The team supplemented this primary data with a historical review of price seasonality in those same markets.

This study thus aims to answer the following key questions: 1) Were price movements indeed unusual during the 1992 Boro season? 2) Why did they occur? and 3) What are the consequences - for both the private sector and for government. Discussion with key informants in the rice trade, government and among market watchers lead to a series of testable hypotheses and, after empirical testing, the following conclusions.

1. Were price movements unusual?

Yes. Rice prices went down throughout most of the 1992 Boro season, not up. Prices peaked very early - at the beginning of July and not, as normal, in mid-October. After a short initial rise, half of the normal amplitude, prices fell steadily from July onwards.

2. Why?

Natural causes played a role in the unusual price behavior.

Hypothesis 1. Boro harvest was larger than expected. True

Hypothesis 2. Dry monsoon weather lowered post-harvest crop loss. True

Hypothesis 3. Surprisingly large Aus harvest, or extended Braus, dampened rice prices from July and August onwards.

a) in the aggregate. False

b) in traditionally deficit zones. True

Government intervention also contributed.

Hypothesis 4. Millgate contracting, with its above-market fixed government procurement price, induced speculative stock building by millers early in the season. True

Hypothesis 5. Concentration of government purchases in the early months of May and June increased intensity of procurement and made market vulnerable to speculative let-down. True

Hypothesis 6. The unanticipated early stoppage of government procurement, necessitated by the suspension of rural rationing, precipitated two waves of falling price,
a) the first due to suspension of government purchases; True
b) the second due to millers' sale of unwanted stocks. True

3. What were the implications for private traders?

Traders and millers sustained heavy losses. Because most could not unload stocks fast enough as prices fell, they carried over large surplus stocks into the Aman harvest season. Shortage of working capital, together with high carryover stocks, dampened their ardor as well their capacity to purchase vigorously in the Aman season. Coupled with the very reduced level of government procurement, this lack of trade demand pushed early season Aman prices to record lows.

4. What are the implications for government?

The millgate contract, like any fixed-price procurement system, was subject to abuse given the inevitable spread between market and procurement price. With its free advance financing and liberal milling ratios, the millgate contract proved an especially tempting target for abuse and malpractice. Suspended prior to the 1992/93 Aman season, the millgate contract imposed high cost on both government treasury and on market confidence.

The focus of future procurement efforts must be to design a reliable, predictable successor to the expensive and disruptive millgate contracting system.

2. BACKGROUND

GOALS OF THE POST-MORTEM

On the surface, the 1992 Boro season¹ appeared very unusual. Normally, prices fall to their lowest level at harvest, then rise steadily until the next harvest. But in the 1992 Boro season, this classic pattern reversed. After a short initial rise, prices fell throughout much of the season (Figure 1). The initial goal of this report is to determine whether or not this price behavior was unusual, and if so, to understand why.

The apparent reversal of normal seasonal price patterns holds strong implications for both private traders and government. Rice millers and traders can only lose money in a falling market (Box 1). Consequently, this price pattern, or its recurrence, will seriously undermine incentives for the private sector to participate in the rice trade.

Government, too, has a vital stake in monitoring seasonal price movements, since a stated principal aim of government food policy is to stabilize seasonal price fluctuations. During periods of rapid change, government may need to adjust its intervention strategy periodically. And major changes have occurred over the past several years, both in the structure of food production and trade as well as in the policy environment. Three successive years of record Boro and Aman harvests have punctuated a decade and a half of rapid growth in rice production. Production, marketed surplus and private grain stocks have all risen to record levels (Chowdhury, 1992). Policies have changed, too, particularly those encouraging input liberalization and private import and trade in foodgrains. In some cases, changing policy has triggered the changing supply structure - as with input liberalization in agriculture. In other instances, the causality is reversed, with changing structure inducing policy change - as in the case of growing private stocks allowing government to scale back its own foodgrain procurement.

The feedback between changes in structure and policy leads to a continual need for monitoring and policy adjustment. To assist in this effort, this report aims to explore whether or not recent policy changes have contributed to the unusual price pattern and whether policy adjustments are necessary to avoid repetition.

¹ The Boro rice crop is Bangladesh's largest irrigated dry season crop and the principal source of recent expansion in cereal production. The country's two other rice harvests are the Aman and Aus crops. Aman, the largest rice crop, is harvested from November to January, while the Boro crop matures in May and June, and the much smaller, Aus crop in August and September. See Annex E for details on cropping seasons.

Overall, the report aims to answer the following four questions:

- Was the 1992 Boro price movement, in fact, unusual?
- If so, why did it occur?
- What are the consequences for private millers and traders?
- What are the implications for government intervention?

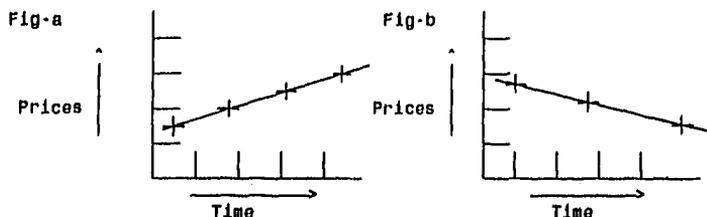
DATA AND METHODS

To understand price behavior during the 1992 Boro season, the study team first launched a historical review of seasonal price behavior in key rice and paddy markets. We selected eight key markets, which together account for the bulk of Bangladesh's marketed surplus and for over 90% of government procurement. The selected markets include Bogra, Dinajpur, Rangpur, Mymensingh, Nagaon, Natore, Thakurgaon and Dhaka (See map in Annex A). We based our historical analysis on weekly price data from the Directorate of Agricultural Marketing (DAM). Annex B presents the original raw price data for all eight stations.

Box 1. The Laws of Gravity

Players in a game aim to win. Players in a market aim to make profit.

In the commodity markets of Bangladesh, traders and millers can only make money when prices rise. In a rising market, no matter when an investor buys a commodity, he will always recover his initial costs and potentially make a profit - so long as storage costs do not exceed the magnitude of the price rise (Figure a). Yet in a falling market, no matter when an investor buys, he will lose money selling later at a lower price (Figure b). In either case, the timing or quantities bought and sold will not alter the final results, only the magnitude of profit or loss.



+ = sales or purchases.

The laws of gravity differ in the sophisticated futures markets of rich countries, where paper transactions and "short selling" - of commodities borrowed on paper but not owned - allow traders to make money even in a falling market. But in Bangladesh, because a trader must physically own the commodity he trades, he will always lose money in a falling market (Figure b).

For traders to participate in any market, they must reasonably anticipate a general upward price trend. Any reversal of historically established price patterns will generate potentially disastrous losses for traders of that commodity. When predictability and confidence are shaken, capital will shy away from that market, weakening competition and market performance in future years. This was the danger posed by the Boro season of 1992.

To supplement this statistical review, we launched a rapid field survey in early January 1993, deploying a team of four field investigators. The field work focused on rice millers, rice traders and paddy traders in the eight key markets identified above. Where possible, the team re-visited millers and traders already known to us from IFPRI's in-depth marketing survey of 1990/91 (Chowdhury 1992). This provided both time-series comparisons and the considerable benefits of respondent rapport. Many reported price and transactions data for us directly from their books. In all, we visited 120 private millers and traders. Randomly selected, the sample represented millers and traders of different sizes, as well as those supplying government millgate contracts and the open market. Annex A reproduces the survey instrument and basic summary statistics.

The field survey offered three important inputs into our analysis. First, by pulling price data directly from traders' books, it allowed us an independent check on DAM's published price data. In the end, the price data from our survey data closely matched those published by the Directorate of Agricultural Marketing (DAM), in all markets. Second, the formal survey allowed us to estimate key variables such as private stock levels, buying and selling patterns of private traders, and their operating profits and losses. Third and perhaps most important, it allowed for open-ended input from the trading community, who make their living from the rice market. They were clearly upset by the unusual price behavior in 1992. They bent our ears - even singed them on occasion (See Interlude 3) - and added greatly to our inclination to chronicle the events of the highly unusual Boro season of 1992.

Interlude 1 — The Rice Mill Engineer

We drive over bricksoled roads through what was once Sal forests. The forests are long gone, leaving behind red laterite soil, typical of a Barind landscape of endless paddy fields. In this early winter, the harvesting has just begun of an evidently bountiful Aman harvest. We come upon a corrugated iron gate which opens magically at our very approach. Obviously cars are few and far between in these parts.

It is an old major mill, one of the very few still operating a steam engine. The chores of parboiling, drying and milling are organized by specialized labor. The technology is age-old, only the organization is early industrial, enough to gladden the hearts of a Boulton or a Ford.

"Salaam Sahib", says the guard, the accountant, the purchase manager almost in unison, and the group of itinerant traders who jump up with the inborn courtesy of our rural folk. "Where is the malik Sahib?" "The owner? He is in Dhaka doing politics, he has enough; he doesn't need to count his wages by the day". This with a ghost of a smile, for to grin is bad manners, specially when the visitor is known to be an "Owner" himself. "Whom can I talk to? I have many important matters to discuss as the Food Policy is changing, as you all know. We who feed our children by trade must know what is happening, have we not; who will feed us in these difficult days if we don't know what is happening?" "Oh yes! difficult days all right, the government will not buy rice anymore, they say, the prices are falling. We don't know, buy or not to buy, and the last-year's stock...." "But whom to talk to in your mill on these matters?" "Oh, call the Engineer, he is out there supervising harvesting of his fields ... you fool, call the Engineer Sahib and move"! This to a drying yard labor who was hanging around nearby not knowing perhaps what to do.

I see a personage approaching. Tall for a Bengali, dressed in spotless white cotton, long white beard dyed crimson with liberal application of henna, left hand lifting his lungi for easy locomotion and the right holding aloft a Japanese umbrella; indeed a figure to attract attention and respect anywhere. "Salam Sahib, bring a chair for the Sahib, you sons of low caste fathers!" says he, all in one breadth and smiles broadly exhibiting his still robust teeth to advantage. "Salam Engineer Sahib, how are things with your mill?" "I am no Engineer, Sahib, only the foreman, but these illiterate imbeciles know no better". He says indicating the traders and laborers with a broad sweep of his left hand which has let go of his lungi by now. "Well, how goes your mill, Foreman Sahib?" "Very well Sahib. You see the old Lancashire, the old Marshall, the lineshaft which I turned out of a ship's propeller shaft in a 25' lathe at the sugar mill workshop" "Yes, but how is business?" I must stop the old boy from being carried away and come to point. "Business? That is malik Sahib and the accountant Sahib's responsibility. I run the engine, the boiler and mill the best quality rice on this side of the Jamuna. Please come along. I show you the works- I heard you flew aeroplanes once, you will understand". News travel fast by the Bengal grapevine, and before he starts talking about my grandfather, I follow him into the boiler shed.

The old rivetted Lancashire boiler is marked 1887 and bears the marks of her checkered history with mute dignity. She feeds on rice-husk now - a fuel as alien to her design fare of hard coke as the climes of western Bogra to her native County Lancashire. The Marshall of England 150 hp single cylinder steam engine with open governors is very similar to one I saw in Kensington Science Museum in the Early Industrial section. The engine is still hot, for she ran only the night before on 60 PSI, though initially built for much higher pressures. One has to take it a bit easy when one is above 100!

The series of four Engleburg hullers and wooden aspirators are well maintained and each connected by flat leather belts to a massive line shaft. The whole works exhibited signs of regular maintenance, care and love. The Engineer was smiling as I carefully examined each part. "Ok, Sir? I pass the inspection"? So says the old gentleman. "Now, Mr. O'Brien was my shop steward and Col Hamilton, the factory manager, at the Bengal River Services Workshop at Khiddirpore, Calcutta back in 1940 when I was but a lowly machinist's assistant. I learnt the ropes since, you see. The lubricant is castor oil, the best lube there is, Sahib, and the flat belts, I made out of best buffalo hide at the Owner's younger brother's tannery by the river. The engine casings I supervised being cast at Rangpur Foundry, they are the best. The problem was the crank-shaft, which I got rebuilt at the new workshop of Bogra Motors; they have German grinding machines. The 25 feet shaft was tricky, but I got the best propellershaft from the ship-breaking yard at Bhatiari, Chittagong and got it turned at the Panchagarh Sugar Mill Works; they have the only moving-bed lathe in North Bengal. And the old Lanc? She needs no maintenance, once a year checking of the rivets and a few caulking will do, but the chimney that is another story, the Japanese plates.....". He goes volubly on. "Now, I teach my sons to be mechanics and craftsmen, but they want to go to the Middle East to make money. A great pity, I say". He goes on. "If we who make and run machines want to make just money like the usurers, may Allah curse them, what will happen to the craft of makers and machinists. What will happen to all the equipment- May be we will have to import mechanics from Europe and Japan along with the machines." He looks worried and troubled. "Do not worry, Engineer Sahib. Your machines are the best I have seen. Do not worry about others. They will learn, maybe from you, for I know you are here for a long time, may be as long as your engine!" I quip. He smiles. Even if I did not learn much about the trade and prices, I was rewarded enough - enough for a day's journey.

Well Dr. Shumacher, here is Intermediate Technology for you. This old foreman has practically built a steam engine from scrap and converted an old boiler from coal to husk fuel which evidently generates steady steam pressures to run the engine. He buys nothing, no electricity, no fuel, no imported parts other than bearings and runs a mill with at least 2 tons per hour capacity. In good weather, his trained women turn and move the steamed paddy to get uniform drying. His men use the hullers with exquisite skill to mill rice of fine quality with little brokens and high polish. A landowner himself, he is wealthy by the standard of his fellowmen. He works now for the dignity and pride of his craft. He is the Engineer.

3. WAS THE 1992 BORO SEASON UNUSUAL?

Yes, it was. Traders, millers and other knowledgeable observers all agreed that prices peaked much earlier than usual and then fell steadily, unlike any year in their memory.

Yet to test this proposition empirically required some care. For, given the vagaries of nature, "normal" years are frequently disrupted - by floods, or cyclones, or other natural disasters. After careful scrutiny, we have summarized seven years of price data from eight markets, by sifting as follows. Because price movements proved to be consistent across all eight markets, the main discussion centers on data from only two, Dhaka, representing major consumption markets, and Bogra, representing the major supply area. Since paddy and rice prices also track closely, we have taken one of each, paddy in Bogra and rice in Dhaka. Finally, to capture movements in a "normal" year, we have averaged together raw, undeflated prices for 1990 and 1991 in order to provide contrast to 1992. The effect of the 1987 and 1988 floods tainted the normalcy of the three prior years. For the serious researchers, we have included the raw data for all years, all markets and for both commodities in Annex B.

To summarize the central tendency of large volume of data, the discussion below focuses on paddy prices in Bogra and rice prices in Dhaka, for the years 1990 through 1992. In comparison with the two prior years, 1992 did indeed emerge as an atypical year, for three principal reasons:

1. Prices went down, not up.

As Figures 1 and 2 indicate, the predominant price trend in 1992 was clearly downward. Yet prior years witnessed the "normal" upward price trend. This was true for both rice (Figure 1) and paddy (Figure 2).

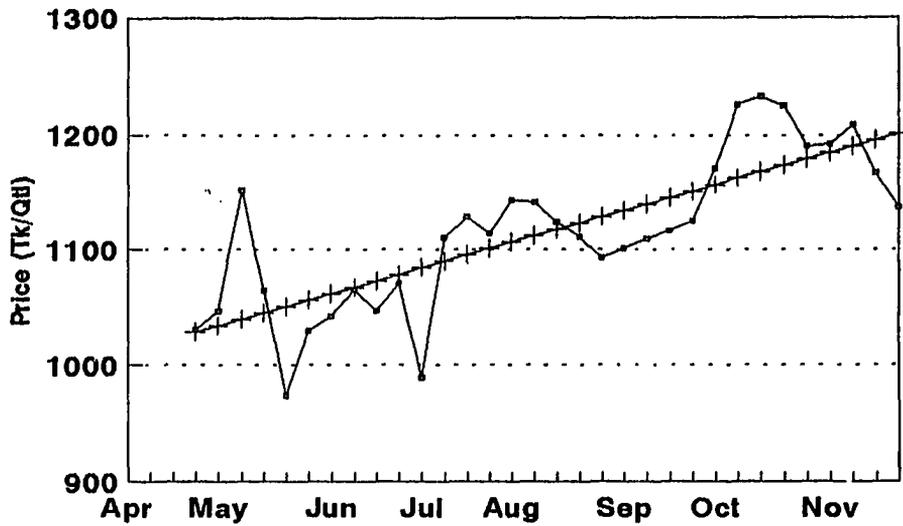
2. Prices peaked in early July, not as normal in mid-October.

In all years, prices dipped to their lowest level after harvest, in late May, and then began their ascent. But instead of the gradual upward trend of prior years, the 1992 prices rose sharply, peaked in early July, and fell continuously thereafter.

3. Amplitude of the price rise was cut in half.

The peak not only occurred sooner in 1992, it plateaued at a much lower level than in prior years. Instead of a gradual 25% trough-to-peak movement in weekly rice prices, the 1992 season

Figure 1
Weekly Price Movements of Coarse Rice in
Dhaka, a. Boro Season, 1990-1991



b. Boro Season 1992

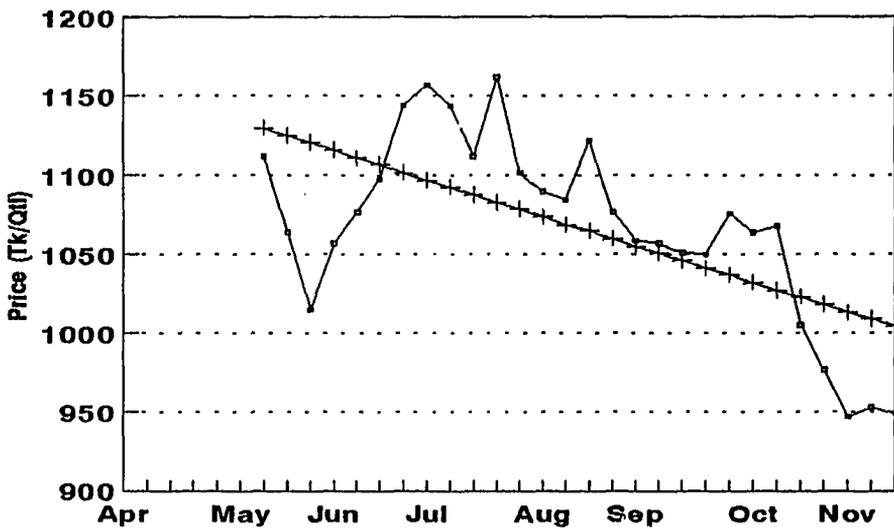
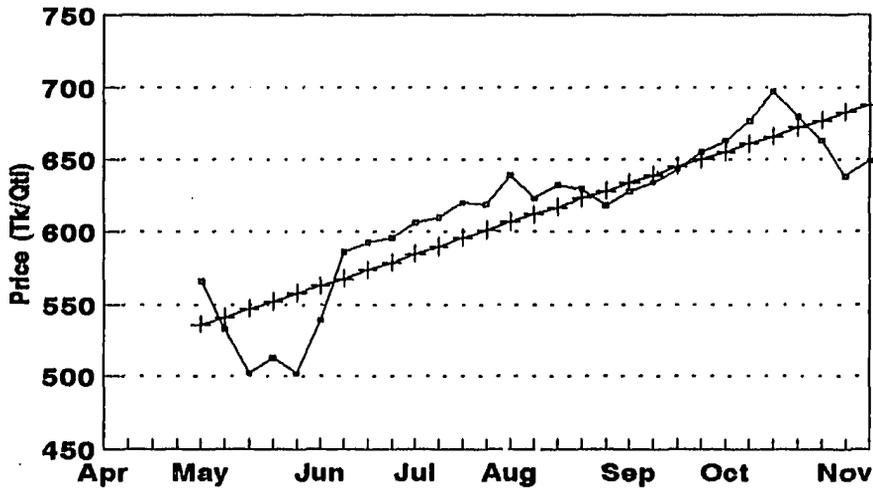
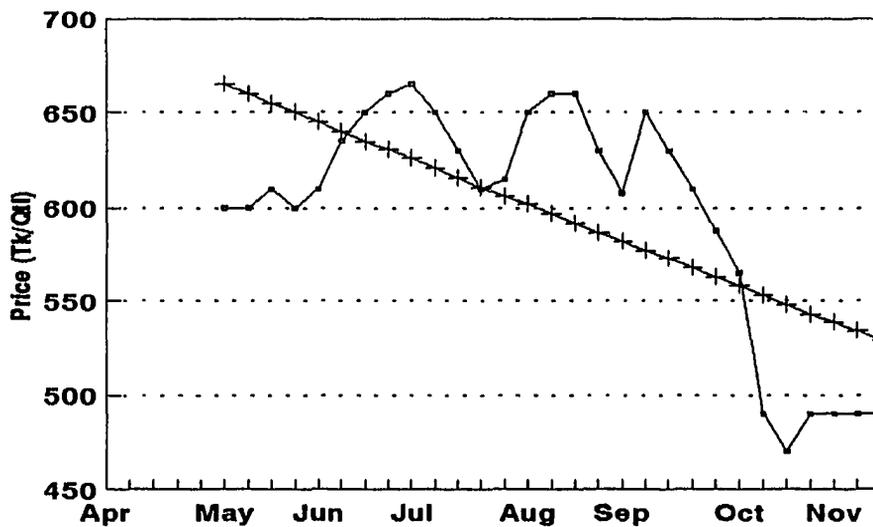


Figure 2
Weekly Price Movements of Paddy in
Bogra, a. Boro Season, 1990-1991



b. Boro Season 1992



experienced a much smaller but more abrupt rise of about 15%.² In paddy markets, the price amplitude was compressed even further, from 40% in prior years down to about 10% (Table 1).

Table 1 - Contrasts between the 1992 Boro Season and the "Normal" Years of 1990 and 1991

	1990-1991	1992
A. Dhaka rice price		
seasonal price trend	up	down
price amplitude		
- trough	970	1,000
- peak	1,240	1,150
- spread	+ 25%	+15%
timing of peak	Oct, 2nd week	July, 1st week
timing of trough	May, 3rd week	May, 3rd week
B. Bogra paddy price		
seasonal price trend	up	down
price amplitude		
- trough	500	600
- peak	700	660
- spread	+ 40%	+10%
timing of peak	Oct, 3rd week	July, 1st week
timing of trough	May, 3rd week	May, 3rd week

Source: Figures 1 and 2 and Annex 3.

²Weekly prices yield greater extremes than do monthly averages. Using monthly prices, which are commonly used to establish rules of thumb about seasonal price movements, shows a 15% increase in Dhaka rice prices in 1990 and 1991. In contrast, the weekly figures record a 25% upward swing.

4. WHY?

Traders, millers, food officials and other informed observers offered a variety of explanations for the unusual price behavior in the 1992 Boro season. In general, the explanations they advanced fell into two categories: a) natural causes; and b) unintended consequences of government intervention. From the private sector, millers and traders universally blamed government and the abrupt suspension of millgate contracting³ (Table 2). Yet over half also pointed to natural causes, particularly higher than normal Boro production.

Table 2 — Private Traders' Explanations for the 1992 Boro Season Price Decline

Reason Stated	Wholesalers Paddy & Rice	<u>Millers</u> Nonmillgate Millgate		Total
<u>Government-induced</u>				
1. Abrupt suspension of 98% millgate contracting	100%	100%		99%
2. Sales of private 40% stocks after July	40%	34%		40%
<u>Natural Causes</u>				
3. High production	64%	73%	51%	61%
4. No natural disaster	25%	33%	29%	28%
5. Lower demand in deficit districts	10%	7%	21%	16%
Sample size	26	26	60	112

Source: IFPRI Boro Season Price Survey. See Annex Table B.2 for details.

³ Millgate contracting accounted for over 95% of government rice procurement during the 1992 Boro season. This contracting system involves purchase of rice from millers at a fixed price. In the 1992 Boro season, the fixed procurement price stood at taka 245 per maund of paddy. Annex D describes the millgate contracting system in detail.

In order to systematically test the importance of each set of causes, Table 3 categorizes the full range of views into six hypotheses. We examine the merits of each below.

Table 3 — Why were the 1992 Boro season price movements abnormal?

Key hypotheses

Natural Causes

Hypothesis 1. Boro harvest was larger than expected.

Hypothesis 2. Dry monsoon weather lowered post-harvest crop loss.

Hypothesis 3. Surprisingly large Aus harvest or extended Braus dampened rice prices from July onwards.

- a) in the aggregate.
- b) in traditionally deficit zones.

Government Intevervention

Hypothesis 4. Millgate contracting and above-market government procurement price induced speculative stock building by millers early in the season.

Hypothesis 5. Concentration of government purchases in the early months of May and June increased intensity of procurement and made market vulnerable to speculative let-down.

Hypothesis 6. The unanticipated early stoppage of millgate contracting, necessitated by the suspension of rural rationing, precipitated two waves of falling price,

- a) the first due to suspension of government purchases
 - b) the second due to millers' sale of speculative stocks.
-

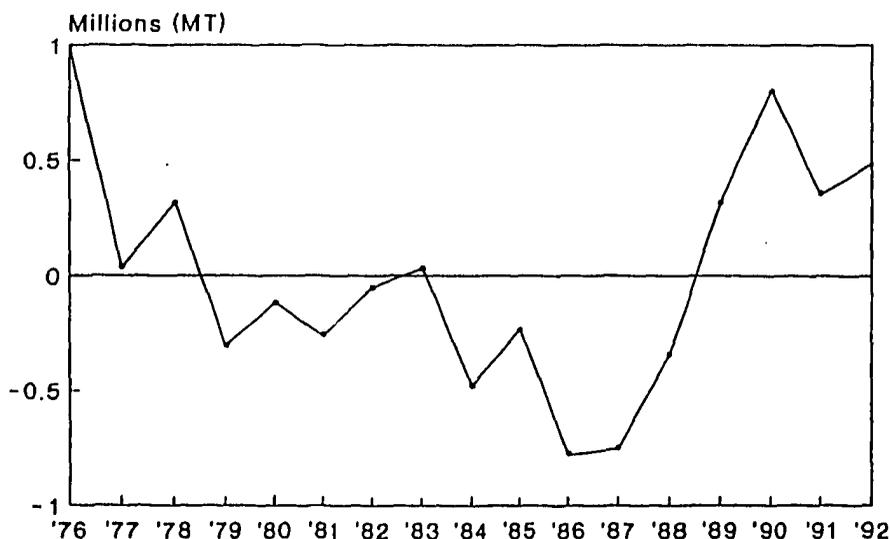
NATURAL CAUSES

Hypothesis 1: The size of the Boro harvest was larger than expected. Initially, it was underestimated, by both government and traders. This raised price expectations and led to a willingness to pay higher prices early in the season. But prices softened later, as the full size of the harvest became known.

Conclusion: True.

Evidence: Both government and traders initially underestimated the size of the Boro harvest. The Bangladesh Bureau of Statistics (BBS) initially estimated a Boro harvest of 6.5 million metric tons. Later, they revised their estimate upward about 5%, to 6.8 million tons. As Figure 3 indicates, the 1992 Boro harvest was well above trend.

Figure 3
Boro Production 1976-92
Deviations From Trend

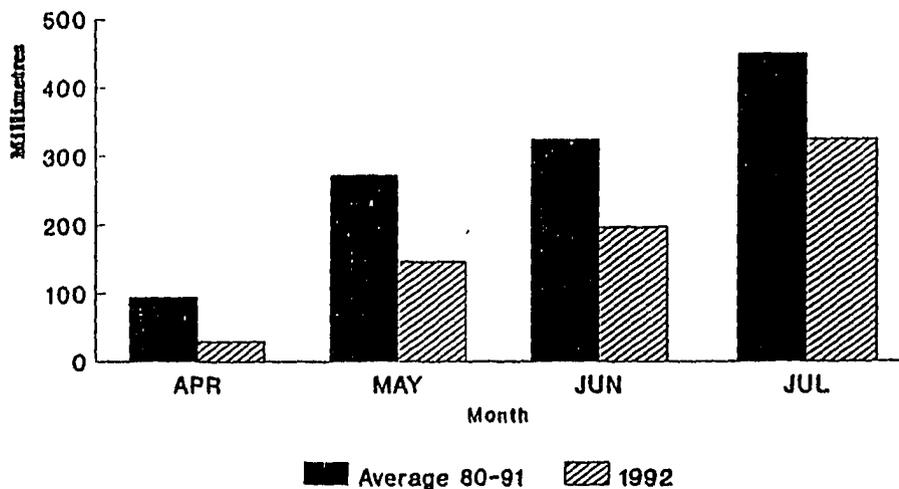


Hypothesis 2: Dry weather resulted in very low post-harvest losses. This increased supply even further above initial expectations.

Conclusion: True.

Evidence: Meteorological data clearly document the dry monsoon of 1992 (Figure 4). An absence of early flooding reduced harvest losses, while abnormally low rainfall in May, June and July reduced post-harvest losses and facilitated drying of parboiled paddy. Reduced spoilage made probably an additional 500,000 tons of rice available in the market.

Figure 4
Rainfall Pattern in Procurement Zones
1980-1992



Station: Rajshahi, Dinajpur, Bogra,
Rangpur, Ishurdi, Mymensingh.
Source : Bangladesh Meteorological Dept.

Hypothesis 3: A surprisingly large Aus harvest or extended "Braus" dampened rice prices from July and August onwards.

Conclusion: a) False, in general.
b) True, in normally deficit zones.

Evidence: a) In general, country-wide figures from BBS crop cutting exercise shows no evidence of an extended Boro harvest. BBS crop cutting samples, which they must take directly at harvest, suggest no delay in harvesting the 1992 Boro rice crop (Figure 5). As in prior year, farmers harvested over 90% of their Boro paddy between the last week of April and the first week in June.

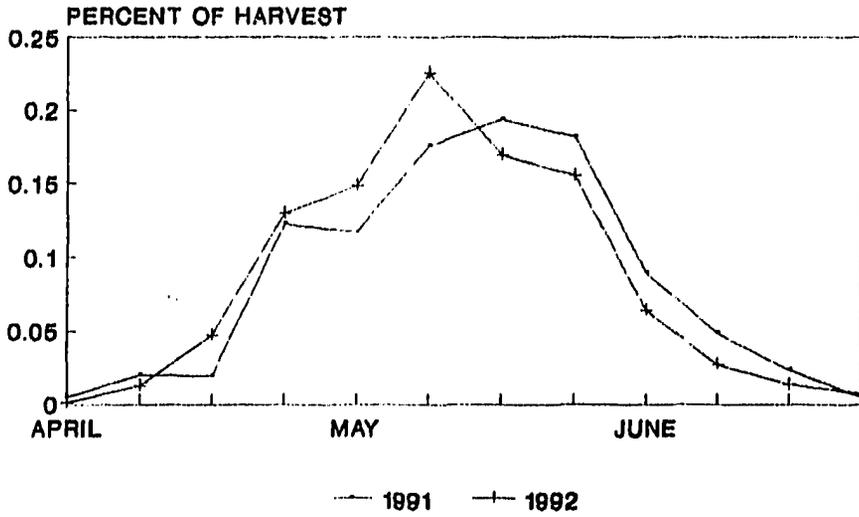
Nor could the Aus crop have accounted for the initial price fall in early July. It was not harvested until late July and throughout the month of August (Figure 7). Moreover, the Aus crop was very small, only 2 million tons and well below trend (Figure 6).

b) Yet in traditionally deficit zones⁴, Boro production was well above trend. This more than compensated for a diminishing Aus harvest. The net result was a clearly above trend "Braus" (Boro plus Aus) output in calendar year 1992 (Figure 8).

Many of the traders and millers we interviewed (16%) noticed the resulting falloff in demand from the traditionally deficit zones (Table 2). This translated into diminished demand for private exports from Rajshahi Division to the deficit zones, placing further pressure on depressed paddy and rice prices in the northwest.

⁴We consider the four divisions of Chittagong, Dhaka, Khulna and Barisal to be deficit zones. The fifth division, Rajshahi, however, generates a large rice surplus.

FIGURE 5
TIMING OF THE BORO HARVEST
1991 & 1992



SOURCE : BBS CROP CUTTING

Figure 6
Aus Production, Deviations From Trend
1975-92

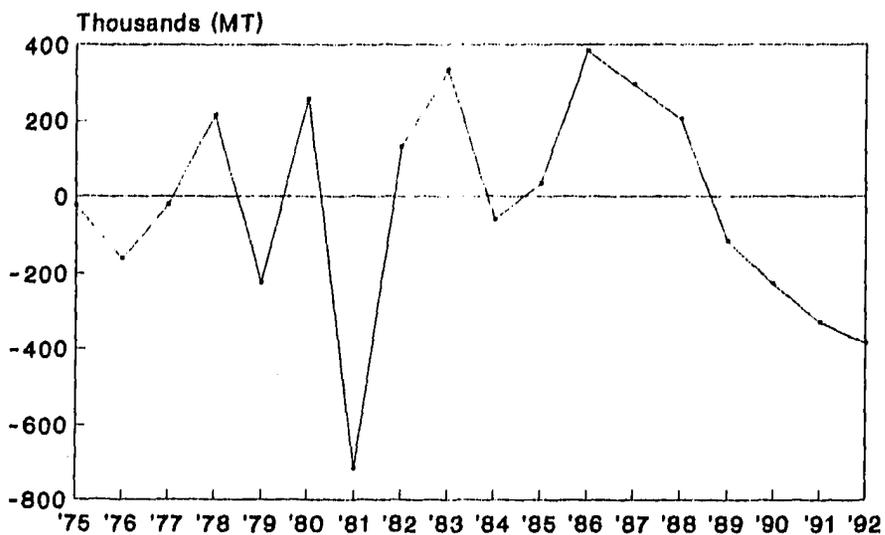
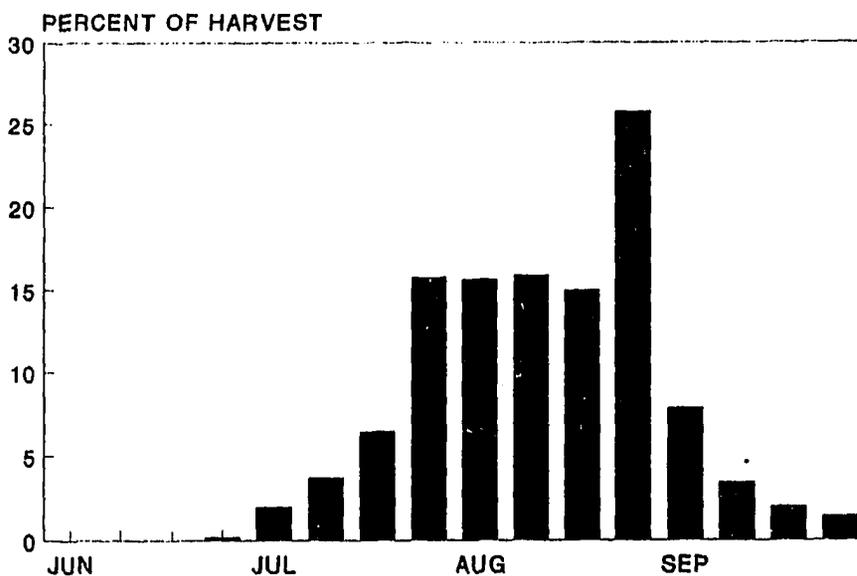
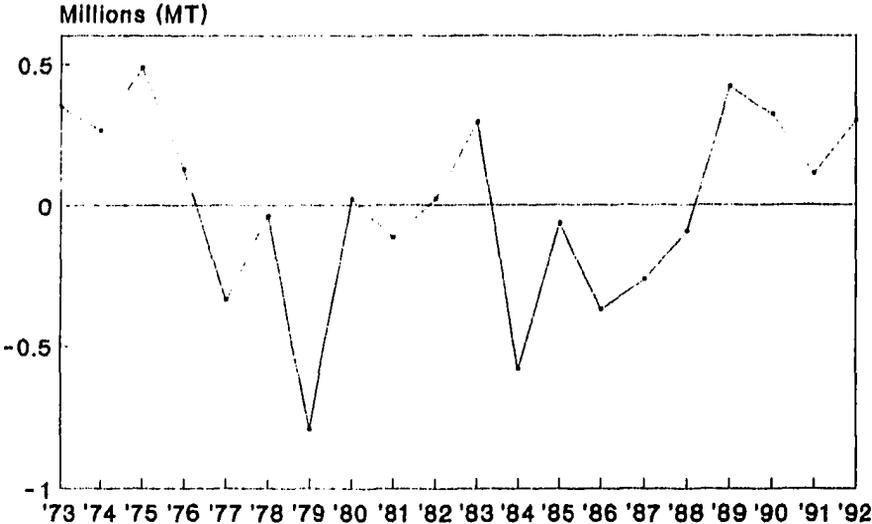


FIGURE 7
TIMING OF THE AUS HARVEST, 1992



SOURCE : BBS CROP CUTTING QUESTIONNAIRES

Figure 8
BRAUS PRODUCTION IN DEFICIT ZONES
'73-'92, Deviations from Trend



Interlude 2 - Daughters of the Soil

The end-April sun mercilessly beats down upon a land parched for over six months, for it rained last in October. The mauve clay soil has cracked open in ugly fissures and whorls, like the back-skins of the loathsome Bengal toad. The fields are alive with the noise of a thousand diesel engines incessantly chugging away to power the pumps which are having little purchase over a plummeting water-table. It is the dreaded draught whose malignant presence is palpable in that windless afternoon as I walk by the dusty bridlepath in that extreme North Western village.

I had come only the day before with a friend to visit his ancestral home. The magnificence of the single-story brick building of his landowning forebears is sharply contrasted as much by its decaying facade as by the visible poverty of the village folk. Everything not only looked oppressive but felt so; the draught, the crumbling mansion, the dejected looks of the villagers, the brownish leaves of the mango trees, the culvert with a collapsed wing-wall - everything. I was depressed as I walked by the path through the monotonous landscape of paddy fields exhibiting varying degrees of damage by water starvation. Centrifugal pumps don't work with a suction head of over 26 feet. If the water table goes below that level, you must bring the pump nearer to the water by digging a hole and placing the pump below ground level so that the suction head remains within limit. If the table goes further down, you dig a deeper hole. But, if you use a multi-stage Tara pump, which is only being mechanized now, it could solve the problem. It won't, because, the Tara has a low volumetric capacity, but by enlarging the 1st stage cylinder....

.....I had been thinking as I turned a corner and what I see, a small patch of healthy paddy with emerald green leaves indicating sufficient irrigation and adequate fertilization. Stranger still, by the date palm tree at the corner, two young women are operating a treadle pump, double acting, twin cylinder jobs whose two criss-crossing arms are being worked much like a non-stop see-saw. The women look at me, then look down in modesty, as is befitting for young maidens in front of a stranger. And I look down too, as is befitting a man in front of gentle women-folk, and pretend to examine the paddy sheafs as the women whisper among themselves. I look for a gambit to start conversation.

"Are there no men in this miserable village? Why is it that young women do men's work? Perhaps the day of judgement is near", I sigh loudly and approach the pump, examining the paddy all the time. A giggle and a twitter, "Oh! there are no men in this country as well, for doesn't the Sahib know the Prime Minister is a woman and so is the Leader of the Opposition?" I hear from my left, both my remarks and the women's addressed to no one in particular. "Touche!" Taken aback, I take a minute to collect my wits, for it is not every day that I am made speechless by unlettered village belles! "I can see that there are no husbands, but don't they have any brothers to do the hard work? The father will be old and infirm, but no brothers, a great pity!" Again I remark to the open air, now examining the date palm, as by now, further scrutiny of the paddy will make a greater fool of myself than I already am. "Why a pity Sahib? God has given us to our father who is a good man who lost his wife, our mother, when we were young. He never re-married and raised us as both father and mother. We grow paddy and tobacco on our land of three fourth acre, he sells the produce, we have no debt with the money lender, we have even bought this pump from the Mechanic Uncle by the big pond, he builds all kinds of machines - very good mechanics they are...." They are voluble now, speaking in loud voices over the screeching of the reciprocating bamboo levers, as in spite of the declared mechanical excellence of the pump, there is evidently no bearing at the pivot points. Bearings are expensive, and the additional exertion needed to overcome the friction is for free!

I sit by the date-palm facing opposite the pump and address directly, now that the ice is broken, but careful not to look at the operators. "What have you planted, BR-8? How much will be the yield? What are the fertilizers that you applied? Does the price of paddy cover your costs?" - the basic questions I always ask the farmer whenever the opportunity arises. "BR-8? Oh no! BR-8 is very prone to pests, we plant BR-14, the variety with the awns, we give three dressings of Urea, the last one only the day before, that's why we irrigate the paddy. We hope to get 90 maunds, yes it covers the cost even if the price is down to 150 taka for we don't have to go to the market, the faria comes to our home and negotiates price with father. He taught us to read and we have many pamphlets by the Agricultural Extension which we collect on request from the Health Visitor Apa, the Sister who visits the village once a month and talks to the women on family planning and health". On this they giggle again shyly. "We have a radio, we listen to the BBC and the Voice of America Bangla Programs too! Now, Marak Tally (Mark Tally) is a great man, he always tells the truth as our father said when he heard him on the BBC during the bad days of the War, we were not even born then!"

So they can read. They mentioned family planning, the unthinkable, unspeakable word for an unmarried girl to utter. They listen to the BBC and VOA and they are about 20 years old. They not only fertilized the field right, they even planted the newest variety of paddy released by the BRRI only the year before. With their expected yield, the cost of production calculations, so dear to the specialists, is a joke. With one paddy, one tobacco and one oilseed crop, the crop rotation, diversification and agricultural economics are all tied in a neat knot in one stroke. Here is revolution, in this backward, depressing village in the middle of a bad draught.

"Why the Sahib is speechless! Has he run out of questions? Wait a half-hour and our father will come, he will surely invite the Sahib to our poor home, we have coconut water to offer only, we don't have any tea." Not quite revolutionary remarks, as only a man may invite another to his home. "No sisters, I must leave now," I say, standing up. "I have a longway to walk, but may God bring you plentiful harvests." I look at them for the first time. "Please come again Sahib and meet our father," they say, looking down, but never missing one single stroke of the pump in all these times. As I walk away, I again look back to these daughters of the soil. I am no longer depressed, the mango leaves are no longer so brownish, there are young leaves sprouting, which curiously, I never noticed before. The crumbling mansion looks grand and there is a cool refreshing breeze to banish the dankness of the draught.

GOVERNMENT INTERVENTION

Hypothesis 4. Millgate contracting, together with an above-market government procurement price, induced speculative stock building by millers early in the season.

Conclusion: True.

Evidence: On the surface, this proposition appears false, since the spread between procurement and market price was not abnormally large in 1992. While the premium government paid over market price stood at 15-20% in 1990 and 1991, it dropped to about 11% in the early weeks of the 1992 Boro season (Figure 9).⁶

But testimony from millers suggests strongly that the millgate contractors, then into their sixth year of this mode of procurement, simply became more adept at lubricating the system and using it to their advantage.⁶ The number of millgate contracts roughly tripled between 1989 and 1992 (Table 4). And by all reports, the number of subcontractors grew at least as fast.

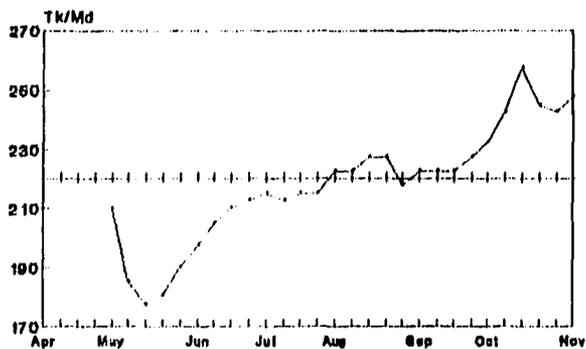
The millgate contractors became increasingly expert at exploiting any margin between the market and official procurement price. To do so, the millgate contractors bought paddy heavily early in the Boro season, purchasing paddy stocks at roughly three times the rate of non-millgate firms (Table 5). They amassed a large stockpile early in the season, in anticipation of signing further millgate contracts later in the season.

In 1992, millgate contractors clearly accelerated their buying in comparison with prior years. In fact, all millers - those supplying government as well as the private market - increased their

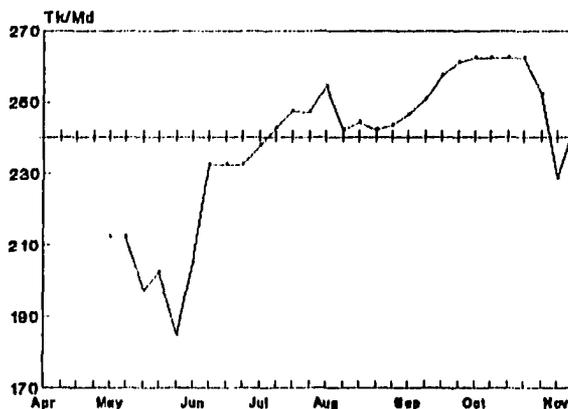
⁶Given the guaranteed taka 245 procurement price, it is quite probable that government's heavy purchasing, in fact, lifted the market price above where it would otherwise have been after successive record Aman and Boro harvests. The taka 220 post-harvest paddy price in the early weeks of the 1992 Boro season contrasts with the much lower taka 180 to 190 price prevailing during the same period in prior years.

⁶See Annex D for a detailed description of the millgate contracting system.

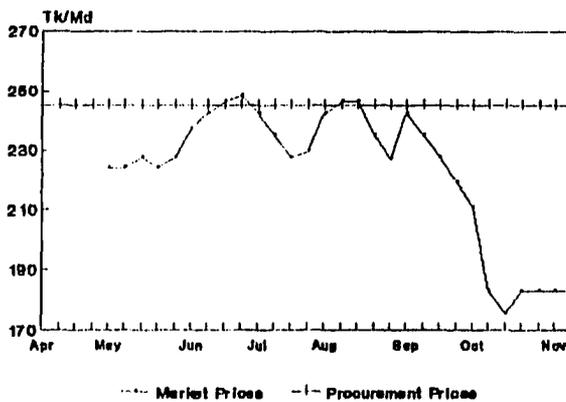
Figure 9
Market & Procurement Prices of HYV Paddy
in Bogra, a. Boro Season, 1990



b. Boro Season, 1991



c. Boro Season, 1992



--- Market Prices - - - Procurement Prices

Table 4 — Growth in Numbers of Millgate Contractors

Year	Number of Millgate Contractors
1986	274
1987	n.a.
1988	n.a.
1989	623
1990	1,391
1991	1,270
1992	1,714

Source: DG Food, MOF.

Table 5 — Early Season Paddy Stocks at Millgate versus Nonmillgate Rice Mills, 1992

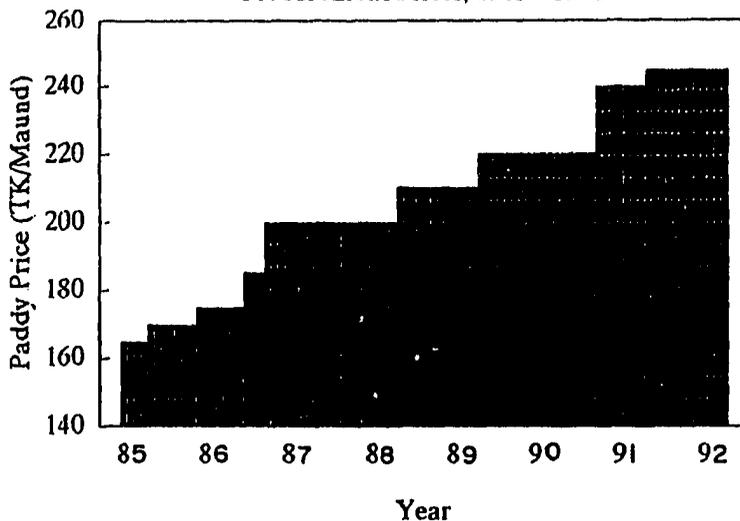
Month	Ratio of paddy stocks, millgate/nonmillgate mills		
	Small mills	Major mills	Automatics
May	3.5	2.0	3.4
June	4.0	1.2	4.4
July	3.1	1.4	1.0
August	2.0	1.5	2.0

Source: IFPRI Boro Season Price Survey. See Appendix 2.

activity in May and June 1992 because dry weather permitted. Nonmillgate firms held paddy stocks in double the levels held two years earlier, in May and June of 1990.⁷ Yet millgate firms quintupled their stocks over the same interval. Clearly, in the early months of the 1992 Boro season, millgate firms were holding far more paddy than in prior years years, and far more than their nonmillgate counterparts.

In normal years, this stock-building entailed little risk as millgate contractors actuated the safety valve of next season's millgate contract with increasing dexterity. If prices dipped, after the Aus harvest for example, millers would withhold sales in anticipation of the next season's contract, just a few months away. Stock carryover proved a lucrative investment given the steady increase in government procurement price over the past half decade (Figure 10, Box 2).

Figure 10 – Evolution of Official Paddy Procurement Prices, 1985–1992

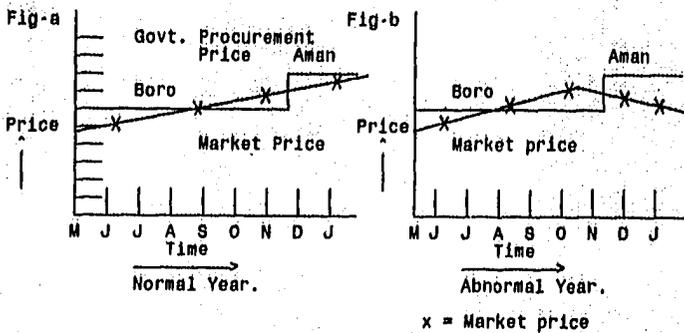


⁷This calculation compares data from 1990 (Chowdhury 1992) with that of the present 1992 Boro Season Price Survey.

Box 2 -- The Speculator's Paradise : Millgate Contracting

All commodity trades are highly speculative (see Box 1). All traders, therefore, are essentially speculators, whether one describes them as such or not. When they buy an agricultural commodity at the harvest time "low" price, they are, in fact, betting against a price fall from the level at which they have purchased. When government buys a commodity to "stabilize" the price, they too are "speculators" in marketer's parlance, since "stabilization" implies purchasing at a low price in anticipation of later sale, presumably at a higher price.

When traders' assumptions about future prices become a predictable fact, evidenced not only by a regular price rise but also the exact knowledge of the timing of each price rise, it is no longer a speculation to invest in that market; that market has been "cornered". That phenomenon was taking place in the twin processes of millgate contract and steady annual rise in the procurement price of rice (Figure 10) announced at a fixed date and eliminating uncertainty among traders supplying government contracts.



The millgate contractor ate his cake and took it home also. In a normal year, he sold to the government when market price was below the procurement price (Figure a), and then to the market when that price was above the government price. In an "abnormal" year, (Figure b) he sold to the government when the margin was good enough. If the spread between the market and procurement price was not sufficient, he held onto the stock at the end of the season. He couldn't lose; since the procurement price, he knew, will surely rise next season, when the stock would be unloaded to the LSDs at a good profit. In the 1992 Boro season, the millgate contractor was hit by a two-pronged missile, early stoppage of Boro procurement and an announced lowering of the procurement price for the coming 1992/93 Aman season. With a jolt, it was paradise lost.

Hypothesis 5. Concentration of government purchases in the early months of May and June increased the intensity of procurement and made rice markets vulnerable to a speculative let-down.

Conclusion: True

Evidence: Growth in the number of millgate contractors, from 274 in 1986 to 1,714 in 1992, certainly increased the speed at which the Directorate General of Food could procure rice. Since millgate contractors made money on the spread between market and government's fixed procurement price, they had every incentive to supply as quickly as possible, while market prices were low and the "millers' subsidy" was as large as possible. As the contract millers learned the rules of this game, procurement became increasingly concentrated in the months of May and June (Figures 11 and 12).

The dry weather of 1992 accentuated this trend towards compressed procurement. Dry weather effectively enhanced the drying capacity, and hence the milling capacity, of traditional small and major mills who practice manual sun drying. Since these mills account for 95% of all suppliers in the millgate system, their increased early capacity greatly accelerated the speed of procurement in 1992. They swamped government depots in May and June of 1992. With this intensification came associated problems of management - accounting, storage, transport to other zones, quality control and a multitude of others.

The concentration of government procurement into an increasingly tight time frame has led to an overwhelming government presence in procurement zone markets during the early months after harvest. Most observers note that government purchases account for only about 15% of total marketed surplus nationwide. Yet few notice that, with the accelerating speed of procurement under millgate contracting, government purchases accounted for 50% to 60% of total market purchases in Rajshahi Division during the months of May and June 1992 (Figure 13). Dominance on this scale, coupled with routinely large spreads over market price, aroused the millgate contractors to a frenzy of activity as they raced to cash in on these lucrative contracts.

Figure 11
Monthly Rice Procurement Nationwide
Boro Seasons of 1990 to 1992

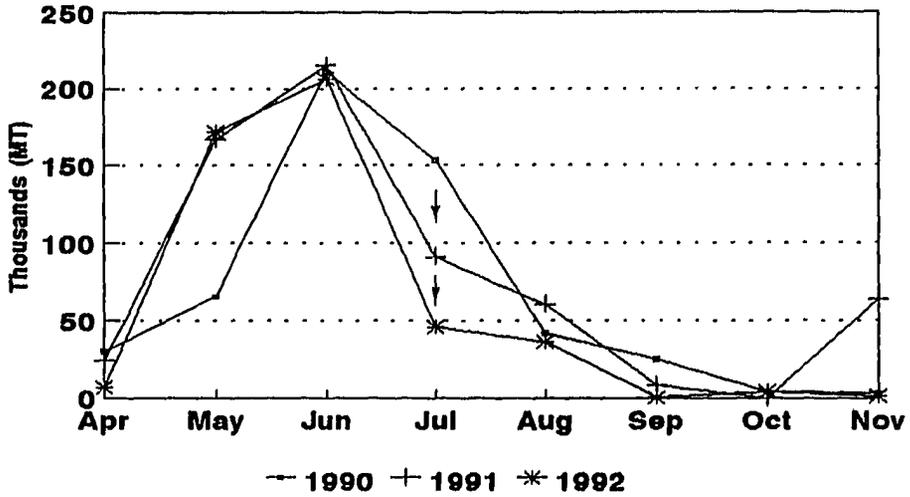


Figure 12
Monthly Rice Procurement in Bogra
District, Boro Seasons of '90 to '92

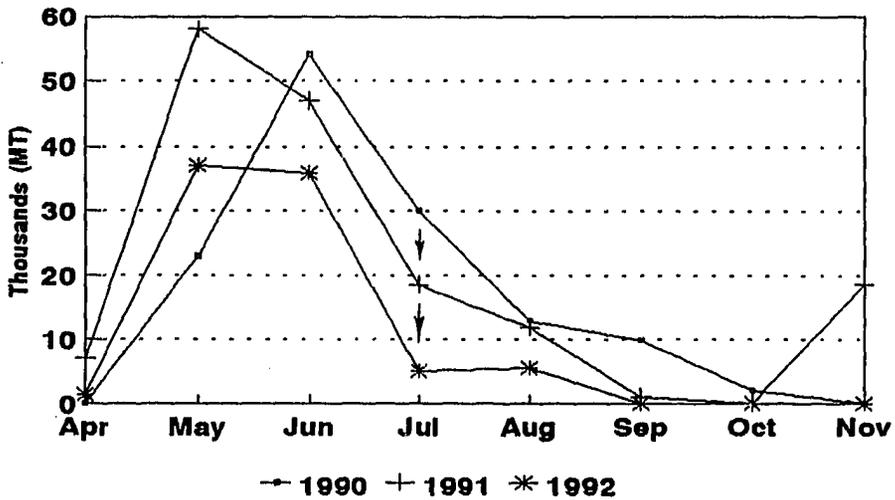
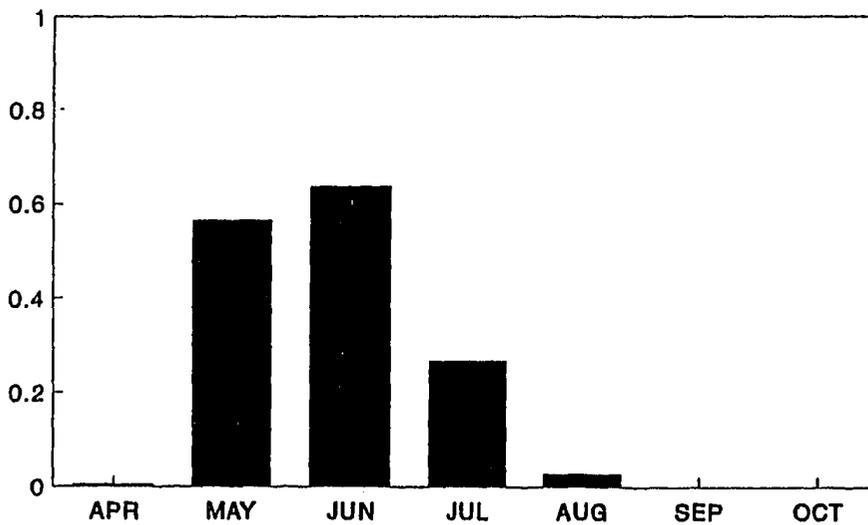


Figure 13
Ratio of Govt. Rice Procurement to Total
Marketings, Raj. Div., Boro Season'92



Hypothesis 6. The unanticipated early stoppage of millgate contracting precipitated two waves of falling price,
a) the first due to suspension of government purchases
b) the second due to millers' sale of speculative stocks.

Conclusion: True.

Evidence: The suspension of Palli (Rural) Rationing, in December 1991, cut off the largest rice outlet in the Public Food Distribution System (PFDS). Historically, it had accounted for about 50% of all public rice distribution. So in normal years, DG Food was able to dispose of 30,000 tons of rice per month through Palli Rationing. The offtake from Palli Rationing released pressure on the rapidly filling public godowns in the North West by drawing grain out of procurement zone warehouses to replenish depleted stocks in the consumption zones. But in 1992, this pressure release valve was unavailable. As rice stocks built up in the Northwest, they found no outlet. Storage space became a binding constraint limiting procurement.

This lack of outlets led to a firm procurement cap, a virtual cessation of purchases after the end of June. Many millgate contractors complained to our survey team that government stopped procurement too abruptly - and without warning. Some even claim that government reneged on issued contracts.

This abrupt suspension of millgate purchases triggered an initial fall in paddy prices in early July (Figures 1 and 2). And it caught millers and traders with surplus stocks. As they came to realize the suspension was firm, the millers began successive rounds of selling their excess stocks (Table 6). Some sold early. Others held out hoping for prices to firm up. But since prices never recovered, most millers ultimately sold at some point, to cut their losses. As they did, the price continued to cascade downward from early July through the end of the Boro season. It kept right on falling into the Aman harvest.

Table 6 - Buying and Selling of Paddy by Traders and Millers during the 1992 Boro season

Month	<u>Actions of Traders & Millers interviewed (percent)</u>			
	Bought	Bought & Sold	Sold	Did Nothing
May	2.9	96.2	1.0	0.0
June	1.0	98.1	1.0	0.0
July	1.9	91.3	2.9	3.8
August	3.8	54.8	17.3	24.0
Sept.	1.9	41.3	30.8	26.0
Oct.	0.0	33.0	35.0	32.0

Source: IFPRI Boro Season price Survey.

Interlude 3 — The Paddy Stack Philosopher

It is a husking mill, the smallest and crudest of the processing units to mill parboiled rice. We drive in through the narrow winding rural road to the bamboo shed which serves as the mill storage. A similar lean-to nearby is the mill house with the single huller-aspirator. Behind is the drying yard and the parboiling tanks with steaming vats. As is usual, a series of oil drums linked with steel pipes serve as the jury-rigged boiler to provide the low-pressure steam, a very dangerous practice indeed!

The stack of paddy beside the soaking tanks is six bags high. After the early morning fog, a shaft of sunlight falls on this stack and an old man is taking full advantage of it at the most convenient place - on the stack itself. On our approach, he turns around and looks down with evident interest, for it is not every day that two sahibs, one of whom is white, visits this small mill at the center of Mahiganj, the heart of traditional milling industry of Rangpur.

"Salam sahibs." "Salam Uncle, how is business?" "Business Sahib? There is no business, only continuous losses since the last Boro, but then, who you are and who is this Ingrez Sahib?" "Not English, Uncle, American. He has come to know about rice-trade of Bangladesh and he works for International Food Policy." "Food Policy Shahib?" Suddenly the old man shouts, his salt and pepper beard aqiver in anger, "Food Policy is at the root of all our ruination!" "Calm down Uncle! we are not government, we are neither FAO, we are independent like you or the owner is." This I say hastily, pointing to the man who earlier introduced himself as the owner. "What are you then? If you are neither government or the donor agency?", suspiciously asks the oldman, not believing that an American Sahib can be independent like he himself is. "We are consultants, like the lawyer and the doctor, to whom you go when you have problem either with your land deeds or your stomach after eating the wedding feast. We advise the government and the Americans at Dhaka, if anything ails the Food Policy - we don't own it, we don't operate it, we don't even get any money if the government buys American wheat. And this Sahib is a Doctor of Philosophy, you understand?" "Ah! a Doctor, like Doctor....., the politician, who talks of rule of law and the constitution in the Supreme Court?" Evidently, the oldman is keenly interested in politics and reads newspapers!

His face is now animated, he half crouches on his paddy stack and goes on. "I tell you what is wrong with the Food Policy- those fools at Dhaka know nothing. They do things for the farmer not knowing who a farmer is. They buy rice at high price and spoils them at the godown because the ration price which should be lower than market price is always higher than market price. They give money to the millowner to buy paddy at their fancy price - will the millowner pay this money to the faria and will the faria pay this to the grower? The millowner, the faria, the food official, all take their cuts of the government pie and I, the independent man, am ruined. I lost forty thousand taka when I am only a two hundred maund Bepari. God knows how much the big automatic mill owner lost!"

"How can you lose 40 thousand, uncle, when the cost of 200 maunds of paddy is about that much? Did the price of rice come to zero?" I chide the old man. "Don't be daft, Sahib. To get 200 maunds in the market, I got to have 200 in the paddy market, 200 in the soaking tank, 200 in the drying yard and 200 in the mill house. All these make 1000 maunds. You lose 10% of the price, in two cycles you lose your original 200, see!" "You are right, uncle, but what can we at the Food Policy do to help you?" "Help me? I need nobody's help except His", he points upward. But if you really want your Food Policy to survive, tell this Fellow to stay away from the market. Market is for real men like us, who use their own money, not anybody else's. We play for real, we don't make-belief. No one pays us, we pay our employees and our taxes. Tell them not to ruin us with our own money - I mean our tax-money which pays for all their fancy cars, air conditioning and their cushy trips to foreign lands". He grows very angry again. "Who is that Fellow uncle, and what should he do?" I venture timidly. "Don't be daft, Sahib, you know that I mean the government, tell them to stay away from the rice market and play somewhere else", he growls, "STAY AWAY FROM RICE MARKET, you hear, and leave us and the market to God almighty, who will take care of us and the farmer. We need no government to help us, for keeps sake!" He points an angry finger at me.

Another country, another time. Was it Demosthenes who asked the mighty king to stay away from the sun in which he was basking contentedly? Our philosopher, the bearded man looked much like an angry Greek from his stack of paddy which was both his worldly wealth and his sun-bathing platform. He wanted nothing but to be left alone! That is not too much to task, more so, when his money was being used to disrupt the market in which he transacts business, from which he draws sustenance.

5. IMPLICATIONS

FOR MILLERS AND TRADERS

Many millers and traders sustained heavy losses (Figure 14). In a falling market, those who hold stocks can only lose money. Some millers got out of the market early and salvaged a profit for the season. Yet the great majority lost money, 4 lakh taka on average for major mills and 1 lakh for the small mills. Given typical turnover at these mills, losses of this magnitude depleted working capital by 40% to 60%.

In addition, millers' retained large carryover stocks at the end of the Boro season. At the end of October 1992, they held rice stocks about three times as large as in October 1991 (Table 7). By tying up their limited working capital, it even further constricted their purchases in the Aman season of 1992/93.

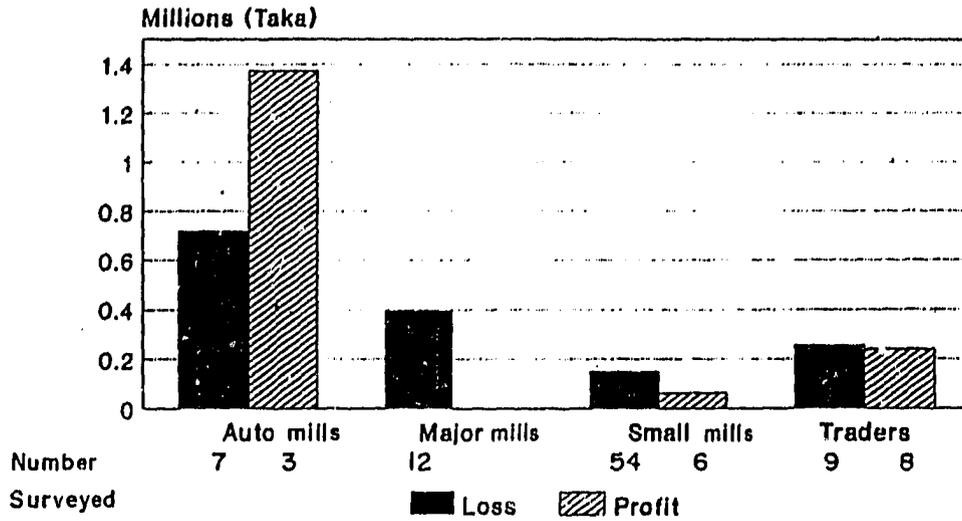
Traders and millers vocally voiced their mistrust of government after the heavy losses they endured during the 1992 Boro season. They complained loudly to us that government was undependable and unpredictable (Interlude 3). Many traders said, "We prefer no government intervention at all to unpredictable, destabilizing intervention."

AMAN PRICES

Because of their large carryover stocks, traders and millers were not interested in purchasing as much as normal in the next Aman season. And because of their depleted working capital, millers and traders did not have the means to purchase paddy, even if they had wanted. To compound the liquidity problem, government stopped pre-financing purchases during the Aman season, further reducing liquidity of millers. On average, private traders and millers reduced their early season Aman purchases by roughly 33% (Table 8). Government also curtailed its own procurement drastically, purchasing only 15,000 tons total in the post-harvest months of November, December and January. They limited procurement largely because of their overflowing godowns and inability to dispose of that large stock in the wake of a suspended Palli Rationing channel.

Given high levels of private and public carryover stocks, an acute shortage of working capital, and an all-time record Aman harvest, prices fell a record 25% below their level one year prior. Record production was part of the reason. But the fallout from the Boro season undoubtedly exacerbated the fall.

Figure 14
Average Loss/Profit For Three Types
Of Millers & Traders



Source : IFPRI Boro Season Price Survey

Table 7 - Increase in Boro Carryover Stocks in 1992

Carryover stocks of rice on October 31 (maunds)	1991	1992	1992/1991
<u>Rice Traders</u>	323	433	1.3
<u>Millgate millers</u>			
Small	361	1,949	5.4
Major	862	2,148	2.5
Automatics	1,962	7,801	4.0
<u>Nonmillgate millers</u>			
Small	452	1,177	2.6
Major	-	-	-
Automatics	3,000	10,000	3.3

Source: IFPRI Boro Season Price Survey.

Table 8 - Falloff in Aman paddy purchases in 1992

Average turnover in December (maunds of paddy)	1991	1992	1992/1991
<u>Paddy Traders</u>	2,902	1,363	0.47
<u>Millgate millers</u>			
Small	8,771	3,999	0.46
Major	10,559	2,418	0.23
Automatics	12,222	7,508	0.61
<u>Nonmillgate millers</u>			
Small	2,485	1,617	0.65
Major	-	-	-
Automatics	22,728	15,620	0.69

Source: IFPRI Boro Season Price Survey.

GOVERNMENT PROCUREMENT PROCEDURES

The millgate contract, and the steady build-up of corruption and speculation it induced, was a major culprit in the 1992 Boro season price collapse. Like any fixed-price procurement system, the millgate contract was subject to abuse given the inevitable spread between market and procurement price. The millgate contract, with its free advance financing and liberal milling ratios proved an especially tempting target for abuse. Suspended prior to the 1992/93 Aman procurement, the millgate contracting system must remain dead and buried if government is to avoid similar disruption of food markets in future years.

In designing a successor procurement system, government must seek a system with the following characteristics:

- **predictable:** Millers and traders must know what government intends and how government will act in order to act intelligently themselves. During the 1992 Boro season, government's abrupt suspension caught the millers completely by surprise. Given government's subsequent non-procurement in the first three months of the 1992/93 Aman season, its shifting procurement modes, and a series of four changes in procurement grades over a three-month period (November 1992 to January 1993), traders and millers remain confused and unable to anticipate government behavior. As the largest trader in the rice market, government must be predictable. Otherwise, they will risk driving private traders from the market.

- **non-disruptive:** In 1992, rice markets were disrupted by unpredictability - the unanticipated suspension of millgate purchases - combined with government purchase of large quantities at above-market prices. Buying at market price would avoid much of this problem. Reducing the scale of government procurement would also minimize the potential for speculative bubbles.

- **low-cost:** The millgate contract system was extremely expensive. Government paid approximately 100 crore taka (\$25 million) above market price for the rice it procured during the 1992 Boro season.

Tendering offers one means of achieving these objectives. By purchasing at market price, tendering limits the price speculation that occurs when millers scramble to sell at government's lucrative premium price. It also limits scope for corruption by avoiding any spread between official and market prices. By fixing a quantity target, government avoids the problem of procurement in excess of distribution requirements.

To support any new procurement system, and to invigorate growth of the private grain trade in general, will require two further interventions.

- credit for foodgrain trade: Since government previously pre-financed all procurement itself, withdrawal of the millgate financing has greatly reduced liquidity among the trading community. Although Bangladesh Bank has rescinded regulatory restrictions on credit for foodgrain traders in October 1992, banks have been slow to respond and formal banking credit remains rarely available for rice millers and foodgrain traders (IFPRI, 1992). Expanded credit facilities will be essential to ensure competitive, well-functioning rice markets.

- multiple grades: Introduction of multiple rice grades is likewise crucial to the modernization of Bangladesh's rice economy. The institution of established multiple grades will increase the value added in rice production by providing incentives for private traders and millers to sort and sift rice by variety and grade. Multiple grades will position government and private traders for export, providing a crucial outlet for surplus government stocks and an outlet for growing domestic rice production. Government is the only trader in the market large enough to institute a workable system of multiple grades.

The transition to a new procurement system will take time, many years at least. And it must proceed as part of the overall reform efforts in the food sector. This post-mortem of the 1992 Boro season suggests that the focus of future procurement efforts must be to design a reliable, predictable successor to the costly and easily abused fixed-price millgate contracting system.

6. POST-SCRIPT

Since the 1992 Boro season, foodgrain markets in Bangladesh have changed rapidly and dramatically. In the ensuing Aman season of 1992/93, Government suspended millgate contracting to prevent further high costs and abuse. This closely followed their May 1992 abolition of Palli Rationing, the largest rice outlet in the Public Food Distribution System. This rapid sequence of curtailed procurement and distribution has effectively reduced Government's role in both paddy and rice markets.

The private trade, too, appears to have diminished its buying activity (Box 3). Heavy losses sustained in the 1992 Boro season have reduced their working capital. This, coupled with record carryover stocks into the Aman season, dampened buying. The 1992/93 Aman season produced record low rice prices due to a bountiful harvest and the greatly diminished purchasing by both government and private traders. The continuing general downward trend in rice prices has left many traders discouraged, disconcerted, and on the sidelines.

In the Boro season of 1993, low prices persist, roughly 30% below the same period last year. Skittish private traders and millers still remain largely absent from paddy markets. Rice mills are operating at perhaps one-third of their capacity as wet weather in April and May have further slowed post-harvest activity. Government, meanwhile, has procured very little rice since the 1992 Boro season, for want of outlets and storage. Instead, they have been preoccupied with stock disposal, first of rice, now of wheat. Initially, abolition of the Palli Rationing channel caused public rice stocks to build up without easy outlet. Donors' subsequent agreement to swap rice for wheat in the Food for Work season transformed a public rice disposal problem into a public wheat disposal problem.

The politics of rice are changing as well. For decades, politicians complained of high rice prices, unaffordable, they claimed, for low-income consumers. Today, instead, they clamor that prices are too low, that farmers cannot cover their cost of production.

Both government and private traders are adjusting to a new era:

- of rice surpluses,
- correspondingly low prices,
- increased marketings - from 15% of total production thirty years ago to 50% today,
- a growing number of private traders, and

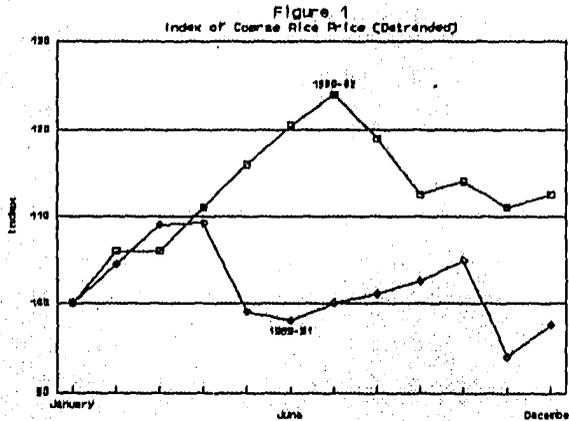
- reduced government presence, motivated by cost containment and made possible by growing private sector activity.

Government, in adjusting to a new and less-prominent market presence, is digesting its temporary stock disposal problem and attempting to develop new rules of interventions for both procurement and disposal. The private trade, still skittish, is trying to anticipate government behavior. To facilitate adjustment by both parties, rapid appraisals such as this one can play a key role in facilitating communication and rapid feedback as both parties adjust to the new realities of a growing rice market.

Box 3 -- Private Grain Storage, On-farm and Off.

For storage to be profitable, commodity prices must go up as the season progresses to cover the cost of storage, which can be considerable. For a cereal grain, the primary components of storage cost are: (i) weight loss due to loss of moisture, (ii) warehousing costs, either rent or amortization on the cost of the warehouse itself (iii) labor and management costs, (iv) cost of insecticide and fumigation, (v) interest on borrowed capital (vi) depreciation of packing material like gunny bags, (vii) loss due to deterioration of quality (viii) insurance, if any, (ix) overheads like licensing fees, land rent local taxes on business etc, and (x) the routine "transaction costs" of business operations in Bangladesh.

For paddy traders, these costs may be as high as 40% per year or 20% per six-month season (Rahman, 1992). Farmers, however, can store at much lower cost since they avoid, or at least greatly reduce, costs under heads ii, iii, vi, vii, ix, and x. This cost advantage may explain why farmers currently hold about 80% of all private grain stocks, while traders hold only about 20%.



The profitability of long-term storage has apparently diminished over time. According to Chowdhury (1992), traders currently earn low or even negative returns to long-term trader storage of rice and paddy. Dampened seasonal price movements - the result of a second major rice harvest during the rabi season (Figure a) - and increased cost of warehouse space in terminal markets have eroded the traders' profit margins. It appears that traders must increasingly focus on short-term storage and spatial arbitrage, while Bangladesh's 20 million farmers become the guarantors of food security, emerging as the largest repository of long-term grain storage. Future efforts at monitoring private grain stocks must focus, not just on traders, but on farms.

Interlude 4 — The Miserable Manager

The river ferry takes over four hours to reach the ghat, though the river port is only about 6 miles across. The old boat must chug along a route roughly representing an inverted U, the points being the ports of departure and destination, the peak reaching almost the Indian border with innumerable shoals and shallows between the two arms. It is a tricky navigational task evidenced by intermittent but frequent clangs of the old-style telegraph by which the Master was ordering change of engine speeds from the bridge. We heard the clangs clearly from the cabin located just below the bridge.

"Winter is almost here", said the middle aged little man seated on the canvas covered bench next to me, and sighed deeply in melancholy. How the inevitable change of weather could be a source of lamentation appeared to be a mystery to me. "Yes", said I, "and the water level is so low that you can see the eddies indicating shallows which our Captain is assiduously avoiding by use of rev and helm". It always helps to be formal in speech and manner when opening conversation with a manifestly unhappy man. Through his heavily rimmed glasses, the man looked at me. Why, he looks like a hopelessly trapped fish, I thought. "Going North?" "Yes, to the North and there is nothing I can do about it, can I, going North. To my job of making sugar out of sugarcane for which I must pay a fixed price and sell sugar at fixed price, only that no one buys my sugar at that price". Why do I smell fish oil in this wooden cabin, I wondered, there is no fish nearby, only the obviously unhappy man who makes sugar and sells it, nothing fishy about that by the wildest imagination. "I will buy paddy within two weeks, so you will buy sugarcane," I ventured. "What is so different about those", I continued. "Are you the manager of the sugar mill? Sugar prices are rather low this year they say". "Yes, I am the General Manger of the biggest sugar mill in this Northern district. I have over 2000 acres of mill land, in half of which I planted the HYV variety from the Cane Research Centre at Isswardi. I topped my class at the Agricultural University back in '66, my research paper was on the control of pest in the hybrid variety of potatoes, they were just introduced then, you see", he said absentmindedly. This is going to be the Mad Hatter's party in Alice In The Wonderland; put the dormouse in the tea pot said the Hatter, because he is sleepy! "Oh yes, but we hear all these sugar mills are losing money and government is thinking about de-nationalizing many of them". I must have touched some hidden chord for he now looked positively animated. He shifted in his seat, raised a leg after massaging the calf for a few moments, looked at me intently and started with a startling lucidity.

"You want to hear why are we - why am I, losing money in the sugar industry? I started my career at that Mill which was privately owned then, as an agronomist. I taught the farmers scientific methods of cane cultivation, and then analyzed the crop for the sugar content. You pay for the sugar content and not the weight of the juice, and then you pay for the juice and not the weight of the cane", he said mysteriously with a hint of a mischievous smile, "most of all, you pay for the cane at a price which reflects the price of sugar from which you get all your expenses; price of sugarcane, though a major one is but only one of a million items for which you pay"! He beamed, having given me this piece of the ultimate wisdom.

"Why are you losing money then, when you know so much?" I said irritably. "Ah! Why I lose money, I never lost money when I bought sugar cane at economic prices back then. We sent millions to Karachi, the Company headquarters and we received three, four bonuses almost every year. After the liberation, the Communists look over and fixed the price of sugarcane regardless of sugar content, regardless of juice content and the Union got their raises, got their fake labours enrolled in the muster roll, the ghost workers, you know". "Socialists took over, not the communists", I corrected him. "Same thing", he said, with the finality of a morgue supervisor, "same thing, call them by whatever name you like and the result will be the same, we are ruined". This conversation is getting us no-where. The ghat is approaching, perhaps in another half-hour and the rush to disembark will start with all the cacophony of noises one hears at any river port, anywhere, which only a Conrad can describe with full justice. "And the Corporation is breathing down our necks to cut losses, to be profitable", he remarked looking out of the window. "I have been censured for inefficiency. I have to show profits or lose my job of 25 years. I am no magician, how can I do it when I must pay Tk. 27.50 a maund for poor quality cane and the price is 11 rupees across the border, that is Tk. 16 at most at the current exchange rate, and I must compete with smuggled sugar when my price of sugar is Tk. 29 per Kg fixed by the Corporation", he went on. This semi-soliloquy is getting on my nerves. "But what about price support? What about the farmer, is he not benefitting even if the price is high? What about incentive price to the poor farmer?" I said loudly to make him turn his head.

He turned alright. He looked back and fixed me through his thick glasses. "Farmer? You don't know who a canefarmer is! Cane is not poor farmer's fare, it takes a year to harvest cane, no poor farmer can afford to wait a year for his crop. I have M.C., a "farmer" who supplied cane worth eighty lacs last year, out of which I could not pay him 30 lacs so I had no money in the bank but a store full of unsaleable melting sugar. M.C. doesn't even care. Keep your books in order G.M. Sahib, he says, keep your accounts clear, even if this government doesn't pay me, I will get paid by the next, he says. Disgusting, I just can't think of him waiting at the Railway Station for me", said the Manager dejectedly. "Your land ruined? The likes of M.C. are buying up all the land from the poor farmers out of their fat-profits and converting the high land paddy fields into cane fields. You won't get any rice in the Sugar Mill area within a few years if this state of affair continues. Tell that to the Communists!" he glowered. "Socialists", I corrected hastily.

There is a jolt, the boat has struck the floating jetty. The Manager gathered up his bag and the brief case. "And I tell you what, if the government continues to buy paddy at fixed price you will be the same as the sugar market. You won't be able to sell the high cost rice, I guarantee you. So buy paddy at above market price and try to sell rice at fixed price, you will be the same as us in sugar. You will be ruined too!" He smiled for the first time. "Tell that to the Communists!" he laughed. "Socialists," I croaked.

ANNEX A.

FIELD SURVEY: DESIGN AND BASIC RESULTS

THE BORO SEASON '92 PRICE SURVEY

1. SURVEY OBJECTIVE

The price behavior of the 1992 Boro season warranted our special attention due to its unusual downward trend. Price level peaked during the early part of the season and then continued to decline steadily till the end. Both traders and millers with large initial stocks suffered losses due to this unexpected price fall.

IFPRI's 1992 Boro Price Survey aimed to collect information bearing on the following four questions:

- Was the 1992 Boro price movement, in fact, unusual?
- If so, why did it occur?
- What are the consequences for private millers and traders?
- What are the implications for government intervention?

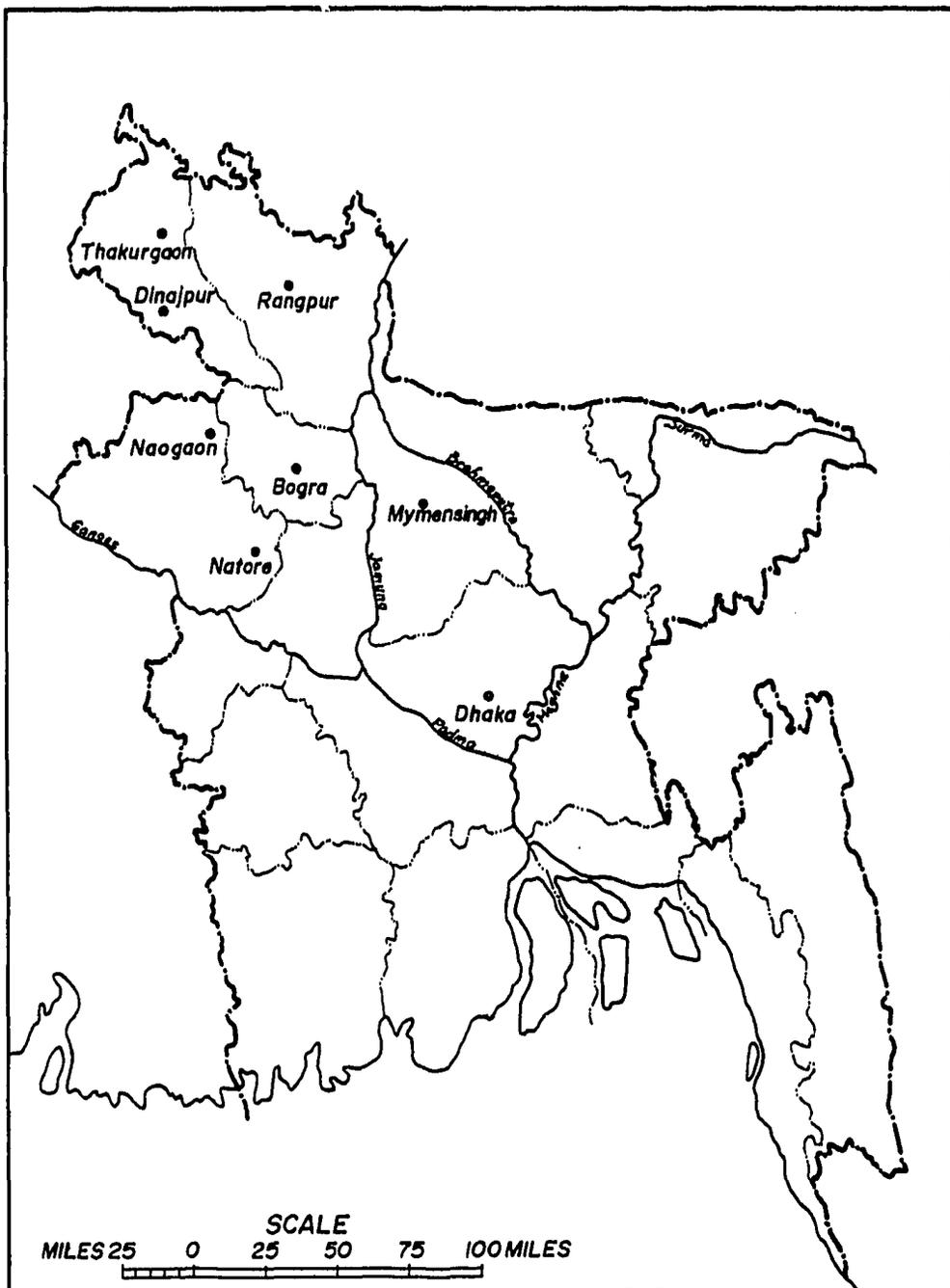
2. SURVEY DESIGN

Sampling : The survey was designed to cover a representative sample of different types of rice-millers and wholesalers of paddy and rice. A subsample of respondents was drawn from an earlier nationally representative marketing survey (Chowdhury 1992). Millers were classified by size - automatic, major and small - and as millgate and non-millgate firms, based on whether they held government millgate contracts. Wholesalers specialized either in paddy or rice trading. Where the selected firms were not available, the survey team replaced them with firms of similar classification.

The survey team conducted one hundred and twelve interviews in eight districts, namely, Thakurgaon, Dinajpur, Bogra, Naogaon, Natore, Rangpur, Mymensingh and Dhaka (Map A1). Six of the eight districts surveyed belong to the Rajshahi division - a part of the country which has traditionally been a surplus zone in rice production. Normally about 90% of government procurement of rice takes place in this division. Most of the respondents in this survey were also interviewed during an earlier survey by IFPRI (Market Survey 1989/90). The rapport built during the earlier survey helped ensure cooperation from the respondents since some of the questions asked during the survey were somewhat sensitive. Sampling from the previously surveyed part of the population would also allow us to build a longitudinal data base which could eventually be used for time series analysis.

Sample size was decided upon taking the total population, time frame and cost of surveying into account. The breakdown of the sample size by district and by business type is given in the following table :

Map A.1 – Locations of Rice-Paddy Markets Surveyed
(IFPRI BORO '92 PRICE SURVEY)



District	Wholesalers		Millgate Millers			Non-millgate millers		
	Paddy	Rice	Small	Major	Auto	Small	Major	Auto
Dhaka	0	8	0	0	0	0	0	0
Dinajpur	0	2	8	3	2	9	0	0
Bogra	0	4	15	1	1	3	0	0
Rangpur	1	0	1	0	2	1	0	0
Natore	0	2	3	0	2	1	0	0
Naogaon	0	3	4	0	1	3	0	1
Thakurgaon	0	2	5	5	1	2	0	0
Mymensingh	2	2	1	4	1	4	2	0
Tot. Smpl.	3	23	37	13	10	23	2	1
Bangladesh	9500	5100	1621	65	28	18049	421	60
Sample Weight	3166.7	221.7	43.8	5	2.8	784.7	210.5	60

Questionnaire : The questionnaire was developed primarily to gather information on the boro season of '91-92. A supplementary questionnaire was added to collect information on the subsequent Aman season. Questions were designed to probe the issues of monthly price levels, stocks and general performance of the seasons. A sample questionnaire has been attached.

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Questionnaire for Boro Season (92)

- (A) Name of the Firm : _____
 (B) Address : _____
 (C) Proprietor/Owners : Thana _____
 District _____
 (D) Type of Business : (a) Paddy wholesaler
 (b) Rice wholesaler
 (c) Rice Millers

Q.1 Monthly average prices paid/received (Tk/maund)(Coarse variety)

	Paddy	Rice	Actions		
			Your B/S/N	Others B/S/N	Govt B/S/N
May 92	_____	_____	_____	_____	_____
June 92	_____	_____	_____	_____	_____
July 92	_____	_____	_____	_____	_____
August 92	_____	_____	_____	_____	_____
Sept. 92	_____	_____	_____	_____	_____
Oct. 92	_____	_____	_____	_____	_____
Nov. 92	_____	_____	_____	_____	_____
Dec. 92	_____	_____	_____	_____	_____

Note *B = Bought *S = Sold *N = Did nothing

Q.2 What in your opinion are the causes for this behavior of price of Boro.

Q.3 Are you a government contractor: Millgate - 01
 Supplied to a Millgate - 02
 Non Millgate - 03

Q.4 Extent of Business: Quantities Handled: Rice/paddy (maunds in Total)

01. Supplied to the Govt. _____
 02. Supplied to Millgate Contractor _____
 03. Supplied to the Open Market _____

Q.5 Extent of stock of Rice/Paddy

	Paddy	Rice
May 92	_____	_____
June 92	_____	_____
July 92	_____	_____
August 92	_____	_____
Sept. 92	_____	_____
Oct. 92	_____	_____
Nov. 92	_____	_____
Dec. 92	_____	_____

Q.6 What was your carry-over stock at this end of season ? _____ (Oct.31st). How does your carry over stock compare with your stock of Oct. 31st 1991 _____

Q.7 Did you post a loss/profit in the Boro season of 92
 Loss/profit _____
 Could you tell us the Loss/profit as a % of turnover _____

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BANGLADESH FOOD POLICY PROJECT

Questionnaire on Aman '92

Q.1 Present price of coarse variety of paddy/rice: -

	Paddy/Rice (1991)	Paddy/Rice (1992)
December	_____	_____
January	_____	_____

Q.2 What was your turnover in

	Rice	Paddy
December 1991	_____	_____
December 1992	_____	_____

Q.3 What is your opinion regarding 1992 Aman Crop ?

(a) Same as 91 (b) Higher than 91
 If higher, how much 5%, 10%, 20%, 30%

Q.4 What is the market supply as compared to 1991 season?

More, Less, Same

If More/Less, then, at 5%, 10%, 20% 30% of 1991 Aman

Q.5 In your command area, do you think the farmers will grow next Boro crop:

(a) More, (b) Less, (c) Same area of plantation for Boro as 1991

- If More/Less, then how much
 5%, 10%, 20% of the Boro of 1991.

Q.6 In your opinion, will the farmer be changing his Boro cultivation to wheat ? If so how much 10%, 20%, 30%

Q.7 In your command area, the value of land rent (pattani) is _____ /acre what is: same as '92, more than'92.

SUMMARY OF THE SURVEY RESULTS BORO SEASON '92

BACKGROUND INFORMATION :

Types of Business

Type	Frequency	Percent
Paddy Wholesaler	3	2.7
Rice Wholesaler	23	20.5
Small miller (millgate)	37	33.0
Major miller (millgate)	13	11.6
Auto miller (millgate)	10	8.9
Small miller (Non-millgate)	23	20.5
Major miler (Non-millgate)	2	1.8
Auto miller (Non-millgate)	1	0.9
Total	112	100.0

QUESTION NO.1

Monthly average wholesale prices(Tk/maund) of paddy during boro season 1992 :

District	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Thakurgaon	218	220	224	219	215	209	166	154
Dinajpur	219	223	233	228	191	198	153	154
Bogra	222	239	245	233	209	191	157	165
Naogaon	217	231	241	225	208	193	175	180
Natore	222	241	245	229	222	na	157	170
Rangpur	214	206	223	200	187	179	161	156
Mymensingh	227	249	260	238	225	220	223	na
Dhaka	na							

Monthly average wholesale prices of rice (Tk/Maund) during boro season of 1992:

District	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Thakurgaon	392	394	395	378	326	299	268	247
Dinajpur	393	394	394	378	321	301	269	263
Bogra	389	391	393	369	339	301	278	276
Naogaon	391	395	394	375	355	323	285	295
Natore	398	401	400	379	358	323	296	291
Rangpur	354	360	365	353	306	287	297	263
Mymensingh	371	387	401	358	331	319	321	na
Dhaka	391	392	391	367	362	347	340	274

The following tables summarize the actions (Buying/Selling) of traders/millers and the government throughout the boro season (as mentioned by the survey respondents) :-

Month	Actions of traders & millers interviewed (percent)			
	Bought	Sold	Bought & Sold	Did nothing
May	2.9	1.0	96.2	0.0
Jun	1.0	1.0	98.1	0.0
Jul	1.9	2.9	91.3	3.8
Aug	3.8	17.3	54.8	24.0
Sep	1.9	30.8	41.3	26.0
Oct	0.0	35.0	33.0	32.0
Nov	0.0	28.2	35.9	35.9
Dec	0.0	19.0	76.2	4.8

Month	Actions of the other traders and millers as perceived by the survey respondents (percent)			
	Bought	Sold	Bought & Sold	Did nothing
May	0.0	0.0	99.0	1.0
Jun	0.0	0.0	99.0	1.0
Jul	0.0	0.0	98.1	1.9
Aug	1.0	16.3	67.3	15.4
Sep	1.0	26.2	46.6	26.2
Oct	0.0	23.3	36.9	39.8
Nov	0.0	23.3	45.6	31.1
Dec	0.0	10.0	85.0	5.0

Month	Actions of the Government, as perceived by the survey respondents (percent)			
	Bought	Sold	Bought & Sold	Did nothing
May	78.6	5.8	1.0	14.6
Jun	82.5	5.8	10.7	1.0
Jul	78.6	3.9	1.0	16.5
Aug	24.3	0.0	1.0	74.8
Sep	4.9	0.0	0.0	95.1
Oct	0.0	0.0	0.0	100.0
Nov	0.0	0.0	0.0	100.0
Dec	0.0	0.0	0.0	100.0

QUESTION NO.2

The reasons for boro'92 price decline as mentioned by different types of millers & wholesalers are as follows :-

1. Suspension of millgate contracting by the government.
2. Excess sale of private stock by the millers and wholesalers. (Traders and millers had accumulated large speculative stocks early in the season.)
3. Overall higher production.
4. No natural disaster.
5. Less demand in the deficit districts.

The percentages of different types of millers & wholesalers who mentioned the above listed reasons are given in the following table :-

Reason	Total (%)	Wholesalers		Millgate millers			Non-millgate millers		
		Paddy (%)	Rice (%)	Small (%)	Major (%)	Auto (%)	Small (%)	Ma.j. (%)	Auto (%)
#1	98.5	66.7	100	100	100	100	100	100	100
#2	40.3	66.7	37.5	16.7	77.8	40	40	100	100
#3	61.2	66.7	62.5	54.2	66.7	20	73.3	100	100
#4	28.4	0	25.0	33.3	22.2	20	33.3	0	100
#5	16.4	0	12.5	25	11.1	20	6.7	0	100
N*	112	3	23	37	13	10	23	2	1

N* = Number of respondents.

QUESTION NO. 3

Contracting types of millers :

54.8% of all the millers interviewed had millgate contracts, 11.5% supplied to other millgate millers and the rest supplied to the open markets.

QUESTION NO. 4 (% of total quantities handled in terms of rice)

- a) Supplied to the government : 38.4%
- b) Supplied to the millgate contractors : 5.7%
- c) Supplied to the open markets : 55.9%

QUESTION NO. 5

Average stock (maund) of rice (overall and by category of firm) :

Month	Total	Rice Trader	Millgate miller			Non-millgate miller		
			Small	Major	Auto	Small	Major	Auto
May	670	261	311	895	3189	408	100	1120
Jun	631	458	405	741	2327	406	145	1245
Jul	689	446	528	1278	1630	477	135	1330
Aug	1381	588	1643	2237	2180	936	100	1440
Sep	1594	418	1784	2397	4520	598	85	3250
Oct	1284	382	1103	2207	4793	351	0	3200
Nov	709	135	613	1439	2308	270	0	1000
Dec	247	130	284	286	576	113	0	1100

Average stock (maund) of paddy (overall and by category of firm):

Month	Total	Paddy Trader	Millgate miller			Non-millgate miller		
			Small	Major	Auto	Small	Major	Auto
May	4343	92	5369	2992	17082	1517	1500	5080
Jun	5387	150	7680	3885	17005	1942	3250	3900
Jul	3970	150	5176	3634	11839	1672	2650	11500
Aug	2496	107	2741	2000	9255	1393	1350	4520
Sep	1223	80	1035	1871	3964	851	450	4280
Oct	805	0	543	654	4253	509	0	860
Nov	557	0	373	477	2837	376	0	860
Dec	548	0	368	365	1968	303	0	11980

QUESTION NO. 6

Average Carry-over stock (maunds of rice) at the end of season (Oct. 31st, '92 & '91) :

Year	Total	Rice Trader	Milligate miller			Non-milligate miller		
			Small	Major	Auto	Small	Major	Auto
1992	2131	433	1949	2148	7801	1177	0	10000
1991	600	323	361	862	1962	452	0	3000
N [†]	112	15	37	13	10	23	2	1

N[†] = Number of respondents.

QUESTION NO. 7

Average loss (Tk) of millers and traders during the season :

	Milligate Miller			
	Overall	Small	Major	Auto
Avg. Loss	161,045.28	184,675.12	424,343.59	49,814.12
N [†]	99	36	11	9

	Paddy Trader	Rice Trader	Non-milligate miller		
			Small	Major	Auto
Avg. Loss	76,500	9,235.43	38,939.26	24,102.5	476,000
N [†]	3	14	23	2	1

N[†] = Number of respondents who reported loss/profit.

AMAN SEASON '92-93

QUESTION NO. 1

Average prices of paddy & rice in the procurement zone (Thakurgaon, Dinajpur, Bogra, Naogaon, Natore, Rangpur, Mymensingh and Dhaka) :

Month	1991		1992	
	Paddy	Rice	Paddy	Rice
December	239	379	165	267
January	245	387	195	305

QUESTION NO. 2

Average turnover in terms of paddy in dec'91 & dec'92 (overall & by category of firm) :

Month	Ove- rall	Paddy Trader	Miligate miller			Non-miligate miller		
			Small	Major	Auto	Small	Major	Auto
Dec'91	7430	2902	8771	10559	12222	2485	1300	22728
Dec'92	3864	1363	3999	2418	7508	1617	2025	15620

** Average turnover for Rice traders for the months of dec'91 and dec'92 are 4089 and 3733 maunds respectively.

QUESTION NO. 3

Opinion regarding Aman '92's production compared to previous years :

	Freq	Percent
Same as last year	22	21.4
Higher than last year	79	76.7
Less than last year	2	1.8

QUESTION NO. 4

Market supply of Aman Crop as compared to previous season :

	Freq.	Percent
Same as last year	21	20.4
More than last year	20	19.4
Less than last year	62	60.2

QUESTION NO. 5

Expected area of plantation for the next boro crop :

	Freq.	Percent
Same as this year	14	13.7
More	1	1.0
Less	87	85.3

QUESTION NO. 6

Change from boro cultivation to other crops (crop diversification) :

	Freq.	Percent
Yes	75	78.9
No	20	21.1

QUESTION NO. 7

The value of land rent :

	Freq.	Percent
Same as last year	17	33.3
Less than last year	34	66.7

ANNEX B.

SUPPLEMENTARY PRICE DATA

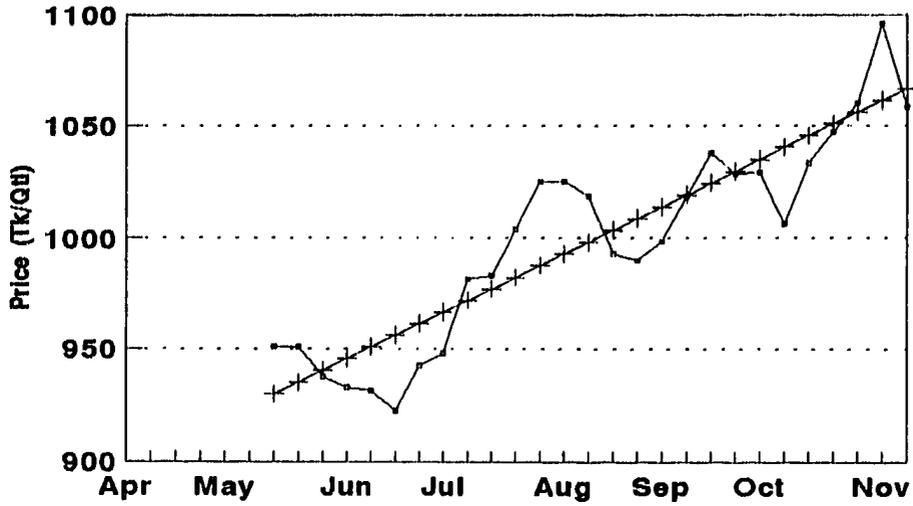
Annex B. Figures

- B.1. Rice Price in Dinajpur
- B.2. Paddy Price in Dinajpur
- B.3. Rice Price in Mymensingh
- B.4. Paddy Price in Mymensingh
- B.5. Rice Price in Nagaon
- B.6. Paddy Price in Nagaon
- B.7. Rice Price in Natore
- B.8. Paddy Price in Natore
- B.9. Rice Price in Rangpur
- B.10. Paddy Price in Rangpur
- B.11. Rice Price in Thakurgaon
- B.12. Paddy Price in Thakurgaon

Annex B. Tables

- B.1. Paddy Prices, 1990 Boro Season
- B.2. Paddy Prices, 1991 Boro Season
- B.3. Paddy Prices, 1992 Boro Season
- B.4. Rice Prices, 1990 Boro Season
- B.5. Rice Prices, 1991 Boro Season
- B.6. Rice Prices, 1992 Boro Season
- B.7. Dhaka 1992 Price Data Comparison
- B.8. Bogra 1992 Price Data Comparison
- B.9. Dinajpur 1992 Price Data Comparison
- B.10. Mymensingh 1992 Price Data Comparison
- B.11. Nagaon 1992 Price Data Comparison
- B.12. Natore 1992 Price Data Comparison
- B.13. Rangpur 1992 Price Data Comparison
- B.14. Thakurgaon 1992 Price Data Comparison

Figure B1
Dinajpur Rice Prices
a. Boro Season 1990-1991



b. Boro Season 1992

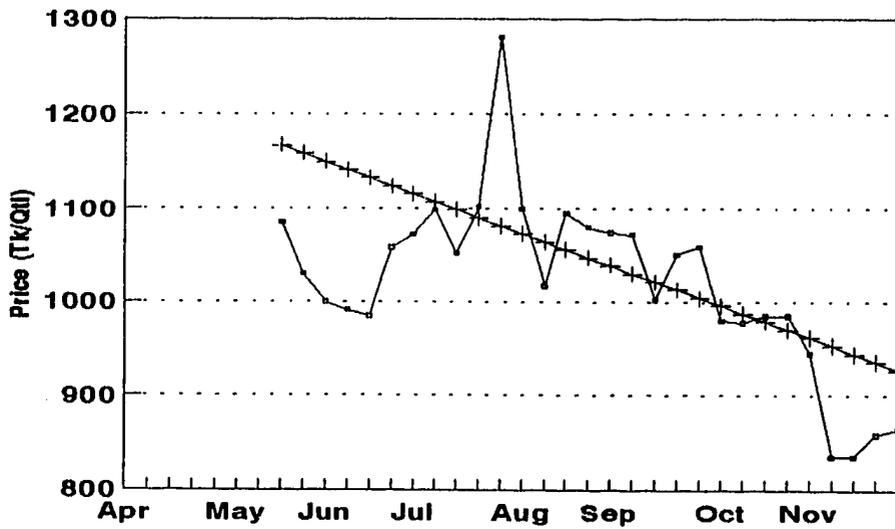
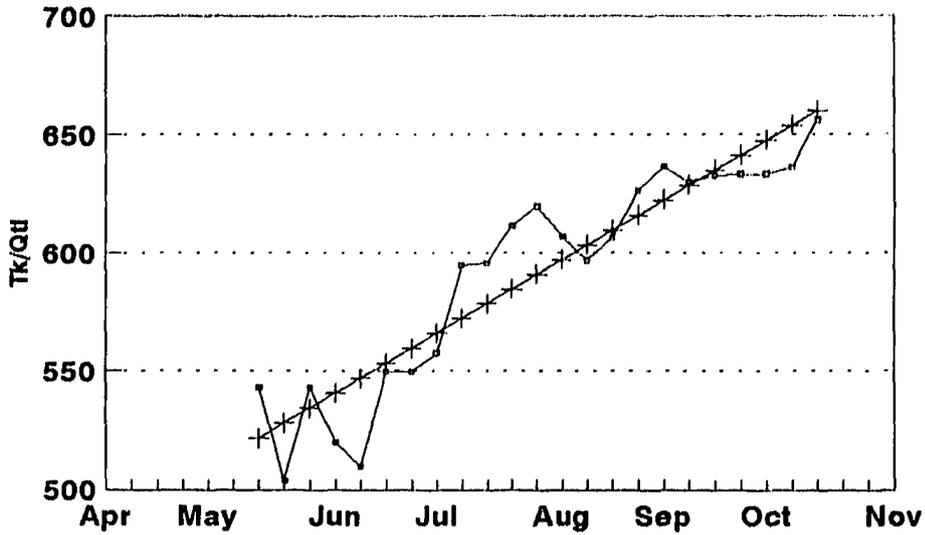


Figure B2
Dinajpur Paddy Prices
a. Boro Season 1990-1991



b. Boro Season 1992

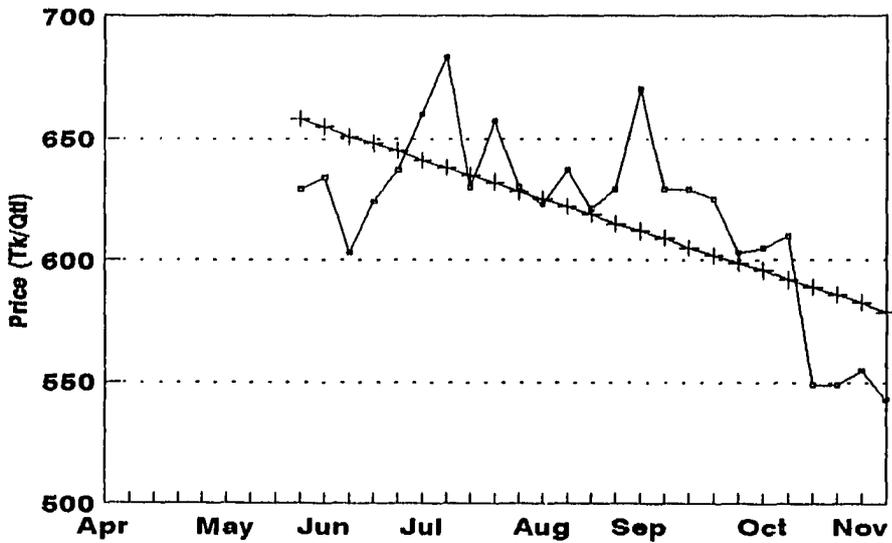
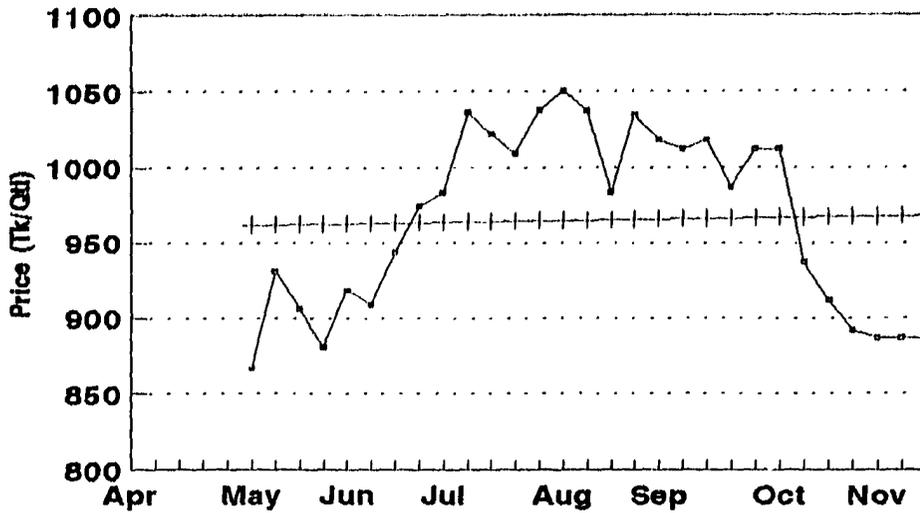


Figure B3
Mymensingh Rice Price
a. Boro Season 1990-1991



b. Boro Season 1992

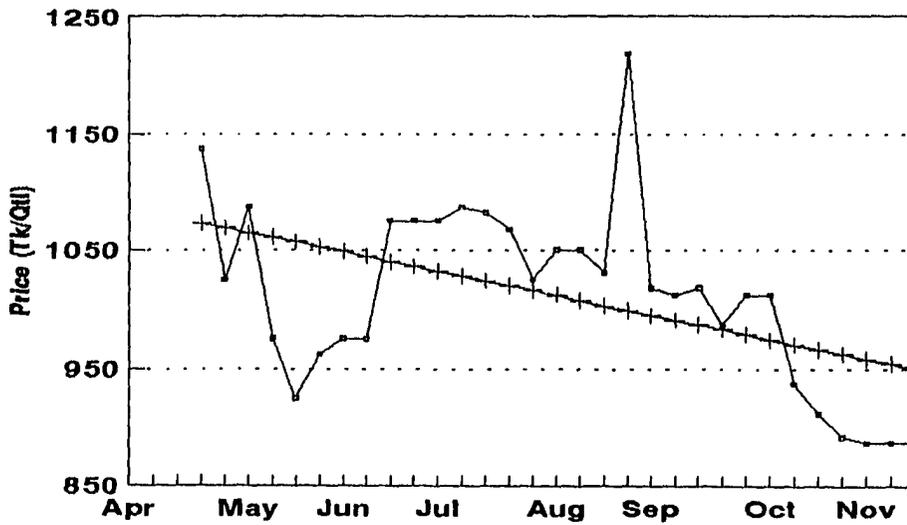
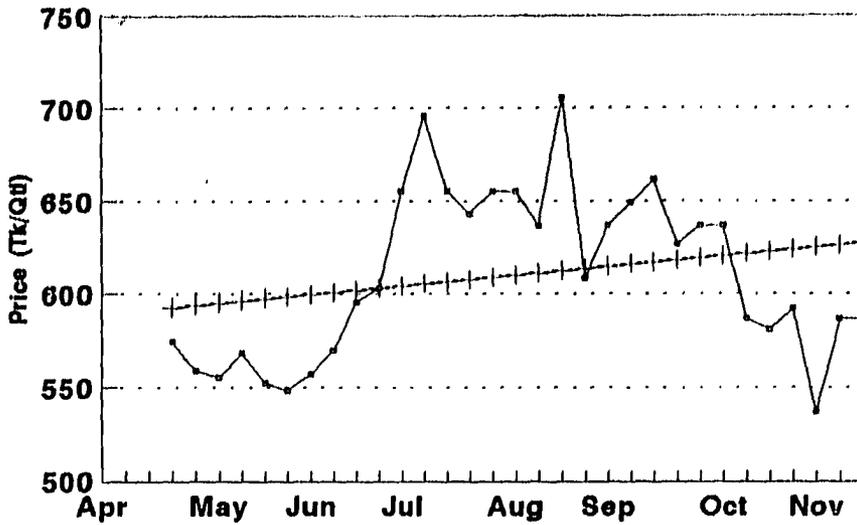


Figure B4
Mymensingh Paddy Prices
a. Boro Season 1990-1991



b. Boro Season 1992

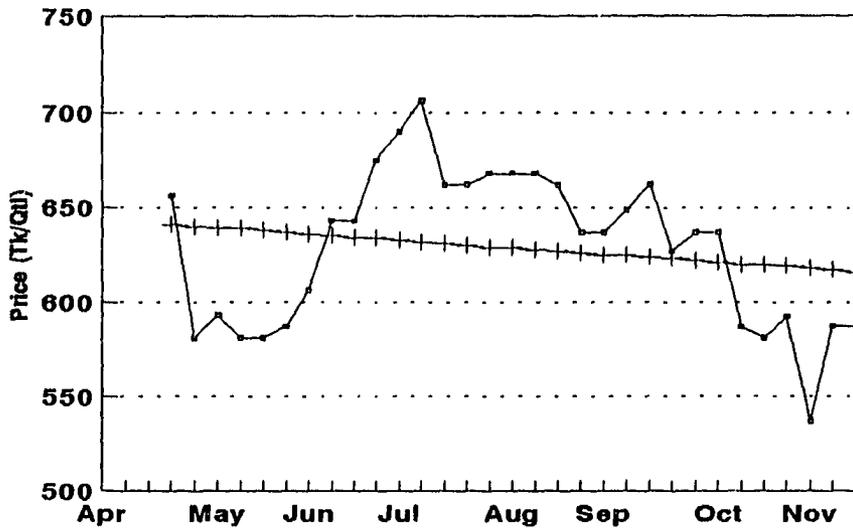
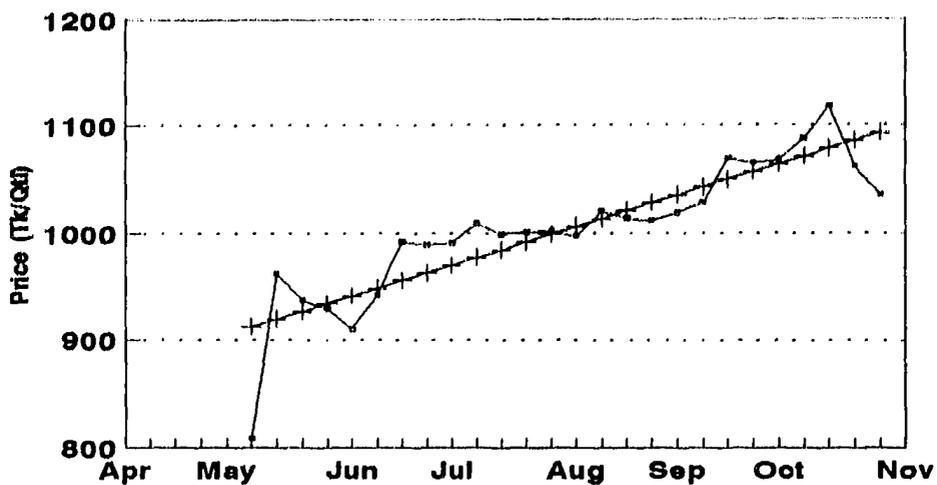


Figure B5
Naogaon Rice Prices
a. Boro Season 1990-1991



b. Boro Season 1992

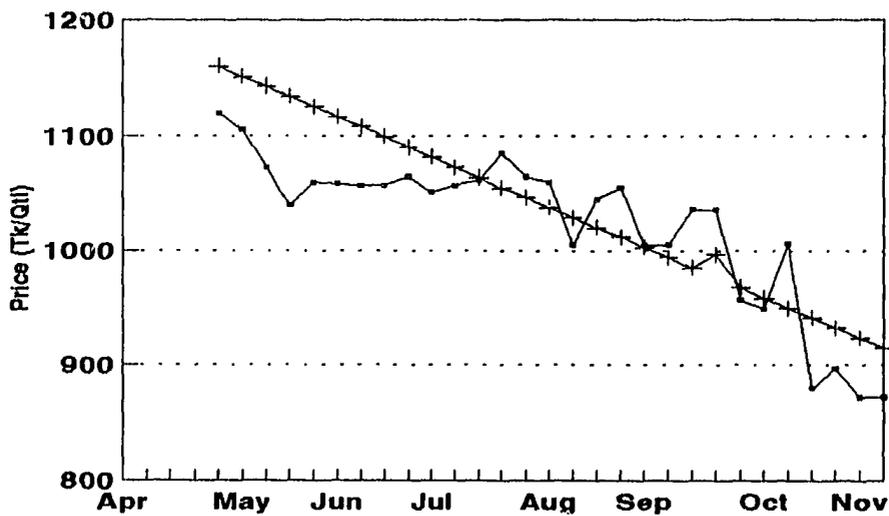
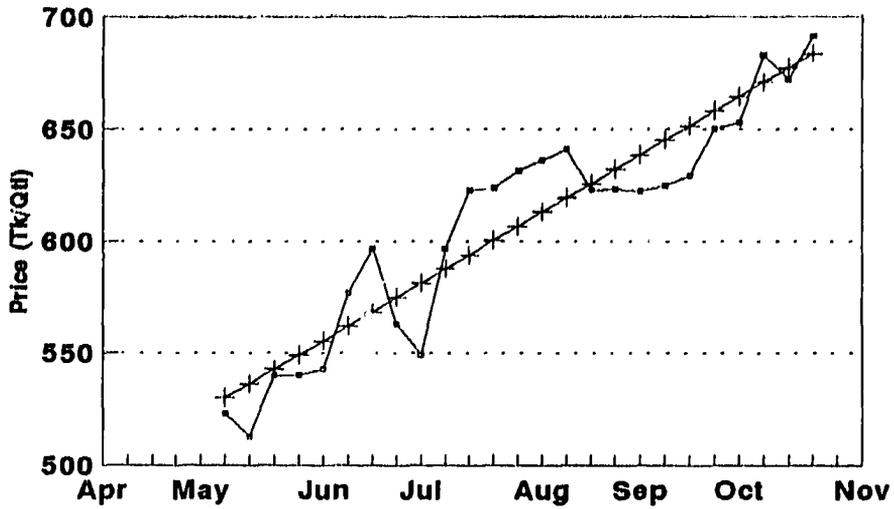


Figure B6
Naogaon Paddy Prices
a. Boro Season 1990-1991



b. Boro Season 1992

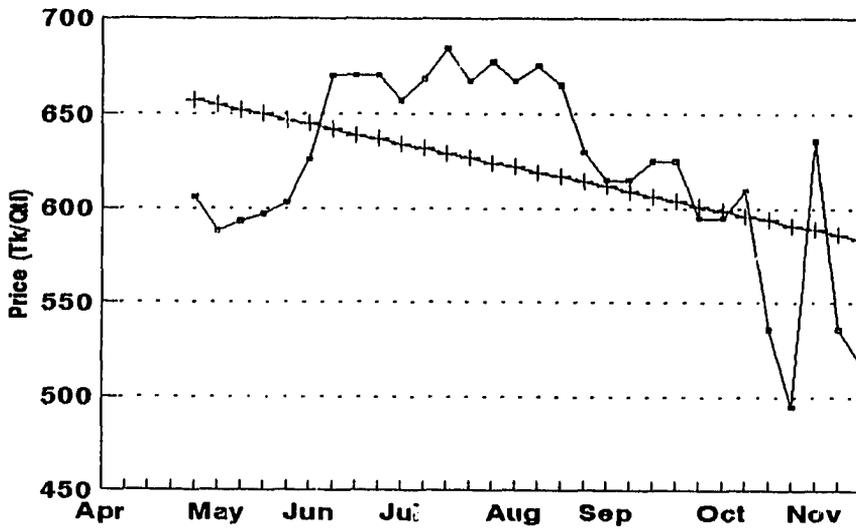
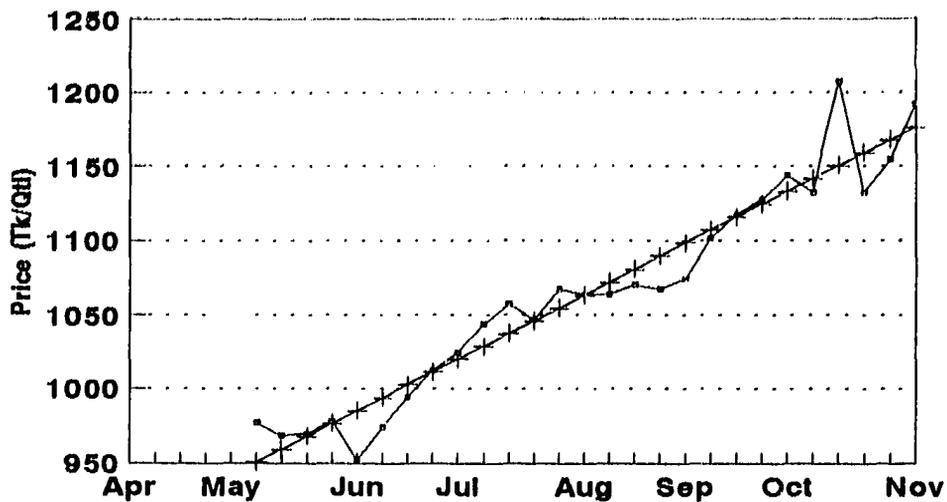


Figure B7
Natore Rice Prices
a. Boro Season 1990-1991



b. Boro Season 1992

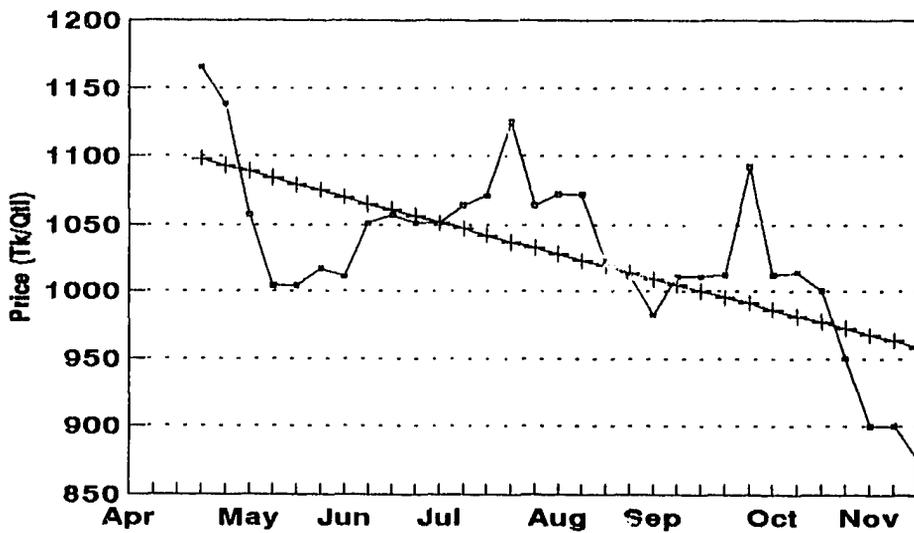
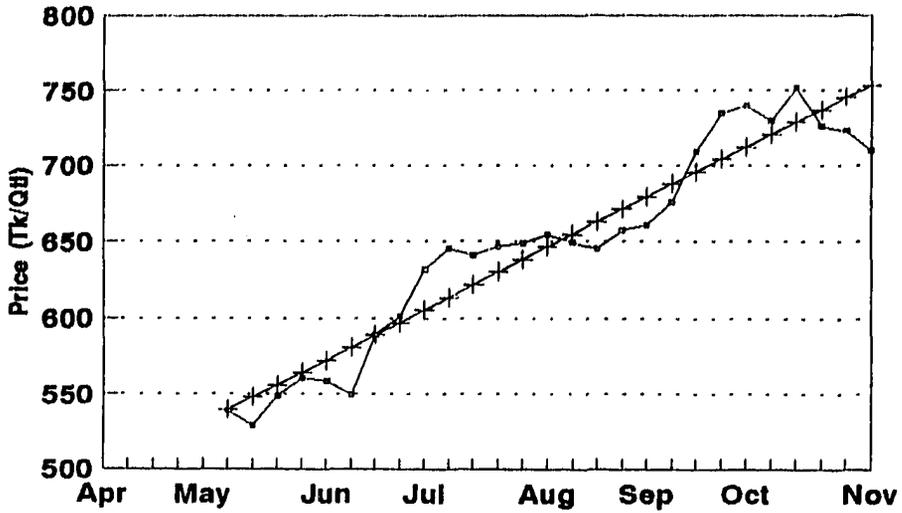


Figure B8
Natore Paddy Prices
a. Boro Season 1990-1991



b. Boro Season 1992

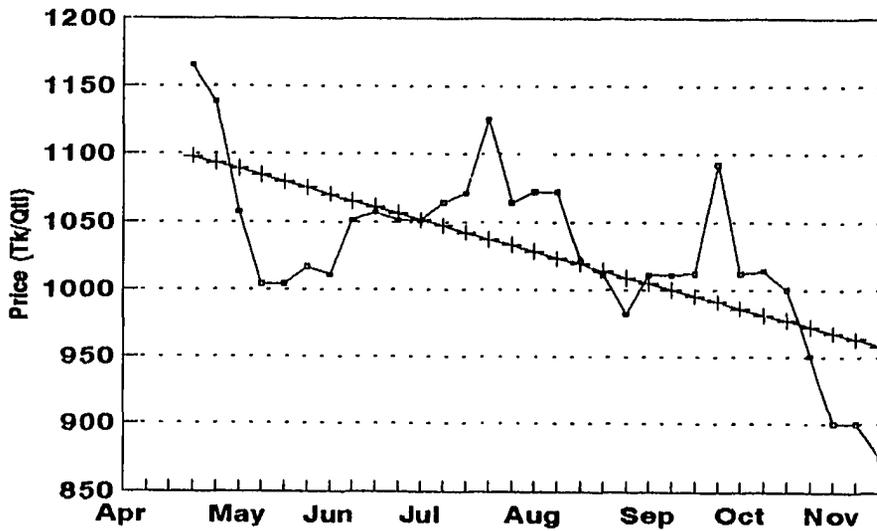
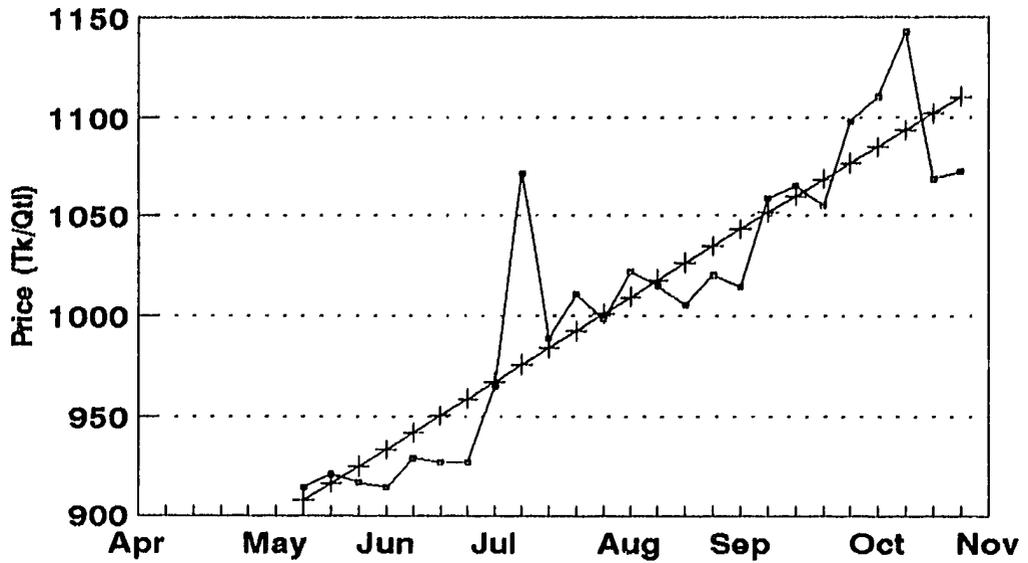


Figure B9
Rangpur Rice Prices
a. Boro Season 1990-1991



b. Boro Season 1992

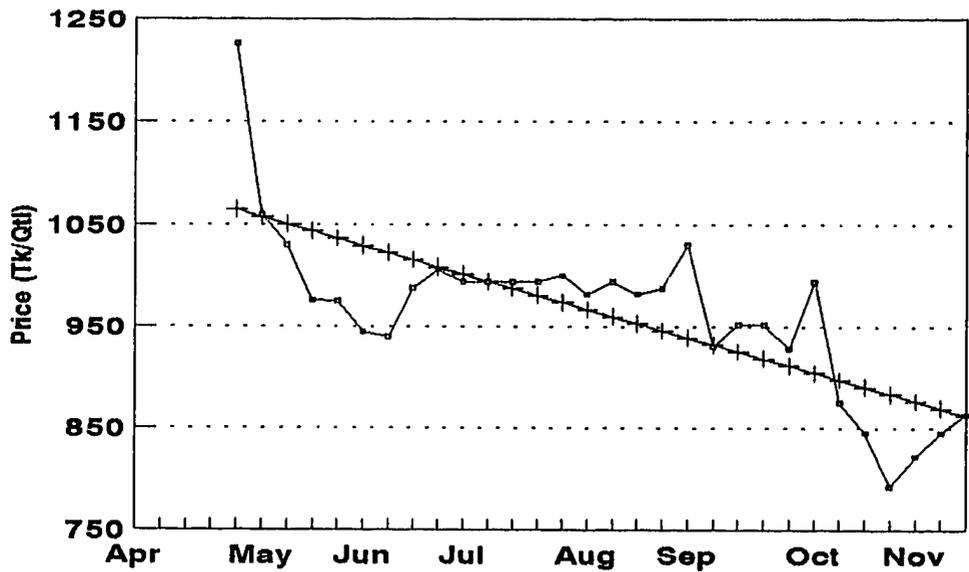
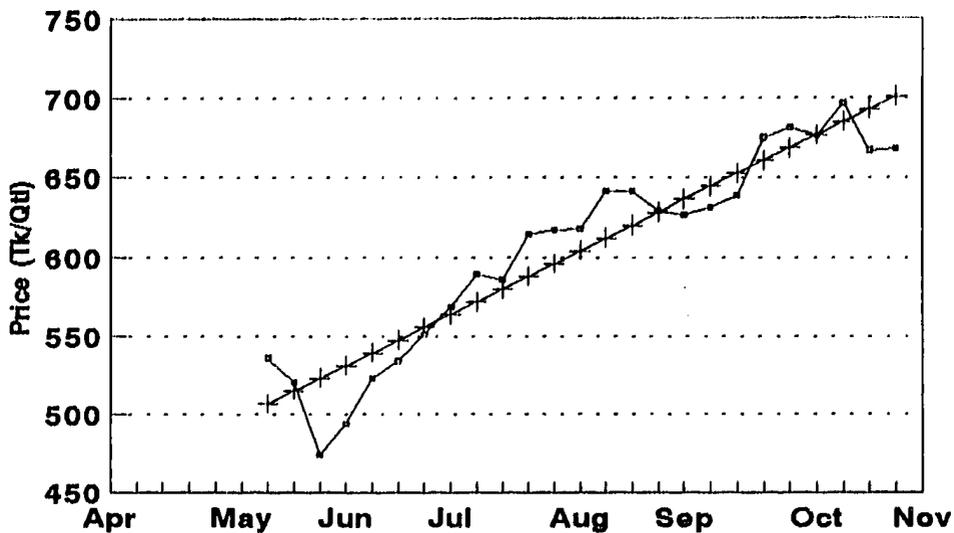


Figure B10
Rangpur Paddy Prices
a. Boro Season 1990-1991



b. Boro Season 1992

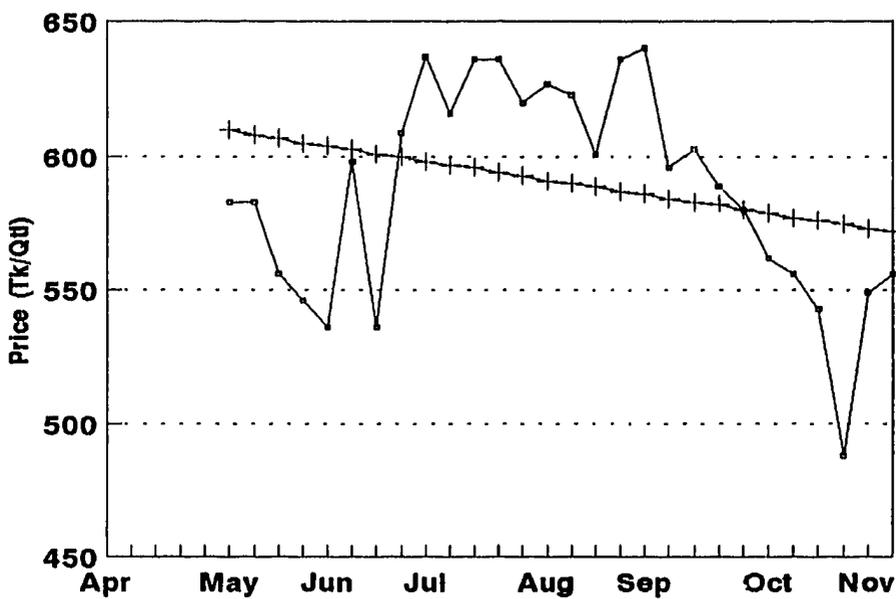
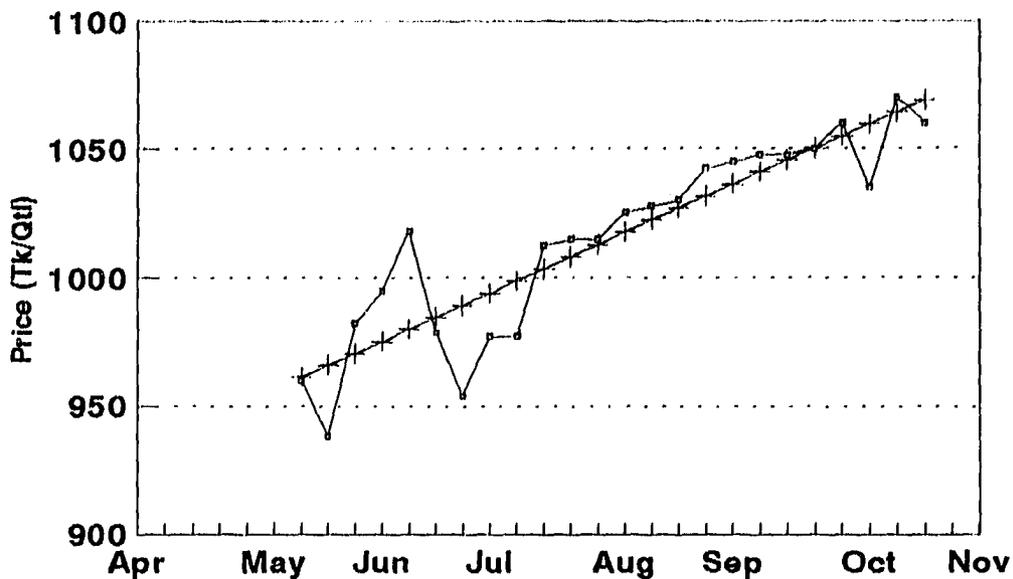


Figure B11
Thakurgaon Rice Prices
a. Boro Season 1990-1991



b. Boro Season 1992

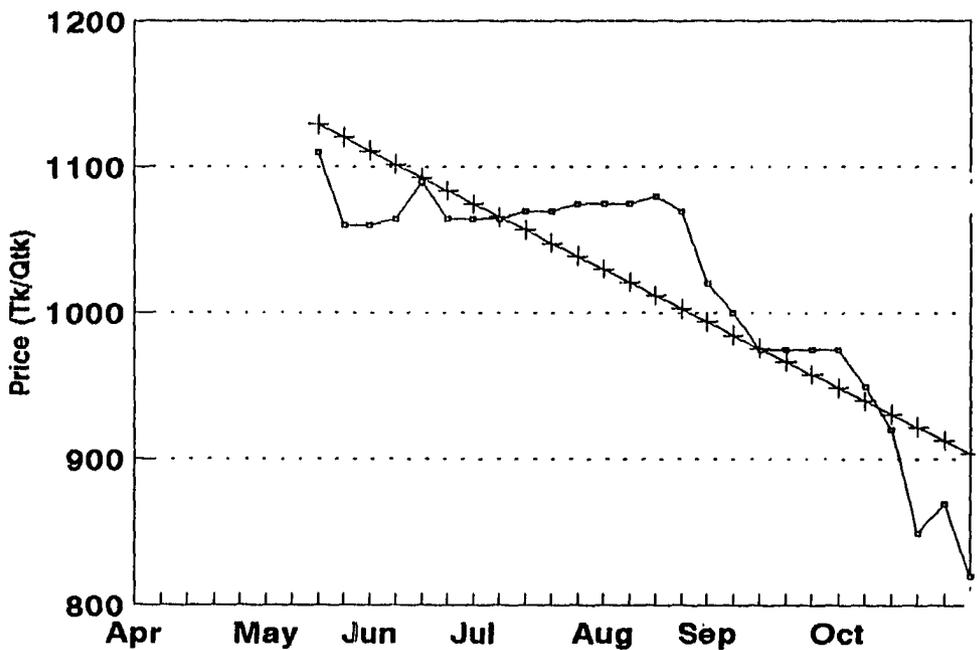
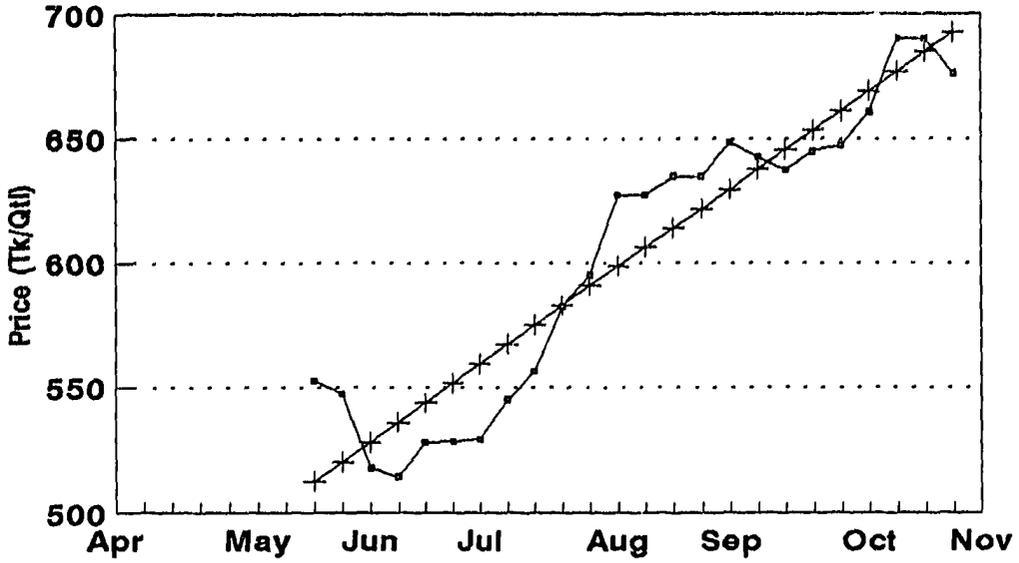


Figure B12
Thakurgaon Paddy Prices
a. Boro Season 1990-1991



b. Boro Season 1992

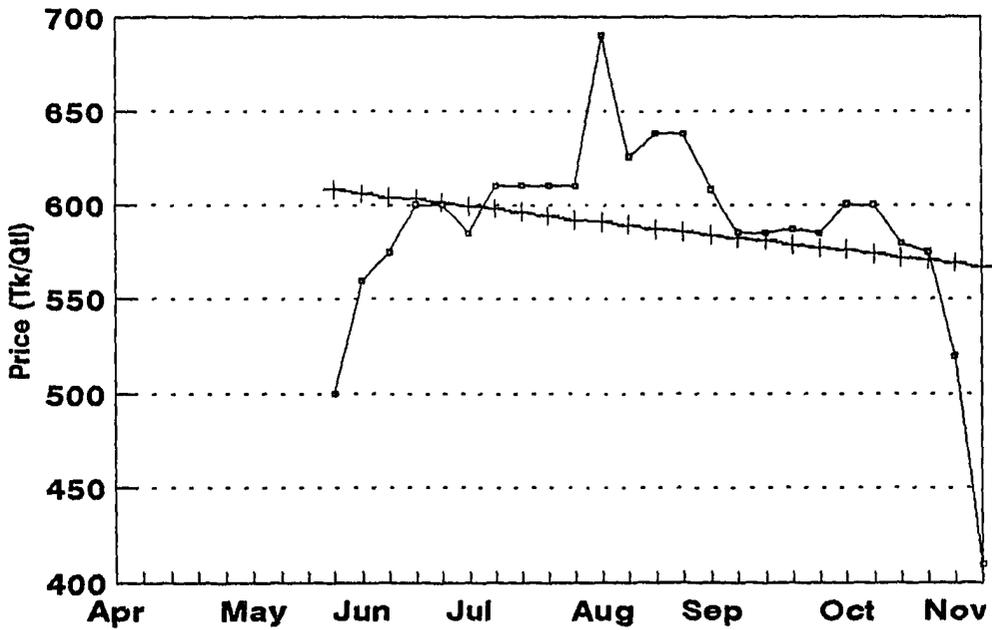


Table B1—Paddy Prices (Tk/Qtl), 1990 Boro Season

Month	Week	Dhaka	Soura Dinalpur	Mymensingh	Naogaon	Matore	Rangpur	Thakurgaon
Apr	1st							
	2nd							
	3rd							
	4th							
May	1st	562		562	540			
	2nd	496		552	475	502	541	
	3rd	475	536	574	475	495	503	
	4th	483	508	556	525	515	483	542
	5th	509	549	535	520	533	439	548
Jun	1st	529	490	540	495	515	472	476
	2nd	549	442	547	530	509	505	455
	3rd	563	495	549	530	549	503	482
	4th	569	495	550	520	573	532	522
Jul	1st	576	505	580	550	582	560	522
	2nd	569	576	593	540	595	566	555
	3rd	576	575	593	568	600	562	568
	4th	576	579	587	570	611	597	590
Aug	1st	596	583	618	588	629	583	590
	2nd	596	583	618	596	629	583	590
	3rd	609	583	631	605	617	622	590
	4th	609	569	793	569	617	622	595
	5th	583	576	593	569	629	597	595
Sep	1st	596	576		569	626	583	595
	2nd	596	576		569	655	587	595
	3rd	596	575		569	682	587	575
	4th	609	576		570	682	593	590
Oct	1st	623	576		570	710	607	595
	2nd	650	589		640	696	609	605
	3rd	690	629		635	737	656	
	4th	656				683	651	
	5th	650				710	646	
Nov	1st	663				710		
	2nd							
	3rd							
	4th							

Source : Directorate of Agricultural Marketing, Government of Bangladesh.

Table B2—Paddy Prices (Tk/Qtl), 1991 Kharif Season

Month	Week	Dhaka	Sogra Dinalpur	Chennsingh	Yoxaon	Hatore	Rangpur	Chakurzon
Apr	1st							
	2nd							
	3rd							
	4th			587				
May	1st	569		581		582		
	2nd	569	549	549	570	575		
	3rd	528	549	562	550	562	569	
	4th	542	500	549	555	582	558	562
	5th	495	536	562	560	589	509	547
Jun	1st	549	549	574	590	602	516	560
	2nd	623	576	593	623	590	541	574
	3rd	623	603	643	663	629	565	574
	4th	623	603	656	606	629	571	535
Jul	1st	637	610	731	548	682	577	537
	2nd	650	613	798	653	696	612	535
	3rd	663	616	718	677	682	610	545
	4th	662	643	699	677	682	632	575
	5th	682	656	693	675	669	652	600
Aug	1st	649	630	693	676	680	653	665
	2nd	654	610	643	677	682	661	665
	3rd	649	643	618	677	674	661	675
	4th	652	676	624	677	685	661	675
Sep	1st	660	696	637	675	696	670	702
	2nd	672	683	672	680	696	676	690
	3rd	690	690	689	690	736	690	700
	4th	700	690	706	730	787	757	700
Oct	1st	703	690	687	735	769	756	766
	2nd	703	683	712	725	763	743	716
	3rd	703	683	724	708	766	737	690
	4th	703	703	737	691	769	683	690
	5th	676	656	712		736	690	676
Nov	1st	613		687				
	2nd	649		587				
	3rd							
	4th							

Source : Directorate of Agricultural Marketing, Government of Bangladesh.

Table B3--Paddy Prices (TK/QT), 1992 Boro Season

Month	Week	Dhaka	Bogra	Dinalpur	Mymensingh	Naogaon	Natore	Rangpur	Thakurgaon
Apr	1st								
	2nd								
	3rd								
	4th				556		656		
	5th				581	605	551		
May	1st	500			593	588	609	583	
	2nd	500			581	593	548	583	
	3rd	610			581	597	548	556	
	4th	600	629		587	603	602	546	500
Jun	1st	610	634		606	626	622	536	560
	2nd	635	603		643	670	642	598	575
	3rd	650	624		643	670	656	636	600
	4th	660	637		675	670	689	609	600
Jul	1st	665	660		690	657	656	637	585
	2nd	650	683		706	668	669	616	610
	3rd	630	630		662	684	656	636	610
	4th	610	657		662	667	669	636	610
	5th	615	630		668	677	662	620	610
Aug	1st	650	623		668	667	665	627	690
	2nd	650	637		668	675	662	623	625
	3rd	660	621		662	665	662	601	638
	4th	630	629		637	630	662	636	638
Sep	1st	608	670		637	615	607	640	608
	2nd	650	629		649	615	665	596	585
	3rd	630	629		662	625	672	603	585
	4th	610	625		627	625	687	589	587
	5th	588	603		637	595	687	580	585
Oct	1st	565	605		637	595	687	562	600
	2nd	490	610		587	609	685	556	600
	3rd	470	549		581	536	636	543	580
	4th	490	549		592	495	596	488	575
Nov	1st	490	555		537	636	546	549	520
	2nd	490	543		587	536	569	556	410
	3rd	490			587	518	600		
	4th								

Source : Directorate of Agricultural Marketing, Government of Bangladesh.

Table 84—Rice Prices (Tk/Qtl), 1990 Boro Season

Month	Week	Dhaka	Bogra	Dinajpur	Wymensingh	Naogaon	Natore	Rangpur	Thakurgaon
Apr	1st								
	2nd								
	3rd								
	4th								
May	1st		998		1037	940			
	2nd		884	910	697	524	917		
	3rd	899	851	910	987	924	917	865	
	4th	876	817	897	862	924	915	878	900
	5th	875	871	897	837	924	924	858	916
Jun	1st	879	871	915	887	880	870	865	900
	2nd	910	871	878	868	912	904	871	920
	3rd	882	871	870	862	912	931	844	946
	4th	924	871	885	856	912	974	878	898
Jul	1st	900	871	890	862	923	978	912	898
	2nd	964	897	951	947	934	1004	1083	940
	3rd	1003	923	921	975	959	1037	948	940
	4th	966	950	943	950	951	1010	950	965
Aug	1st	1024	1005	965	1050	952	1041	955	965
	2nd	1024	1005	965	1050	952	1044	965	965
	3rd	989	1017	965	1050	984	1057	988	965
	4th	975	1025	924	942	957	1057	970	970
	5th	945	1005	918	987	957	1038	970	970
Sep	1st	965	1004	912		957	1038	939	970
	2nd	967	1005	938		971	1056	939	970
	3rd	987	1031	945		983	1063	951	970
	4th	999	1031	932		985	1060	945	975
Oct	1st	1038	1065	938		990	1076	1030	980
	2nd	1095	1098	951		1030	1153	1101	1000
	3rd	1108	1098	992		1060	1189	1160	1000
	4th	1094	1098	1032			1071	1065	
	5th	1051	1112	1058			1138	1085	
Nov	1st	1084	1112	1112			1192		
	2nd	1152	1112	1032					
	3rd	1077	1112						
	4th	1013							

Source : Directorate of Agricultural Marketing, Government of Bangladesh.

Table B5—Rice Prices (Tk/Qtl), 1991 Kharif Season

Month	Week	Dhaka	Bogra	Dingaour	Wymensingh	Haoragon	Natore	Rangpur	Thakurgaon
Apr	1st		1085						
	2nd		1084						
	3rd		1085						
	4th	1031	1004		1012		1031		
May	1st	1047	923		1000		1024	983	
	2nd	1152	1004		1037	992	1037	974	
	3rd	1230	1031	992	975	1000	1020	964	
	4th	1071	1031	1005	950	950	1024	964	1020
Jun	5th	1185	1031	978	925	935	1031	976	960
	1st	1207	1058	951	950	940	1033	964	1065
	2nd	1221	1058	985	950	972	1044	987	1070
	3rd	1212	1058	975	1025	1072	1057	1010	1090
Jul	4th	1219	1058	1000	1093	1065	1050	976	1060
	1st	1079	1058	1006	1106	1058	1071	1018	1010
	2nd	1257	1058	1012	1125	1084	1084	1060	1015
	3rd	1255	1058	1045	1068	1038	1078	1030	1015
Aug	4th	1262	1058	1065	1068	1051	1084	1071	1060
	5th	1264	1058	1085	1025	1052	1091	1032	1065
	1st	1259	1030	1085	1050	1042	1084	1079	1065
	2nd	1259	1024	1072	1025	1056	1071	1042	1085
Sep	3rd	1248	1024	1062	1025	1070	1084	1041	1085
	4th	1241	1024	1062	1081	1065	1098	1070	1090
	1st	1237	1099	1085	1081	1080	1111	1090	1115
	2nd	1253	1098	1099	1075	1085	1147	1178	1120
Oct	3rd	1246	1112	1130	1137	1155	1171	1179	1125
	4th	1252	1115	1125	1150	1145	1194	1165	1120
	1st	1304	1115	1120	1137	1145	1212	1166	1120
	2nd	1356	1115	1062	1150	1145	1112	1120	1120
Nov	3rd	1357	1090	1075	1175	1175	1225	1125	1070
	4th	1354	1113	1062	1125	1062	1194	1072	1070
	5th	1329	1113	1062	1100	1035	1171	1060	1060
	1st	1300		1080	1093			1015	
Nov	2nd	1265		1085	1087				
	3rd	1258		1085					
	4th	1261							

Source : Directorate of Agricultural Marketing, Government of Bangladesh.

Table 86--Rice Prices (Tk/qtl), 1992 Boro Season

Month	Week	Dhaka	Bogra	Dinajpur	Mymensingh	Naogaon	Natore	Rangpur	Thakurga
Apr	1st								
	2nd								
	3rd								
	4th					1137	1165		
	5th		1090			1025	1119	1138	1225
May	1st		1090	1085	1087	1105	1057	1059	
	2nd	1112	1070	1030	975	1073	1004	1030	
	3rd	1064	1040	1000	925	1040	1004	976	1110
	4th	1015	1040	991	962	1060	1017	975	1060
Jun	1st	1037	1030	985	975	1326	1011	945	1060
	2nd	1077	1040	1058	975	1057	1051	940	1065
	3rd	1098	1040	1072	1075	1057	1057	988	1090
	4th	1144	1050	1099	1075	1065	1051	1006	1065
Jul	1st	1137	1050	1052	1075	1051	1051	994	1065
	2nd	1144	1038	1902	1087	1057	1064	994	1065
	3rd	1112	1025	1280	1082	1062	1071	994	1070
	4th	1162	1010	1100	1068	1085	1125	994	1070
	5th	1102	1020	1017	1025	1065	1064	1000	1075
Aug	1st	1090	1030	1095	1050	1060	1072	982	1075
	2nd	1085	1040	1080	1050	1005	1072	994	1075
	3rd	1122	1040	1074	1031	1045	1021	982	1080
	4th	1077	1030	1072	1218	1055	1011	988	1070
Sep	1st	1059	1170	1002	1018	1005	982	1030	1020
	2nd	1057	1030	1051	1012	1005	1011	930	1000
	3rd	1051	1015	1059	1018	1036	1011	952	975
	4th	1050	1005	980	987	1036	1012	952	975
	5th	1076	1010	978	1012	957	1092	928	975
Oct	1st	1064	970	985	1012	950	1012	994	975
	2nd	1068	943	985	937	1006	1014	875	950
	3rd	1005	910	945	912	880	1000	845	920
	4th	977	870	835	892	897	950	792	850
Nov	1st	947	870	835	887	872	900	822	970
	2nd	953	845	858	887	872	900	845	820
	3rd	949	850	864	887		875	863	
	4th								

Source : Directorate of Agricultural Marketing, Government of Bangladesh.

Table B7—Dhaka 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Prices (Tk/Md)		
	DAM (a)	Survey (b)	(a/b)	DAM (c)	Survey (d)	(c/d)
April	-----	-----				
May	-----	-----		397	391	1.02
June	-----	-----		408	392	1.04
July	-----	-----		424	391	1.08
August	-----	-----		408	367	1.11
September	-----	-----		395	362	1.09
October	-----	-----		384	347	1.11
November	-----	-----		354	340	1.04
December	-----	-----			274	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey, IFPRI, Dhaka.

Table B8—Bogra 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Prices (Tk/Md)		
	DAM	Survey		DAM	Survey	
	(a)	(b)	(a/b)	(c)	(d)	(c/d)
April					407	
May	225	222	1.01	396	376	1.05
June	238	239	1.00	388	378	1.03
July	237	245	0.97	384	381	1.01
August	243	233	1.04	386	366	1.06
September	230	209	1.10	390	339	1.15
October	188	191	0.98	345	301	1.14
November	183	157	1.16	319	278	1.15
December		165			276	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey, IFPRI, Dhaka.

Table B9—Dinajpur 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Prices (Tk/Md)		
	DAM	Survey		DAM	Survey	
	(a)	(b)	(a/b)	(c)	(d)	(c/d)
April						
May	235	219	1.07	383	383	1.00
June	233	223	1.05	393	385	1.02
July	243	233	1.04	419	381	1.10
August	234	228	1.03	403	373	1.08
September	236	191	1.23	378	321	1.18
October	216	198	1.09	350	301	1.16
November	205	153	1.34	318	269	1.18
December		154			263	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey, IFPRI, Dhaka.

Table B10—Mymensingh 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Prices (Tk/Md)		
	DAM	Survey		DAM	Survey	
	(a)	(b)	(a/b)	(c)	(d)	(c/d)
April	231			403		
May	219	227	0.96	368	359	1.03
June	239	249	0.96	383	375	1.02
July	253	260	0.97	398	395	1.01
August	246	238	1.03	406	358	1.13
September	240	225	1.07	377	331	1.14
October	224	220	1.02	350	319	1.10
November	213	223	0.95	331	321	1.03
December					273	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey.

Table B11—Naogaon 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Prices (Tk/Md)		
	DAM	Survey	(a/b)	DAM	Survey	(c/d)
	(a)	(b)		(c)	(d)	
April	226			418		
May	222	217	1.02	399	389	1.03
June	246	231	1.06	438	393	1.12
July	250	241	1.04	397	391	1.02
August	246	225	1.09	300	375	0.80
September	230	208	1.10	376	355	1.06
October	209	193	1.08	348	323	1.08
November	210	175	1.20	325	285	1.14
December		180			295	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey.

Table B12—Natore 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Prices (Tk/Md)		
	DAM (a)	Survey (b)	(a/b)	DAM (c)	Survey (d)	(c/d)
April	244			430		
May	215	222	0.97	381	382	1.00
June	243	241	1.01	389	384	1.01
July	247	245	1.01	401	386	1.04
August	247	229	1.08	390	379	1.03
September	248	222	1.12	381	358	1.07
October	243	198	1.23	371	323	1.15
November	213	157	1.36	333	296	1.12
December		170			291	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey.

Table B13—Rangpur 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Prices (Tk/Md)		
	DAM	Survey		DAM	Survey	
	(a)	(b)	(a/b)	(c)	(d)	(c/d)
April					457	
May	212	214	0.99	377	354	1.06
June	222	206	1.08	362	360	1.01
July	235	223	1.05	371	365	1.02
August	232	200	1.16	368	353	1.04
September	225	187	1.20	358	306	1.17
October	201	179	1.12	327	287	1.14
November	206	161	1.28	315	297	1.06
December		156			263	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey.

Table B14--Thakurgaon 1992 Price Data Comparison

Month	Paddy Prices (Tk/Md)			Rice Price (Tk/Md)		
	DAM	Survey		DAM	Survey	
	(a)	(b)	(a/b)	(c)	(d)	(c/d)
April						
May	187	218	0.86	405	383	1.06
June	218	220	0.99	399	384	1.04
July	226	224	1.01	399	383	1.04
August	242	219	1.10	401	369	1.09
September	220	215	1.02	369	326	1.13
October	220	209	1.05	345	299	1.15
November	174	166	1.05	315	268	1.18
December		154			247	

Sources : Directorate of Agricultural Marketing, Bangladesh and Boro Season '92 Price Survey.

ANNEX C.
RAW DATA FOR TEXT FIGURES

Table C1--Data for Text Figure no.1

Weekly Price Movements of Course Rice in Dhaka Boro Seasons, 1990-1992			
Month	Week	Average of '90 & '91 Rice (Tk/Qtl)	'92 Rice (Tk/Qtl)
Apr	1st		
	2nd		
	3rd		
	4th	1031	
May	1st	1047	
	2nd	1152	
	3rd	1064.5	1112
	4th	973.5	1064
	5th	1030	1015
Jun	1st	1043	1057
	2nd	1065.5	1077
	3rd	1047	1098
	4th	1071.5	1144
Jul	1st	989.5	1157
	2nd	1110.5	1144
	3rd	1129	1112
	4th	1114	1162
Aug	1st	1144	1102
	2nd	1141.5	1090
	3rd	1124	1085
	4th	1111.5	1122
	5th	1093	1077
Sep	1st	1101	1059
	2nd	1110	1057
	3rd	1116.5	1051
	4th	1125.5	1050
Oct	1st	1171	1076
	2nd	1225.5	1064
	3rd	1232.5	1068
	4th	1224	1005
	5th	1190	977
Nov	1st	1192	947
	2nd	1208.5	953
	3rd	1167.5	949
	4th	1137	

Source : Directorate of Agricultural Marketing, Bangladesh.

Table C2--Data for Text Figure no.2

Weekly Price Movements of Paddy in Bogra
Boro Season, 1990-1992

Month	Week	Avg. of	
		'90 & '91 Paddy (Tk/Qt1)	'92 Paddy (Tk/Qt1)
Apr	1st		
	2nd		
	3rd		
	4th		
May	1st	566	
	2nd	533	600
	3rd	502	600
	4th	513	610
	5th	502	600
Jun	1st	539	610
	2nd	586	635
	3rd	593	650
	4th	596	660
Jul	1st	606	665
	2nd	610	650
	3rd	620	630
	4th	619	610
Aug	1st	639	615
	2nd	623	650
	3rd	632	660
	4th	629	660
	5th	618	630
Sep	1st	628	608
	2nd	634	650
	3rd	643	630
	4th	655	610
Oct	1st	663	588
	2nd	677	565
	3rd	697	490
	4th	680	470
	5th	663	490
Nov	1st	638	490
	2nd	649	490
	3rd		490
	4th		

Source : Directorate of Agricultural Marketing, Bangladesh.

Table C3--Data for Text Figure no.3

Year	Boro Rice Production, Deviations from Trend, 75/76 to 91/92 (Metric tons)		
	Production	Trend	Deviations
75/76			991059
76/77			33162
77/78			319265
78/79			-307632
79/80			-113529
80/81			-260426
81/82			-51323
82/83			30780
83/84			-477117
84/85			230014
85/86			-780911
86/87			-752808
87/88			-343705
88/89			313398
89/90			801501
90/91			346604
91/92			481707

Source : Derived from BBS production data.

Table C4--Data for Text Figure No.4

Month	Rainfall Pattern in Procurement Zones 1980-1992, (Millimetres).	
	1992	'80-'91(average)
Apr	30	94
May	147	272
Jun	198	325
Jul	326	450

Source : Bangladesh Meteorological Department.

Table C5--Data for Text Figure no. 5

Timing of the Boro Harvest, 1991 and 1992

Month	Week no.	Percent of Harvest	
		1991	1992
APRIL	1st	000.50	000.10
	2nd	002.01	001.29
	3rd	001.98	004.73
	4th	012.22	012.99
MAY	1st	011.66	014.79
	2nd	017.51	022.58
	3rd	019.35	016.88
	4th	018.11	015.46
JUNE	1st	008.93	006.37
	2nd	004.88	002.69
	3rd	002.34	001.37
	4th	000.50	000.75

Source : Derived fro BBS Crop cutting questionnaires.

Table C6--Data for Text Figure no. 6

Year	Aus Production, Deviations from Trend, 75/76 to 92/93 (Metric Tons)		
	Production	Trend	Deviations
75/76			-24893.4
76/77			-164157
77/78			-22470.4
78/79			213215.8
79/80			-226098
80/81			256588.2
81/82			-714726
82/83			129960.6
83/84			332646.8
84/85			-58667
85/86			33019.2
86/87			382705.4
87/88			294391.6
88/89			205077.8
89/90			-116236
90/91			-227550
91/92			-328864
92/93			-385287

Source : Derived from BBS production data.

Table C7--Data for Text Figure No. 7**Timing of the Aus Harvest, 1992**

Month	Week	Percent of Harvest
Jun	1st	000.00
	2nd	000.00
	3rd	000.00
	4th	000.22
Jul	1st	002.00
	2nd	003.74
	3rd	006.36
	4th	015.72
Aug	1st	015.65
	2nd	015.76
	3rd	014.87
	4th	025.68
Sep	1st	007.81
	2nd	003.37
	3rd	002.03
	4th	001.41

Source : Derived from BBS crop cutting questionnaires.

Table C8--Data for Text Figure No. 8**Year Braus Production in Deficit Zones, '73-'92, Deviations from Trend (Metric Tons)**

Year	Production	Trend	Deviations
1973			347609.9
1974			265278.8
1975			486702.7
1976			129221.6
1977			-339665
1978			-40815.6
1979			-793967
1980			-19867.8
1981			-117049
1982			20065
1983			295254.9
1984			-581910
1985			-66253.3
1986			-372589
1987			-266176
1988			-97345.6
1989			418792.3
1990			321861.2
1991			109775.1
1992			301099

Source : Derived from BBS production data.

Table C9--Data for Text Figure no. 9

Market Prices of HYV Paddy in Bogra, 1990-1992

Month	Week	1990 (Tk/Md)	1991 (Tk/Md)	1992 (Tk/Md)
Apr	1st			
	2nd			
	3rd			
	4th			
May	1st	209.70	212.31	223.88
	2nd	185.07	212.31	223.88
	3rd	177.24	197.01	227.61
	4th	180.22	202.24	223.88
	5th	189.93	184.70	227.61
Jun	1st	197.39	204.85	236.94
	2nd	204.85	232.46	242.54
	3rd	209.89	232.46	246.27
	4th	212.41	232.46	248.13
Jul	1st	214.93	237.50	242.54
	2nd	212.31	242.54	235.07
	3rd	214.93	247.39	227.61
	4th	214.93	247.01	229.48
Aug	1st	222.39	254.48	242.54
	2nd	222.39	242.16	246.27
	3rd	227.24	244.03	246.27
	4th	227.24	242.16	235.07
	5th	217.54	243.28	226.87
Sep	1st	222.39	246.27	242.54
	2nd	222.39	250.75	235.07
	3rd	222.39	257.46	227.61
	4th	227.24	261.19	219.22
Oct	1st	232.46	262.31	210.82
	2nd	242.54	262.31	182.84
	3rd	257.46	262.31	175.37
	4th	244.78	262.31	182.84
	5th	242.54	252.24	182.84
Nov	1st	247.39	228.73	182.84
	2nd		242.16	182.84
	3rd			
	4th			

Source : Directorate General of Food, Bangladesh.

Table C10--Data for Text Figure no. 10

Evolution of Official Paddy Procurement Prices, 1985-92
(Prices are averages of Aman and Boro seasons)

Year Price
(Tk/Md)

85/86	169.00
86/87	182.52
87/88	200.00
88/89	206.20
89/90	216.00
90/91	224.16
91/92	242.06

Source : Directorate General of Food, Bangladesh.

Table C11--Data for Text Figure no.11

Monthly Rice Procurement Nationwide
Boro Seasons of 1990-1992

Month	1990	1991	1992
	Rice (Equivalent) (mt)	Rice (Equivalent) (mt)	Rice (Equivalent) (mt)
Apr	30000	24000	7000
May	66000	167000	171819
Jun	211000	215000	206225
Jul	153000	91000	45895
Aug	42000	61000	36498
Sep	25000	8000	269
Oct	4000	0	3875
Nov	3000	64000	1462

Source : Directorate General of Food, Bangladesh.

Table C12--Data for Text Figure 12

Monthly Rice Procurement in Bogra District Boro Seasons of 1990 to 92			
Month	1990 Rice (Equivalent)	1991 Rice (Equivalent)	1992 Rice (Equivalent)
Apr	3	7000	1414
May	23000	58000	37165
Jun	54000	47000	35990
Jul	30000	18548	5062
Aug	13000	11940	5580
Sep	10000	1089	0
Oct	2000	51	0
Nov	7	18722	0

Source : Directorate General of Food, Bangladesh.

Table C13--Data for Text Figure no.13

Ratio of Government Rice Procurement to total Marketings Rajshahi Division, Boro Season 1992				
Month	Production	Est.	Govt. supply	Ratio Prod.
Apr				0.004954
May				0.564842
Jun				0.635152
Jul				0.264831
Aug				0.026324
Sep				0.000680
Oct				0

Sources : Derived from DGF's procurement data and an estimate of marketing ratio; estimate of marketing ratio is from Nuimuddin Chowdhury, "Rice Markets in Bangladesh: A Study in Structure, Conduct and Performance," IFPRI, Dhaka, October 1992.

Table C14--Data for Text Figure no.14

Average Losses and Profits during the 1992 Boro Season					
	Number of Enterprises				
	Total	Reported Loss	Reported Profit	Average Loss	Average Profit
Auto	11	7	3	720413	1372854
Major	15	12	0	390956	0
Small	60	54	6	146924	60913
Traders	26	9	8	252588	239313

Source : Boro Season '92 Price Survey, IFPRI, Dhaka.

ANNEX D.

MILLGATE CONTRACTING: ITS WEAKNESSES AND IMPACT

PUBLIC PROCUREMENT OF PADDY/RICE

MILLGATE CONTRACT : IT'S WEAKNESSES AND IMPACT

BACKGROUND

Internal Procurement of foodgrains has always been considered an essential and effective instrument for coding multiple govt. objectives. The stated objectives of internal procurement vary over different periods. Some of the stated objectives are (a) Maintenance of a Buffer/Security stock (b) Supply of ration to multiple target groups (c) Prevention of smuggling in the border belt (d) Price-support to the farmer so that a floor-price is maintained; etc.

Whatever may be the objectives of procurement, the instruments of procurement under-went radical changes over the years. Different schemes for procurement were adopted in internal procurement. In the past they were:

- (a) Compulsory procurement under a statutory order
- (b) Compulsory procurement with cordoning and border belt assessment
- (c) Voluntary procurement without cordoning and assessment
- (d) Compulsory procurement under levy
- (e) Voluntary procurement under a declared floor/support price

From 1975 to 1984, the major portion of internal procurement was made in the form of paddy under a voluntary sale scheme. This paddy was later milled into rice by contracted mills. A scheme of procurement called Millgate Purchase was introduced in 1984-85. Owing to various economic advantages allowed to the millowner and a multitude of complicated procedures which created great problems in control, this scheme resulted in colossal losses to the government in terms of money as well as low quality of procured rice. As a result, the government has suspended operation of the Millgate contract fully the Boro season of '92. Before its suspension, this scheme was the principle instrument of internal procurement. The expansion of this scheme is illustrated in the table below :-

Table :1

Financial Year	Number of Millgate Contractors
1986	274
1989	623
1990	1391
1991	1270
1992	1714

Source : Directorate General Food, MOF

In the last season of its operation, over 90% of all internal procurement was achieved through the mill gate contract. Therefore, it deserves serious study as to its efficacy towards the objectives of procurement and as a means of efficient procurement itself.

2. BRIEF DESCRIPTION

This system of procurement is a package deal to obtain all the goods and services required in obtaining rice at a fixed price. These goods and services are paid for by a composite contract, a key feature of which is advance payment to the contractor, i.e. the contract miller. The services are : (a) paddy procurement, (b) milling this paddy into rice, and (c) transport to the nearest government store. The contract format for Millgate procurement is essentially the same as the contract for milling of government paddy with some additional clauses. In both cases, the miller has to put security at 60% value of the quantity of paddy calculated at 15 days milling capacity of his mill. The security must be in the form of cash, bank guarantee or other acceptable negotiable instrument.

With the contract and submission of the security, the miller is now required to procure paddy at his store. The DGF officials, after being satisfied as to the (a) quantity (b) quality of the procured paddy, issue a WQSC (Weight, Quantity and Stock Certificate) to the contract miller. This certificate is, in effect, a payment order redeemable at a designated commercial bank against cash. The quantity to be paid for is the 15 days milling capacity of the contractors. This capacity is also determined by the DGF officials prior to signing of the contract. The miller is now contract bound to mill this paddy (now government stock) within 15 days. He, then, again procures paddy for milling and delivery to the government store. The cycle continues until the contractor is no longer capable of supplying paddy/rice at the procurement price or the government stores are filled up, or the procurement period is over. Barring these natural stops, there is no limit as to the quantity a miller may supply in an open ended procurement program.

The mechanism of millgate contract, thus, hinges on the following criteria :-

- (a) Processing capacity of the mill, parboiling, drying and milling - as determined by the DGF officials
- (b) Putting up of financial security partially covering the value of the stock
- (c) In time delivery of government specified rice
- (d) Availability of storage space.

However, this system of procurement has major built in weaknesses and offers scope for many possible abuses.

3. MAJOR WEAKNESSES OF MILL GATE PURCHASE SCHEME

(a) Milling Capacity : As described earlier, there is no scientific way to determine milling, specifically drying capacity of a traditional (Husking and Major) mill. Indian studies reveal a sun-drying yard's physical paddy holding capacity of 60 MT per one acre of yards at 2.50 cm thickness. But this does not

indicate drying capacity which is totally dependent upon weather and the skill of the operators. The standard rule of thumb holds of drying capacity decreases by 50% during Boro, as compared to Aman Season. There is no basis or procedure in DGF to (a) Determine drying/milling capacity (b) Reduction of capacity by season (c) Essential minimum equipment list of a mill including boiler certificate, mandatory under Bangladesh law.

There is a tendency everywhere to over - state milling capacity in the contract to allow (i) sub contracting (ii) purchase rice from market and supply to DGF to seek the milling commission and other rents.

(b) Supply Time : While the contract stipulates maximum time, it is silent on the minimum time. A miller may supply the rice any time within his contractual 15 days and is entitled to another payment of his contracted quantity by WQSC which, in effect, is cash payment from a designated bank. It is not unusual for mills in N.W. region to have several payments within this 15 days. This is theoretically impossible as the stipulated milling capacity can not be exceeded.

(c) Accounting Difficulties : After issuing of the WQSC, the paddy thus bought is entered in DGF stock books as paddy which is not there. It is at the same time issued to the mill to be converted to rice. It is basically bad accounting principle to enter into books an item which is not in hand. If such a thing is to be done, the stock to be entered in books should be rice, the commodity which eventually will enter DGF stores. This seemingly simple problem has far reaching consequences in stock taking and audit. As a matter of fact, additionally owing to differential ratios, no one knows what should be the exact quantity of rice stock procured and question of audit is irrelevant in such a situation.

(d) Advance Payment : The system works basically on advance payment. There is no way to determine the ownership of the of paddy at the miller's store. It is quite possible to (a) keep stocks belonging to other traders (b) same stock being shown time and again (c) on payment, procure rice from market to be supplied to DGF. That this kind of operation is taking place is evident from the fact that rice is supplied before elapse time (15 days) in a large number of cases, which is not possible, if Govt. paddy is milled.

(e) Quality/Quantity Check : DGF, theoretically, buys only FAQ paddy. Unless the paddy is of good quality, resultant rice cannot be of acceptable quality. There is little or no check on quality of paddy in millgate purchase. Naturally so, because, covertly, here the emphasis is on supply of rice and not paddy. As to the quantity, it is physically impossible to weigh the entire allotment quantities in a mill. There are over 1700 contract mills of DGF, mostly in the N.W. region. In a single district there are hundreds of husking mills to be regularly checked for quality and quantity of stock and state of operation which the contract stipulates. It is quite impractical to do so under actual circumstances. Supervision and control also deteriorate in this situation.

4. REALITIES OF THE SITUATION

(a) That all is not well is evident from many sources. The poor quality of

procured rice has been witnessed by independent experts (World Bank, '91 report). The rapid stock deterioration is another indication of high moisture and poor quality stock. Nagging and adverse press reports are another indications of various abuses in the system. Large quantities of outstanding paddy from various mills also indicate severe difficulties of management. At the end of the IRRI/Boro 1990-91 the situation was thus:

Table : 12 Weekly National Milling Status Report (NMR) Period covered : 14-11-91 to 20-11-91

Region	Quantity Issued to Mill (Paddy)	Quantity Received from Mill (Rice)	Expected Recovery (Rice)	Mill Balance (Rice)	Remarks
Rajshahi	16684	447	11123	10676	
Khulna	0	0	0	0	
Dhaka	697	302	465	163	
Chittagong	300	294	200	+94	
Total Current week cumulative	17681	1043	11788	10745	
as from 15-11-91	0	0	0	0	

Source : FAO Reorganization Project, MOF, GOB.

(b) These computer print outs of MIS indicate a short fall of 10,745 MT of rice, valued at least Tk. 107.45 million, a staggering figure indeed. It is to be noted that by 15th October there should be no outstanding Paddy at the mills and by 15th November another procurement season starts. There appears to be serious lapses in the management of the Millgate Purchase way of procurement, with quantities of missing stock and consequent loss to the Govt.

5. ITS IMPACT UPON PRICE SUPPORT

From all indications, the impact of this scheme in the defense of a floor price had been minimal. Various field studies (IFPRI, 1990, WB, 1991) indicate that the going market rate of paddy was below the procurement price. This is not surprising for :-

(a) The price that the miller pays for paddy must be necessarily below procurement prices as it involves a monetary transaction. There cannot be a free lunch in real life situation where no at-par transaction takes place. This is an inherent weakness of the system.

(b) The necessary transaction cost of the miller for payment by WQSC is recouped in margin between market price and procurement price.

(c) The miller is under no compulsion to pay the procurement price but he must make a profit out of this purchase and sale. For him, it should make no difference whether the buyer is Govt. or another trader.

(d) It is estimated that a difference of at least 5% is about minimum margin between floor price and market price for millgate to take place. The more the merrier in actual circumstances.

(e) If the margin cannot be made up in price, it will be attempted to be made up in quality and high moisture.

In fact, since the contract mills only act as DGF procurement agents under this scheme, there must be an agency commission for the services rendered. This "rent seeking" is thus a commission covertly built in the system. Unless the farmer directly receives money from the Govt, for his produce. Such roundabout ways just cannot ensure price support. All empirical evidence indicates what was always obvious to persons having experience of market operations in Bangladesh, that Millgate Purchase is definitely not a sound instrument for price support.

6. A REAL-LIFE CASE HISTORY

"A Shrewd Way of Beating the System" :

During our survey, the owner of a rice mill in Bogra District revealed an ingenious method of abusing the Pali Rationing program through the government rice procurement system. Bogra is one of the largest rice procurement areas in the country. The rice-miller, an apparently wealthy and educated man, confessed that he was involved in the deal, and described the method as follows :

(a) In the procurement program, the government buys rice through a system known as the millgate purchase contract. The contract rice-miller purchases paddy, and after milling the paddy, supplies rice to the government at a fixed price that includes the milling charge (Tk. 10,544 per metric ton during the survey). The Officer-in-Charge of the LSD and the Upazila Food Controller sign and issue a Weight Quality Stock Certificate (WQSC) to the contract miller to supply rice. The miller produces the (WQSC) to a designated bank and receives cash payment for the supplied rice.

(b) In this rent-seeking process, however, a portion of the mill gate purchased rice is not supplied by the miller. Instead, this quantity is shown in the allotment of rice in the PR program. A Delivery order is issued by the food officials to the PR dealer for his full allotment of rice. The PR dealer pays the subsidized price for the full allotment, but receives a less quantity of rice. Later, the PR dealer gets back the money he paid for the quantity he did not receive.

(c) In this process, the government pays a price of Tk. 10,544 per metric ton for a quantity of rice that is not received. In the official record the same quantity is shown as delivered to the PR program at a subsidized price of Tk. 7,340 per metric ton. The difference between the millgate purchase price and the PR issue price (i.e. Tk. 3,204 per ton) is shared by the parties involved in the deal.

An example will give an idea about the magnitude of profit that can be made through this process : The monthly officially recorded PR rice offtake from a typical LSD in Bogra is about 98 metric tons of rice. If one-half of this quantity disappears in the process described above, then about Tk. 157,000 can be earned in a month in one LSD during procurement seasons.

(d) The government also pays for other bills arising from this fictitious transaction. These bills are :

(i) Carrying charge of rice from the mill to the LSD (about Tk. 3 per ton per kilometer) paid to the carrying contractor (for the rice that was not carried);

(ii) Handling charges at the LSD (about Tk. 2 per bag of rice) paid to the handling contractor (1) to received the millgate purchased rice, and (2) to deliver the PR rice (for the rice that was not handled);

(iii) Payment for shortages allowed for storage loss (for the rice that was not stored).

These bills, arising from the false transaction, must be charged to the government to keep the accounting in order.

Source : Quoted from "Operational Performance of the Palli (Rural) Rationing Program in Bangladesh" : IFPRI Report. April, 1992.

ANNEX E.

**AGRO-CLIMATOLOGY OF BANGLADESH,
WITH SPECIAL REFERENCE TO THE SOUTHWEST MONSOON:**

EFFECTS OF CLIMATE UPON BORO SEASON HARVEST

**AGRO-CLIMATOLOGY OF BANGLADESH WITH
SPECIAL REFERENCE TO THE SOUTH-WEST MONSOON:**

EFFECT OF CLIMATE UPON BORO POST-HARVEST

1. GENERAL GEOGRAPHICAL DESCRIPTION

Bangladesh is a predominantly deltaic region of 143,998 sq km. It is densely populated with 110 m people giving it a population density of 760 people per sq km. It has 68,018 villages where the main economic activity is either agriculture or agro-based. The cultivable farmland is about 23 million acres. More than 85% of Bangladesh is flat alluvial plain drained by the Ganges, the Meghna, and the Brahmaputra and their countless tributaries and distributaries. The only hilly areas are the Chittagong Hill Tracts in the S.E., the hills of Sylhet in the N.E., the Southern slopes of the Garo Hills in the Southern part of Mymensingh and a short stretch of small hills, the Lalmai hills in the eastern borders of the Comilla district. The Hill tracts are mostly forested with the continuation of the Burman tropical forests. There are mangrove coastal forests in the S.E regions of Khulna, the famous Sundarbans—the last refuge of the Bengal tigers. There are remnants of swampy mangrove forests in the coastal regions of Chittagong stretching up to Teknaf, the southern most tip of Bangladesh.

Bangladesh lies between 20⁰45' N and 26⁰36' N latitudes and 88⁰03' E and 92⁰45' E longitude. She borders with India on the East, North and West and by Burma on the SW, the Bay of Bengal and the Indian Ocean lies on the South. The foothills of the mighty Himalayas are not far away from the NW parts of the country. Nonetheless, Bangladesh has a very gentle slope of less than 6 cm per Km. No part of the flat land is higher than 30.48m above MSL. The highest peak in the country is 1053m at the S.E. hill ranges of chittagong.

Bangladesh has historically suffered the severest form of tropical revolving storms, the dreaded cyclone which has hit her coastal areas at regular intervals. The estuarial regions being shaped like a funnel, these storms usually generate great storm surges, and if accompanied by a high tide, the calamitous tidal bore known in Bangla as "GORKI". The greatest of them all, the gorki of 1876 raised a tidal surge of 12m and killed 400,000 people. The Barisal cyclone of 1737 killed an estimated 250,000 people and so devastated the region that it took 150 years for the population to reach the original number.

2. CLIMATIC SEASON

Bangladesh climate has four major seasons, namely :

- a) Winter - (December to February) : Mild and mainly dry.
- b) Hot - (March to May) : Nor'westers (Violent thunderstorms usually bursting from the North West direction), occasional tornadoes and one-fifth of total annual rainfall. Maximum temperature occurs in April.

c) South West Monsoon - (June to September) : Warm, rainy and humid climate with spells of torrential rains and clean breaks in weather.

d) Post. Monsoon : (October and November) : Warm and dry.

3. CLIMATIC CONDITIONS

Bangladesh is said to have a typical tropical monsoon climate, with an excess of humidity. This is at best a broad generalization. The climate of Bangladesh is characterized by moderately high temperatures for about eight months of the year. Humidity is high with heavy precipitation in summer. Extremes of heat and cold are not experienced anywhere in Bangladesh. The climate may thus be generalized accurately as moderately warm, equable and humid.

But, it is the weather variation within the general uniformity which are of vital significance in crop production, processing and storage. Agricultural activities which are basic to the economic structure in these areas should be seen, above all, in the context of climatic setting. Next to physiology, drainage and soils, rainfalls decide the cropping patterns as well as yields.

4. THE SOUTH WEST MONSOON

The word monsoon is derived from the Arabic "mausim" which means season. The sea-faring Arabs knew the seasonal reversal of the winds to sail their ships to the SW through the Arabian sea to the Indonesian islands and on to China in summer and return by the reverse wind, in winter; always with a following wind in both directions. The Aryans who settled throughout north India from 4000 to 1000 Bc knew of this S.W winds of summer which brought rain in regular interval and fashioned their life from it. What were the Nile floods in ancient Egypt, the SW monsoon is to the Northern India, a life sustainer from the pre-history to the present day.

5. MONSOONS IN BANGLADESH

For Bangladesh monsoon means SW winds across the Bay of Bengal which brings abundant rains from June to early October. It is now known that the onset, severity and amplitude of the monsoon are produced by a wide and apparently unrelated set of circumstances. They involve oceanic temperatures, pressure, humidity and radiation over wide continental areas, orography, rotational variation of earth and many others. Recently, the Indian Meteorological Department is using three Cray-3 super computers to predict the monsoon, such are the vastness of data and consequent variables!

The monsoon extends northeastwards from the Bay, sometimes quietly and gradually, but more often in association with depressions. After entering the delta, the monsoon rushes north and its advance is marked by disturbed weather, strong winds and rain squalls. The Chittagong area, the Noakhali coast, and the Khasia hills of North Sylhet receive the heaviest rains from these pre-monsoon instabilities.

For most of the area, July is the wettest month, with slightly lower figures for June and August. Often there is a break in August and other minor breaks are marked by intervals of fine weather and passing clouds. Monsoon months up to October are marked by humidity averaging well over 80%. There are sometimes severe storms at the end of October. Heavy rainfalls at the post monsoon are not unusual climatically. Thus in October, 1946, rain was registered as below :

5th to 6th	Natore	17.0 inches
5th to 6th	Patuakhali	21.8 inches
6th to 7th	Rangpur	12.7 inches
19th to 20th	Saidpur	12.7 inches

Obviously, the frequency of such rainstorms are more in the coastal areas than inland as they originate in the Bay and dissipate as they travel inland.

6. RAINFALL

High rainfalls are characteristic of Bangladesh climate, the average being an annual total of 60 inches. Only about one third of the country receives less than 70 inches which cover southern parts of North Bengal, Kushtia, Jessore and parts of Faridpur. Districts of Khulna, Barisal, Noakhali, Comilla, Chittagong and its hills, Sylhet, Mymensingh, Rangpur and Northern Dinajpur receive precipitation from 80 to 100 inches. The SW extremity of Cox's Bazar area get more than 140 inches and the NE Sylhet receive from 150 to 200 inches of rain.

This precipitation, however, is concentrated during the main monsoon period of June to September. The winter rainfalls are negligible all over the country. The Nor'westers (pre-monsoon) varies from 8 to 12 inches in North Bengal, 30 to 40 inches in Sylhet and 10 to 12 inches elsewhere. It is of vital significance to the agricultural economy as with it are linked the fortunes of two major crops, Jute and Aus Paddy. Aus is sown in March-April and harvested in June before the lands are flooded by rain or overflowing rivers.

7. RAINFALL AND CLIMATIC DIVISION

The rainfall and climatic division of the area are shown in map no.1 Eminent meteorologists and geographers have suggested the following general climatic division of Bangladesh (Map no. 4) :

a) Continental - South Dinajpur, Rajshahi, West Bogra, West Pabna, Kushtia, Jessore and North-West Faridpur. (Total rainfall, 50-65 inches. Nor'wester rainfall 10-18 inches)

b) Continental Modified - Rangpur and Northern Dinajpur (Total rainfall, 65-70 inches. Nor'wester rainfall, 10-18 inches)

c) Moderate. Warm-rainy - Mymensingh, Dhaka, Faridpur, Northern Khulna, South Western Jessore, East Pabna, Bogra and Comilla. (Total rainfall 90-100, Nor'wester rainfall 20-30 inches)

d) Cool Rainy - North Eastern Mymensingh and Sylhet, except the southern parts (Total rainfall 100-200 inches. Nor'wester rainfall 20-40 inches) winters are dry and cool with moderately warm summer.

e) Maritime - South Khulna, Barisal, Noakhali and Chittagong Coastal areas. (Total rainfall 70-120 inches or more. Nor'wester rainfall, 12-20 inches) winters are wild and summers moderately warm.

8. RAINFALL AND CROPS

In general terms, the major parts of Bangladesh normally have an excess of rainfall rather than deficiency. Therefore, the amount and distribution of rainfall is of much more importance than the temperature of the air. But failure of rain at its due time or too much or too little of it at certain times, seriously affect crop production. Crop damage, even failure, may result if the rainfall for a given period is normal in quantity, but untimely in its incidence, while precipitation below the average, but well distributed in time, will often ensure a good harvest. Excessive rainfall concentrated within a few days may not only fail to mature a crop, but may damage it considerably. This is a frequent experience with regard to jute and aus paddy. Likelihood of prolonged breaks between pulses of rain, characteristic of many monsoon, is of far reaching significance for rainfed crops.

Seasonal rainfall is an important factor in crop production. The small winter rains of North Bengal enable the farmers to cultivate rabi cereals, such as wheat, barley and minor millets, as well as vegetables and oil seeds. The timely rain from the Nor'wester is indispensable to ploughing of land for aus and jute. It is also the life blood of the major rainfed crop, Aman paddy, the winter rice. Abnormally heavy rainfall during April and May from the Nor'wester drowns and damages young jute and Aus plants. A break in August weather is required for Aus harvesting. A normal monsoon is essential for the successful cultivation of jute and aman. Thus it can be seen that the South-west monsoon with its many vagaries play a vital and significant role in the production of major crops of Bangladesh.

A recent authoritative study (Talukdar - Royal Veterinary and Agricultural University, Copenhagen 1992) did an exhaustive numerical analysis on the agro parameters of Bangladesh with particular emphasis on the evotranspirational models and methods. A major conclusion was "It is clear from these results that irrigation was necessary in Bangladesh in winter and partly in summer and autumn for successful crop production when precipitation is not sufficient..... On the other hand, during monsoon, precipitation was so high that floods occurred"

The relationships between rain and crops are best understood by the farmers of Bangladesh from the proverbs attributed to the legendary seer "Khona" said to

live during the rule of the independent Palas (4th to 6th century AD) of Bengal thus :

- If it rains in Aghan (Nov-Dec) the King goes a begging.
- If it rains in Pous (Dec-Jan) husks turn into Cowries (currency).
- IF it rains in end Magh (Jan) praised be the King, blessed are his domains.
- If it rains in Phagun (Feb-Mar) crops double in yield.
- IF it floods in Bhadra (Aug-Sept) skulls crawl the fields. (certain famine)

9. CLIMATE, IRRIGATION AND POST HARVEST : THE RESENT SCENARIO

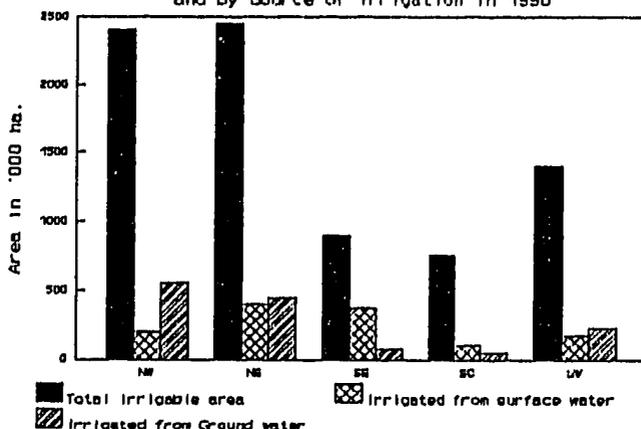
(a) Climate and Irrigation : Recent agro-climatological analysis (Talukdar - Royal Agricultural University, Copenhagen - '92) confirmed what the farmers of Bangladesh knew intuitively from antiquity. That for crops to grow profitably in the dry season, from Nov. to March, irrigation is necessary is not a recent finding. What is recent, is a cost-effective and efficient method of irrigating the land for a 2nd and or third crop.

In 1959-60 about 7% of cultivated land was irrigated by using traditional irrigational methods, mostly in Sylhet, Mymensingh and Rajshahi districts to grow local Boro paddy. Irrigation technologies developed from lifting surface water by LLP to deep tubewell to exploit the ground water. The share of surface water irrigation declined from 84% in 1977-78 to only 42% in 1989-90. Heavy rainfall and the favourable geological structure result in excellent aquifers for groundwater exploitation. The water table is within 12 to 6 meters of the surface over most of the country. As a result, shallow tubewells (STW) are very popular now, resulting in STW share of 69% of area of irrigated land. Hand tubewells (HTW) and treadlepum account for another 3% share to exploit economically the high water tables.

Bangladesh's irrigational potentials are enormous. Out of 9.03 million hectares of cultivated land are, 7.5 million hectares are suitable for irrigation out of which, by 1991, only about 2.6 million are irrigated by a possible expansion potential of 300%. However since 1987, liberalization of minor irrigation equipment led to rapid increase in sale and use of STWs and LLPs. From 1988-89, lifting tariff barriers for small diesel engines added further fillip to the expansion of irrigation by LLPs and STWs.

Recent studies indicate that STWs which drain the high water table also help in quick refill of the aquifers from rain and floods. Should the water table go below the STW capabilities, DTWs may then be utilized. So long as the monsoon is regular, there is little reason to fear depletion of underground aquifers. Unlike the North African or Arabian peninsular aquifers, Bangladesh is blessed with a literal non-depleting, renewable water reservoir fed and replenished by the SW monsoon. All energies can thus be put to good use to develop the great potentialities (Fig-1) for expansion of irrigation, especially in the North-west and South-west regions of Bangladesh.

Fig - 1 : Irrigated Area in Bangladesh by Regions and by Source of Irrigation in 1990



North West, North East, South East, South Central, South West.

Source : W.H.M. Jaim - 1993

The monsoon, the life giver to India, is the source of such inexhaustible resource, which is next only to the adequate solar radiation, allowing the plants to thrive even in the coldest months.

(b) Climate and Post Harvest : With the expansion of irrigation came the HYVs, chemical fertilizes and modern plant protection methods. These advances were most noticeable in the phenomenal advances in the Boro season where irrigation was most needed. It also reduced climatic risks for the rice-grower who for millennia was dependent on the South-west monsoon for a good harvest (see para-8). This assurance along with the evident comparative advantages of rice growing helped expand both the Boro acreage and yields to new heights. But with enhanced Boro production came new climatic difficulties, never felt before. These are the difficulties of post harvest treatment of the rice crops.

Traditional and classical literature of both agriculture and rice-processing technologies are almost totally silent on the problems of post-harvest in the rainy season, probably because of the recent nature of the development. Boro is harvested in the pre-monsoon (end April) period to the peak of monsoon (June-

July). What was a minor problem with a tiny traditional Boro varieties and Aus paddy became a phenomenon of immense magnitude. The major problems are highlighted below :

(a) Varietal Characteristics : All the modern varieties of HVV types cultivated now are crosses between the original IRRI varieties which, in turn, were crosses of Japonica and Indica varieties. While their nitrogen response and other characteristics were most desirable, they have inherently low dormancy. Their high yields are only matched by very poor photo-period sensitivity which have great negative significance in Boro season harvests of Bangladesh. Their propensity to sprout and consequent proneness to spoilage in high moisture, high temperature atmosphere is a major handicap in storing and processing. Boro season paddy, especially HVVs, must immediately be dried to 14% moisture or below, a task said easier than done. Conversely, local Aus paddy has high resistance to moisture and humidity and keeps well even without immediate drying. But crop drying in Boro for HVVs create great difficulties which are yet to be solved.

(b) Paddy drying : With high humidity and temperature, paddy drying is a difficult task in the peak of monsoon when continuous rain for days with little breaks is a norm. In such circumstances, spoilage or deterioration of quality is very common. The major difficulties are :-

(i) Absence of Concrete Drying Yards : Farmer level drying yards are rare in Bangladesh. Only rice mills own such facilities which they use to dry their own parboiled rice. Even with a paved yard drying is uncertain at best, as it would need at least a full day's sun to dry paddy from anything up to 28 % to 14% moisture. Beside, it needs a great deal of skill by labor to dry paddy uniformly.

(ii) Absence of Crop Driers : The ideal solution is, of course, mechanical crop driers. They are expensive equipment owned only by a handful of automatic mills of Bangladesh. Farmers have no access to these driers.

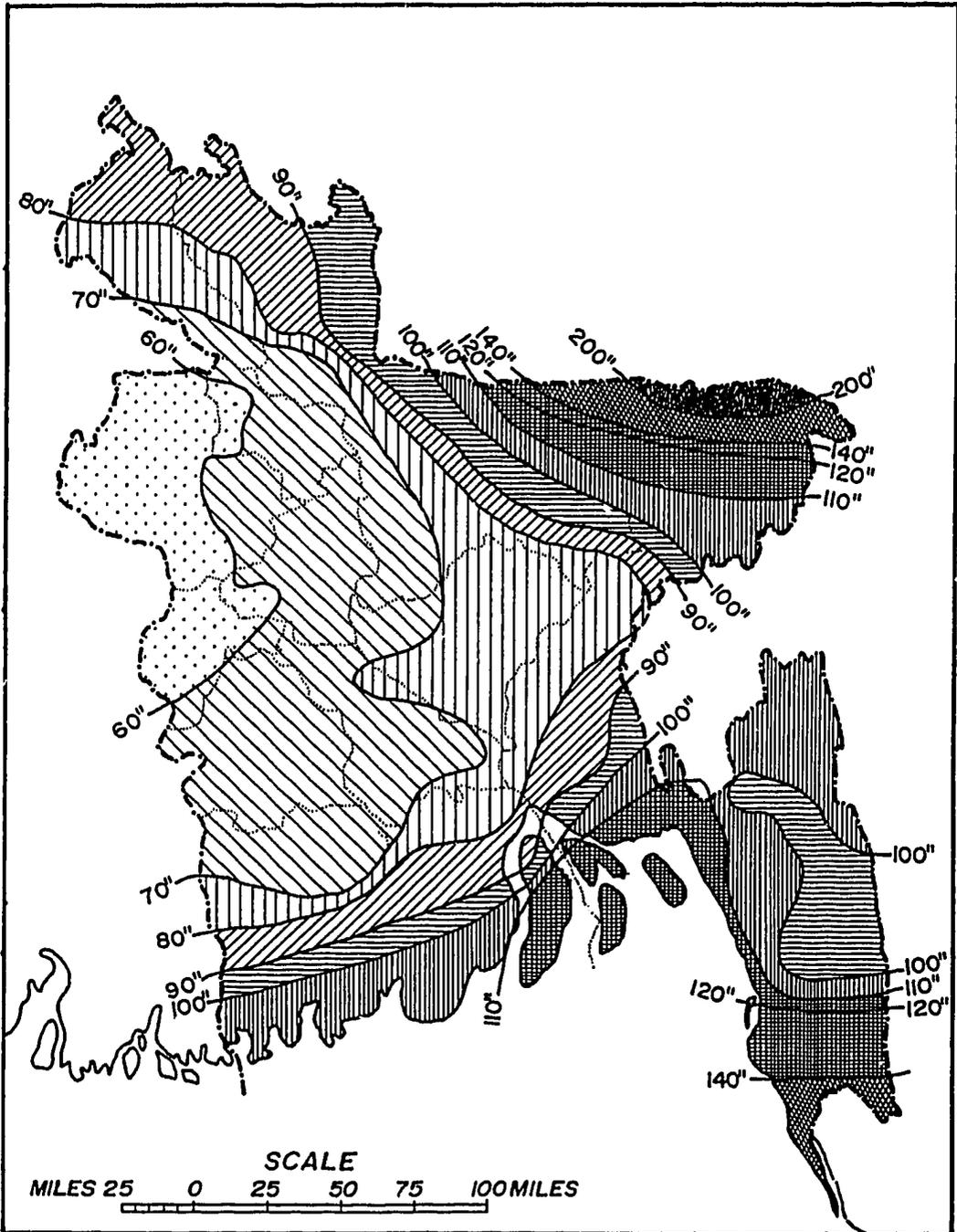
(iii) Parboiled Rice Drying : Untold thousands of tons of parboiled paddy is spoiled each year in traditional mills who depend upon drying yards to dry their paddy. Since parboiled paddy contain moisture up to 50%, it takes both longer time and effort to dry parboiled paddy. In case of rain, the paddy is again soaked in tanks which increase losses due to leaching and the quality deteriorates rapidly.

It was estimated in one study (Rahman-BUET 1989) that in a bad year, (ie intense monsoon) up to 20% of Boro crop may be wasted, in total, in various processes from field to edible parboiled rice. A comparatively mild pre-monsoon with low Nor'wester rains like in the Boro season of 1992 may reduce this loss considerably, to 5% or below. Pre-Monsoon severity, thus, may result in a 10-15% quantity availability of Boro harvest.

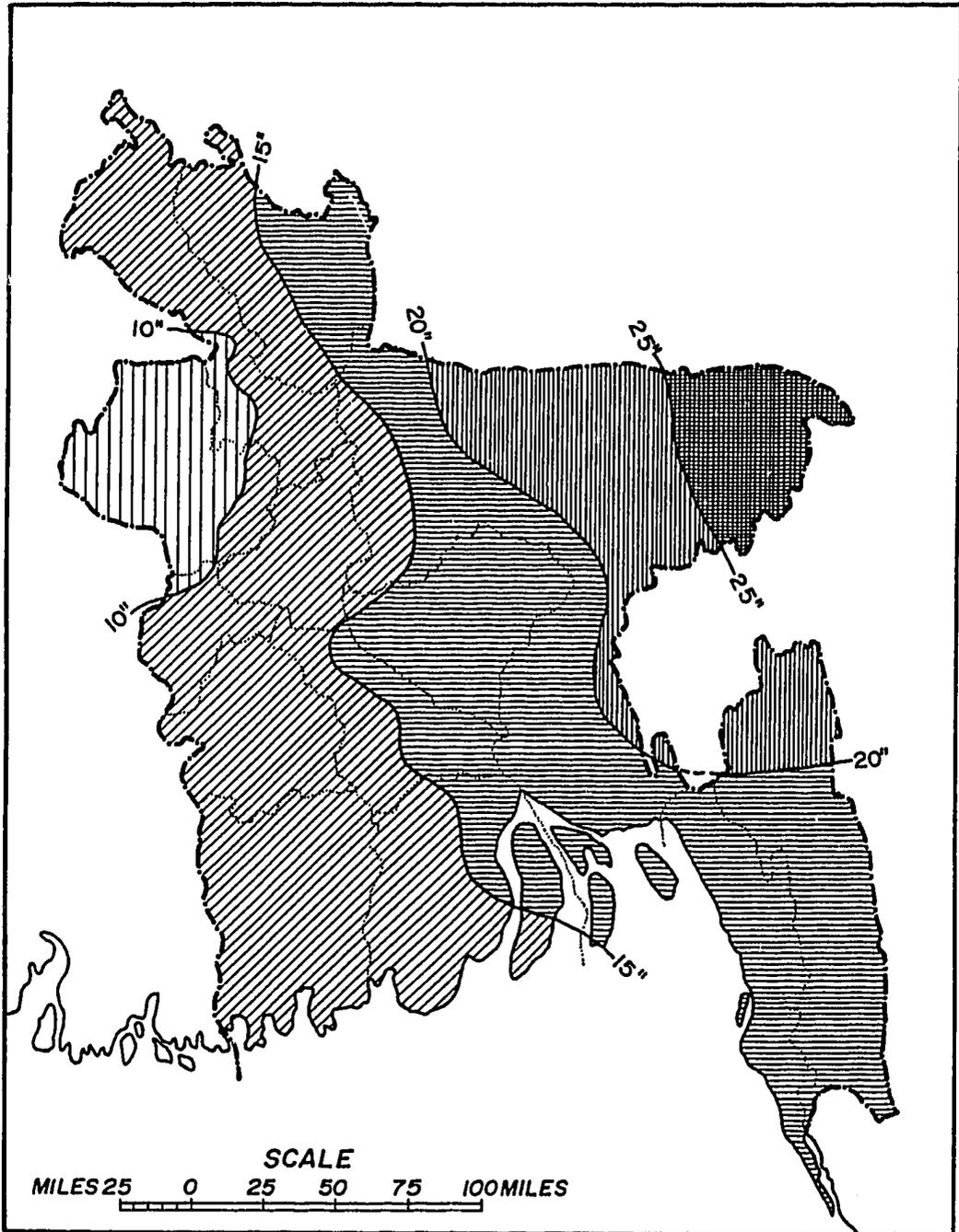
It is intuitively estimated that at least 15% of edible rice was added to the rice supply in the Boro of 1992 owing to a late and mild monsoon. This estimate

translates into a million tons of additional paddy. The effect of climate in the post-harvest phase of Boro has not been fully investigated yet, though the importance of such a study is self evident.

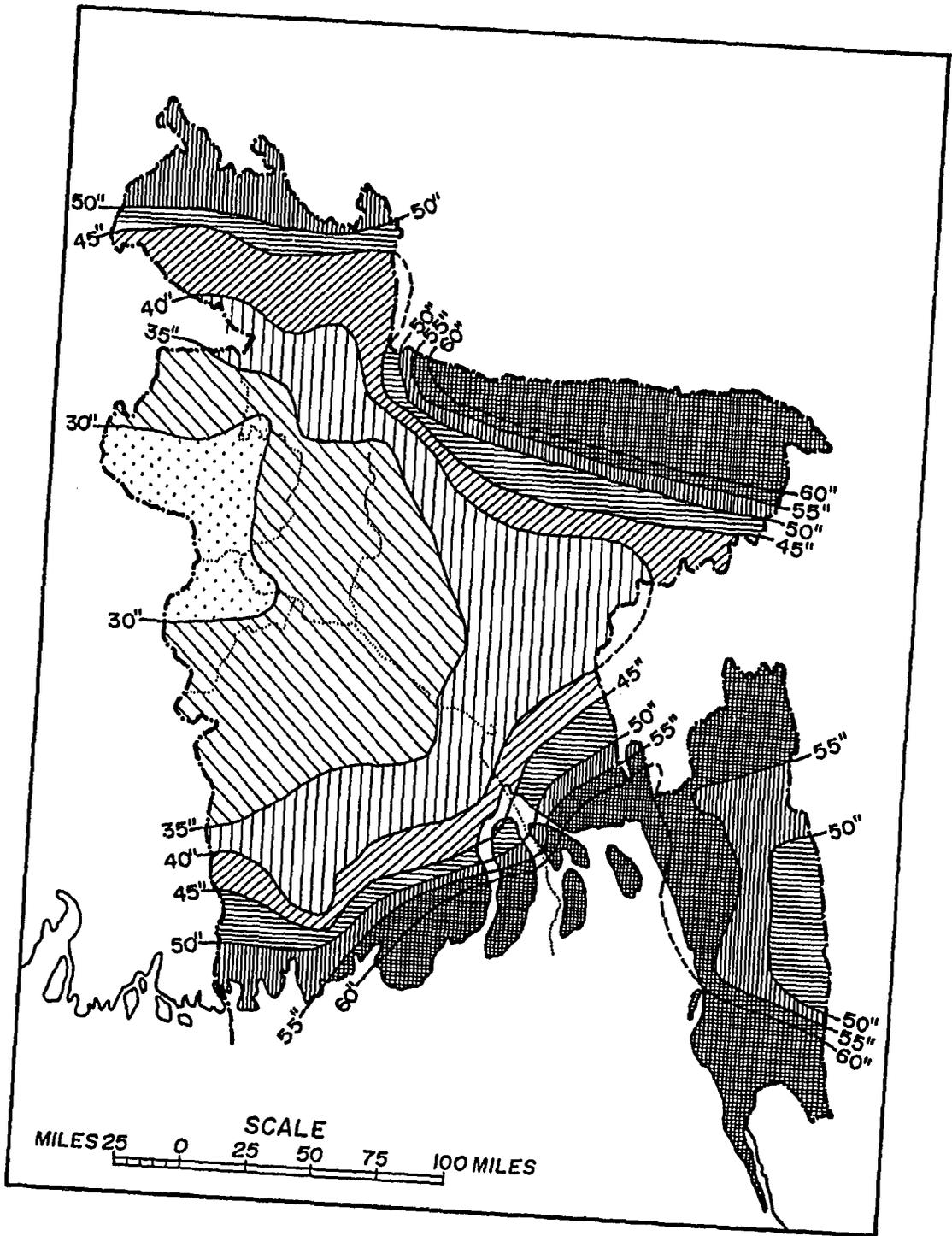
Map E. 1 - Bangladesh - Rainfall : Mean Average



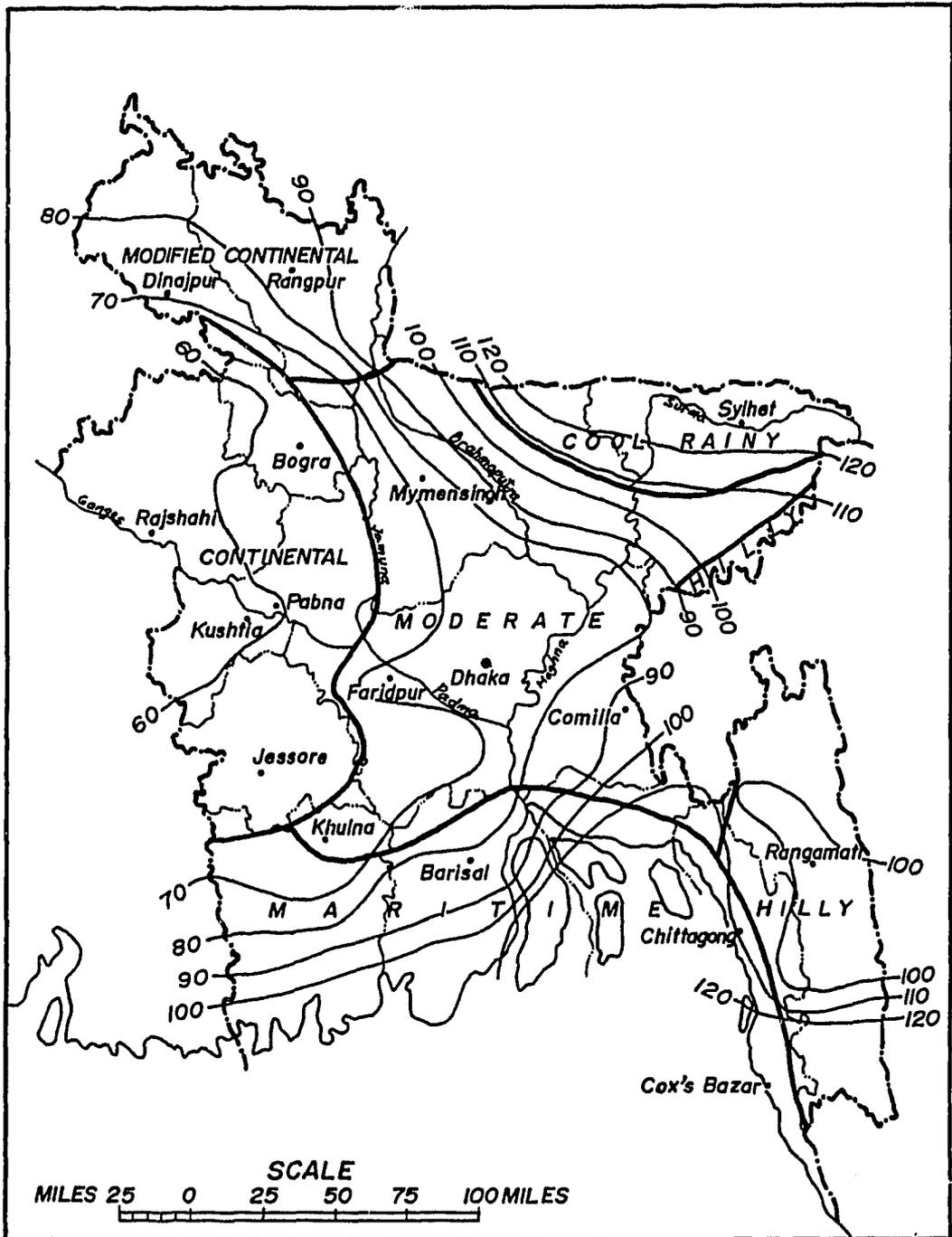
Map E. 2 - Bangladesh - Nor'westers (March-May)



Map E. 3 - Bangladesh-Monsoon Rainfall (July-September)



Map E. 4 – Bangladesh – Climatic Divisions



~ Isohyets (Normal annual rainfall in inches).

ANNEX F.
SUPPLEMENTARY METEOROLOGICAL DATA

List of Tables

1. Distribution of Average Actual Rainfall in Millimetres (1980-1992)
2. Distribution of Average Actual Rainfall in Millimetres (1980-1991)
3. Distribution of Actual Rainfall in Millimetres in 1992
4. Distribution of Actual Rainfall in Millimetres at Major Station, 1980-1992
5. Mean monthly maximum and minimum temperatures °F (normal)
6. Mean monthly pressure (Millibars) 9 hours I.S.T. and rainfall in inches (Normal)

Table 1 -- Distribution of Average Actual Rainfall in Millimetres (1980-1992)

Sl.No.	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	Chittagong	5	21	63	160	250	554	831	480	255	205	56	16	2865
2	Coz's Bazar	4	16	26	131	198	907	891	614	383	195	104	10	3436
3	Satkundia	8	19	63	227	315	537	814	512	384	296	55	11	3209
4	Sandwip	4	22	48	220	303	653	847	608	439	245	50	10	3409
5	Kutubdia	4	31	27	107	193	716	754	489	348	173	84	8	2513
6	Rangamati	10	24	67	187	293	404	548	501	275	151	71	13	2501
7	Teknaf	4	16	14	73	156	1031	977	814	426	217	95	14	3650
8	Sylhet	10	35	142	414	631	733	822	594	690	251	36	23	4382
9	Srimangal	3	55	91	261	504	361	278	344	297	305	49	22	2570
10	Comilla	5	20	59	194	320	325	359	298	257	160	29	16	2042
11	Chandpur	15	23	126	194	308	436	450	429	300	163	42	13	2497
12	Nijdee Court	15	36	63	160	357	552	850	671	385	174	33	9	3307
13	Feni	12	37	78	272	467	553	756	599	369	241	50	12	3395
14	Hetiya	10	28	53	176	256	537	632	596	375	206	50	16	2795
15	Rajshahi	9	16	28	78	142	241	329	267	244	116	17	17	1503
16	Dinajpur	11	11	13	70	234	294	498	377	352	121	5	13	1997
17	Bogra	9	12	21	70	268	314	410	243	307	139	12	19	1823
18	Rangpur	13	16	28	111	290	449	545	380	465	135	7	17	2456
19	Isburdi	6	25	38	79	216	221	329	226	291	98	18	13	1538
20	Khulna	11	46	61	86	212	344	313	307	237	132	35	10	1793
21	Shatkhira	12	46	37	81	147	308	333	300	264	107	34	13	1615
22	Jessore	16	28	51	94	197	334	280	299	238	110	33	10	1665
23	Barisal	6	34	40	134	217	397	401	362	252	204	46	9	2103
24	Bhola	8	45	48	155	290	494	448	407	289	192	42	11	2428
25	Patuakhali	10	32	51	136	246	502	538	462	370	181	55	7	2589
26	Khepupara	6	35	42	97	176	515	599	483	381	223	49	9	2616
27	Dhaka	7	25	70	169	328	361	374	265	352	182	39	17	2190
28	Wymensingh	4	24	34	126	424	375	531	349	375	213	18	12	2485
29	Faridpur	4	33	73	144	284	325	321	279	279	160	34	18	1954
30	Madaripur	7	26	68	178	320	511	463	428	331	184	43	4	2526

Source : Compiled Raw Data from Bangladesh Meteorological Department.

Table 2 - - Distribution of Average Actual Rainfall in Millimetres (1980-1991)

Sl.No.	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	Chittagong	5	13	68	174	261	553	866	497	252	186	61	15	2915
2	Cox's Bazar	5	15	28	141	202	919	896	627	388	191	105	10	3481
3	Satkundia	9	13	68	246	329	537	853	522	390	281	59	11	3283
4	Sandwip	4	19	53	240	314	668	875	604	427	238	51	9	3454
5	Kutubdia	5	18	30	118	195	680	759	525	364	157	89	7	2479
6	Rangawati	11	18	73	201	307	402	566	525	275	151	71	13	2613
7	Teknaf	5	12	15	80	149	1052	973	823	432	199	97	15	3645
8	Sylhet	11	34	140	438	638	739	815	611	711	256	39	25	4456
9	Srinagar	4	57	96	276	519	377	281	344	309	319	54	25	2661
10	Comilla	5	16	64	210	334	327	368	312	268	157	31	17	2109
11	Chandpur	16	16	138	210	322	459	460	437	314	170	45	14	2602
12	Nijdee Court	16	32	68	174	367	575	878	689	395	173	36	10	3413
13	Peni	13	32	84	294	487	574	787	635	374	245	53	13	3535
14	Hetiya	11	19	57	191	258	553	619	606	359	207	54	16	2800
15	Rajshahi	10	15	30	83	144	254	335	274	254	123	18	19	1558
16	Dinajpur	11	11	14	76	247	302	494	391	340	125	5	14	2029
17	Bogra	10	12	22	74	278	323	420	250	297	142	13	21	1861
18	Rangpur	13	17	30	113	294	457	570	381	458	135	7	18	2494
19	Isburdi	6	24	41	84	223	234	336	228	290	103	19	14	1577
20	Khulna	11	33	66	93	214	360	318	316	247	135	38	11	1841
21	Shatkira	13	40	41	87	149	317	328	302	265	108	37	14	1627
22	Jessore	15	24	56	102	195	336	278	312	241	117	35	11	1693
23	Barisal	6	29	43	145	218	415	409	365	256	213	49	10	2158
24	Bhola	8	38	52	168	296	512	454	423	291	196	45	12	2495
25	Patuakhali	11	26	56	148	249	522	536	460	368	175	60	8	2618
26	Khepupara	6	26	46	105	171	533	609	499	378	214	53	10	2650
27	Dhaka	7	23	76	182	343	380	373	272	369	190	42	19	2276
28	Nymensingh	4	23	37	135	447	383	543	365	380	211	20	13	2561
29	Faridpur	4	31	79	155	290	332	315	285	294	164	37	20	2006
30	Nadaripur	7	21	74	193	332	534	476	439	346	192	46	5	2619

Source : Compiled Raw Data from Bangladesh Meteorological Department.

TABLE 3 - - Distribution of Actual Rainfall in Millimetres in 1992

Sl.No.	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	Chittagong	0	119	0	1	127	571	412	280	292	435	4	34	2275
2	Cox's Bazar	1	34	0	1	149	767	824	451	328	237	103	6	2901
3	Satkundia	0	88	0	1	145	539	351	392	316	480	2	9	2323
4	Sandwip	0	61	0	4	190	473	512	659	580	332	41	20	2872
5	Kutubdia	0	138	0	13	176	1074	705	198	207	322	36	19	2888
6	Ranganati	0	93	4	31	137	428	341	239	***	***	***	***	1273
7	Teknaf	0	71	0	0	242	807	1018	704	360	436	62	5	3705
8	Sylhet	0	53	172	129	544	666	913	390	440	188	3	0	3498
9	Srimangal	0	40	33	117	354	238	246	345	188	178	1	0	1740
10	Cowilla	0	63	0	10	154	298	259	128	128	197	2	1	1240
11	Chandpur	0	96	0	20	147	178	338	335	150	84	1	0	1349
12	Mijdee Court	0	90	2	0	240	268	515	456	272	182	5	5	2035
13	Feni	0	90	0	0	229	299	384	202	303	190	17	0	1714
14	Hetiya	0	130	0	0	234	351	776	481	559	191	0	17	2739
15	Rajshahi	1	33	0	16	121	85	250	185	124	29	5	0	849
16	Dinajpur	5	6	1	5	87	212	535	228	483	76	6	5	1649
17	Bogra	0	14	0	30	140	202	289	159	424	108	3	0	1369
18	Rangpur	13	10	0	89	245	348	247	367	552	129	4	2	2006
19	Ishurdi	0	40	0	18	132	73	252	206	295	38	5	3	1062
20	Khulna	13	203	0	2	192	160	255	198	111	90	0	0	1224
21	Sbatkhira	9	115	0	8	134	208	384	280	247	95	1	0	1481
22	Jessore	27	77	0	1	223	303	307	152	204	36	3	0	1333
23	Barisal	4	98	0	1	205	190	299	326	210	98	8	0	1439
24	Bhola	1	126	0	0	208	275	382	211	269	154	0	1	1627
25	Patuakhali	2	100	0	1	208	282	560	479	392	244	3	1	2272
26	Khepupara	2	134	0	0	241	297	480	292	410	336	7	4	2203
27	Dhaka	1	47	0	25	153	132	386	182	148	83	2	0	1159
28	Mymensingh	6	36	0	20	156	270	380	155	318	241	2	0	1584
29	Faridpur	4	61	0	5	216	238	387	209	95	120	0	0	1335
30	Nadaripur	4	87	0	0	187	245	316	297	168	96	2	0	1402

Source : Compiled Raw Data from Bangladesh Meteorological Department.
 Note : *** Denote Data Not Available

Table 4 - - Distribution of Actual Rainfall in Millimetres at Major Station, 1980-1992

Station : Chittagong

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	28	52	46	456	517	627	702	229	275	0	0	2932
1981	15	2	417	279	338	386	825	343	150	20	1	14	2790
1982	0	7	53	140	44	746	475	785	387	5	43	1	2686
1983	5	45	6	21	207	560	788	1437	162	390	56	52	3729
1984	1	0	0	121	425	552	801	326	175	86	0	42	2529
1985	17	6	88	143	511	464	1044	451	141	47	197	2	3111
1986	2	0	0	145	173	820	894	291	188	151	122	0	2786
1987	3	20	80	297	63	394	1267	673	411	36	49	17	3310
1988	0	11	22	255	371	479	641	420	314	371	72	0	2956
1989	0	2	0	220	82	277	1173	66	360	404	14	0	2598
1990	0	39	53	250	203	668	1038	115	141	233	74	36	2850
1991	19	0	43	**	**	774	822	357	360	211	99	13	2698
1992	0	119	0	1	127	571	412	280	292	435	4	34	2275

Station : Cox's Bazar

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	2	27	0	117	258	185	267	**	**	0	0	856
1981	31	3	40	224	235	699	839	384	434	61	11	30	2991
1982	0	22	13	111	157	1164	866	850	483	3	119	0	3788
1983	8	47	19	113	182	716	996	863	332	379	29	44	3728
1984	3	0	0	80	278	1338	697	812	282	123	0	4	3617
1985	6	1	22	133	424	757	867	596	277	85	349	0	3517
1986	0	0	2	51	141	921	745	326	322	233	114	0	2855
1987	1	9	9	202	49	682	1821	1298	410	88	102	13	4684
1988	0	21	12	207	305	1228	796	918	516	157	159	1	4320
1989	0	6	0	160	83	766	866	188	460	516	28	0	3073
1990	0	69	174	135	233	1201	1201	246	259	249	255	19	4041
1991	6	0	22	281	222	1300	877	781	497	211	88	13	4298
1992	1	34	0	1	149	767	824	451	328	237	103	6	2901

Table 4 (Contd.)

Station : Sitakundu

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	**	13	4	111	48	126	137	**	88	0	**	527
1981	71	2	127	494	428	292	887	543	285	45	0	6	3180
1982	0	6	10	207	56	925	701	935	414	142	14	0	3410
1983	9	12	194	461	313	233	953	1441	410	766	46	25	4863
1984	9	0	0	317	1098	1061	1488	452	375	173	0	0	4973
1985	4	3	81	56	456	471	795	416	154	74	88	18	2616
1986	3	1	7	199	281	629	773	365	244	179	115	0	2796
1987	8	10	49	304	104	436	1249	656	694	70	159	10	3769
1988	0	8	38	233	390	600	791	776	439	341	117	0	3733
1989	0	7	3	169	115	308	640	81	386	826	0	0	2535
1990	0	66	273	278	183	654	1131	203	268	514	51	52	3673
1991	2	25	19	229	414	766	696	258	619	154	120	15	3317
1992	0	88	0	1	145	539	351	392	316	480	2	9	2323

Station : Sandwip

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	48	74	46	784	233	1555	682	288	290	0	0	4000
1981	33	1	143	474	371	354	986	402	485	50	0	25	3324
1982	0	46	15	246	25	946	478	1155	352	149	13	0	3425
1983	0	20	29	316	336	949	822	843	406	440	65	0	4226
1984	0	0	0	180	364	909	847	545	188	193	0	0	3226
1985	1	2	89	235	396	777	896	874	207	73	103	0	3653
1986	12	0	0	143	288	708	734	487	551	114	179	0	3216
1987	0	0	35	290	90	309	1184	675	563	73	56	22	3297
1988	0	26	22	279	397	799	782	682	619	181	73	0	3860
1989	0	11	14	217	143	625	440	114	527	674	0	0	2765
1990	0	70	196	213	256	540	1059	351	330	440	47	50	3552
1991	0	4	13	**	**	861	711	434	611	182	78	12	2906
1992	0	61	0	4	190	473	512	659	580	332	41	20	2872

Table 4 (Contd.)

Station : Kutubdia

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	3	0	9	107	122	158	**	**	0	0	0	399
1981	3	**	**	**	**	**	**	**	**	**	**	**	3
1982	**	**	**	151	78	906	675	1220	591	1	**	**	3622
1983	**	**	**	**	**	**	**	**	**	**	**	**	**
1984	**	**	**	**	407	568	627	**	129	**	0	0	1731
1985	0	0	31	199	399	421	808	489	195	51	188	0	2781
1986	0	0	0	59	143	867	748	327	265	143	117	0	2669
1987	4	25	10	165	35	754	1339	702	495	59	114	7	3709
1988	0	61	26	107	310	768	516	513	559	192	118	13	3183
1989	0	0	0	190	69	450	713	67	479	512	0	0	2480
1990	0	56	172	66	206	995	1340	137	167	237	139	41	3556
1991	34	0	1	**	**	946	668	747	397	217	126	0	3136
1992	0	138	0	13	176	1074	705	198	207	322	36	19	2888

Station : Rangamati

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	**	**	**	**	**	**	**	**	**	**	**	**	**
1981	14	3	299	230	407	337	292	447	371	42	24	0	2466
1982	0	71	21	120	84	367	439	413	299	42	7	0	1863
1983	0	34	117	198	441	259	492	811	131	275	166	42	2966
1984	13	0	0	82	582	448	375	896	227	82	0	1	2706
1985	1	0	56	64	214	364	500	400	103	35	93	6	1836
1986	0	0	0	208	99	341	782	469	283	115	145	0	2442
1987	3	36	96	394	99	329	628	816	435	40	100	14	2990
1988	0	18	79	166	347	760	769	567	236	234	23	17	3216
1989	0	11	0	241	163	210	819	175	413	563	40	0	2635
1990	0	22	115	336	365	388	659	174	197	129	91	45	2521
1991	9	5	19	174	578	618	474	606	335	103	88	14	3023
1992	0	93	4	31	137	428	341	239	**	**	**	**	1273

Table 4 (Contd.)

Station : Teknaf

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	0	5	0	99	351	296	358	**	137	0	0	1246
1981	15	2	23	193	259	1127	1204	845	473	115	81	29	4366
1982	0	7	4	58	23	1353	1216	932	475	14	48	**	4130
1983	10	8	46	25	169	730	**	817	532	290	208	30	2865
1984	8	0	0	90	198	1517	971	973	240	109	0	0	4106
1985	8	4	11	25	325	803	983	1093	315	137	268	0	3972
1986	0	0	0	49	70	1371	896	670	284	268	169	0	3777
1987	0	27	14	78	17	**	1294	986	684	48	133	0	3281
1988	0	43	0	113	208	811	889	643	287	188	15	73	3270
1989	0	0	0	126	55	927	653	731	673	410	59	0	3634
1990	0	50	79	95	203	1311	947	563	356	197	112	27	3940
1991	16	0	0	103	160	1269	1354	1261	431	478	74	9	5155
1992	0	71	0	0	242	807	1018	704	360	436	62	5	3705

Station : Sylhet

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	33	114	519	758	457	449	307	154	489	0	0	3280
1981	21	39	109	418	889	347	1141	745	463	43	0	26	4241
1982	0	27	80	641	508	767	834	658	513	290	5	0	4323
1983	13	37	378	499	578	675	950	878	483	275	0	19	4785
1984	72	4	54	269	900	596	816	336	1260	298	23	48	4676
1985	0	27	212	541	368	1083	670	394	577	123	0	22	4017
1986	4	2	41	345	176	424	657	567	539	426	106	3	3290
1987	2	29	351	394	217	971	1272	581	901	157	51	13	4939
1988	0	73	91	338	1115	934	695	1184	758	60	202	80	5530
1989	6	33	11	313	543	870	1342	665	1081	524	34	1	5423
1990	2	45	176	575	546	542	596	582	1023	216	40	3	4346
1991	10	54	60	405	1063	1203	352	437	781	172	3	79	4619
1992	0	53	172	129	544	666	913	390	440	188	3	0	3498

Table 4 (Contd.)

Station : Srimangal

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	4	53	**	631	**	294	**	**	**	**	**	982
1981	**	**	**	**	**	**	**	**	**	**	**	**	**
1982	0	324	31	375	225	372	310	489	221	92	0	24	2463
1983	1	24	342	405	605	431	224	**	**	**	**	**	2032
1984	**	**	0	104	1176	396	212	373	462	156	5	1	2885
1985	5	43	88	**	**	**	**	232	351	50	0	0	769
1986	3	2	20	525	196	406	215	278	281	411	191	0	2528
1987	9	2	65	319	173	253	225	449	191	1304	38	10	3038
1988	0	39	208	170	528	436	444	468	218	185	143	14	2853
1989	0	18	29	99	244	369	402	274	345	191	16	2	1989
1990	0	21	185	233	554	350	206	283	359	235	54	7	2487
1991	17	93	33	258	861	**	**	251	357	244	41	163	2318
1992	0	40	33	117	354	238	246	345	188	178	1	0	1740

Station : Comilla

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	41	50	82	429	195	472	428	219	175	0	2	2093
1981	32	12	101	552	402	298	482	258	140	0	0	27	2304
1982	0	12	60	232	358	601	279	393	224	15	37	0	2211
1983	14	3	114	126	297	275	526	636	532	221	8	13	2765
1984	0	5	0	51	512	568	383	446	221	178	0	2	2366
1985	3	6	75	200	252	281	277	258	261	32	0	0	1645
1986	5	0	16	227	232	186	419	260	381	182	137	0	2045
1987	0	0	36	215	109	167	152	43	166	139	5	13	1045
1988	0	23	62	211	406	354	468	254	210	232	65	1	2286
1989	0	18	18	125	183	341	332	107	250	118	0	5	1497
1990	0	21	203	228	331	333	307	252	227	239	71	27	2239
1991	11	50	37	269	495	323	317	405	387	350	50	115	2809
1992	0	63	0	10	154	298	259	128	128	197	2	1	1240

Table 4 (Contd.)

Station : Chandpur

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	**	**	**	**	**	**	**	**	**	**	**	**	**
1981	72	31	195	679	599	403	506	232	147	15	0	40	2919
1982	0	46	361	199	162	664	824	940	308	170	83	6	3763
1983	70	41	215	356	594	471	320	671	254	287	56	55	3390
1984	22	0	0	24	482	1215	610	749	349	108	0	7	3566
1985	0	0	372	153	480	333	347	432	533	18	0	0	2668
1986	6	0	24	123	145	243	418	213	507	148	197	0	2024
1987	0	0	51	241	81	213	731	552	222	155	27	0	2273
1988	0	5	67	174	334	370	318	301	130	99	74	0	1872
1989	0	0	9	50	111	367	310	206	256	323	0	3	1635
1990	0	36	111	163	189	311	421	177	208	265	55	22	1958
1991	7	18	109	150	367	462	253	334	540	286	6	17	2549
1992	0	96	0	20	147	178	338	335	150	84	1	0	1349

Station : Nijdee court

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	61	71	45	554	267	784	376	273	186	1	2	2620
1981	108	4	77	267	488	533	1043	717	328	27	0	24	3616
1982	0	54	9	275	67	797	852	1033	435	46	18	5	3591
1983	54	42	93	267	444	407	1512	1302	105	80	5	7	4318
1984	0	0	0	0	657	1008	1270	1122	459	141	0	0	4657
1985	0	0	64	36	367	525	548	772	339	49	9	0	2709
1986	8	0	32	163	358	615	635	397	508	80	184	0	2980
1987	2	0	78	350	110	416	1297	816	585	45	13	15	3727
1988	0	50	77	152	402	548	519	622	475	169	54	0	3068
1989	0	20	39	96	188	333	703	162	547	433	0	0	2521
1990	0	83	266	235	429	651	752	522	239	397	99	49	3722
1991	17	66	13	199	337	804	626	430	441	428	45	16	3422
1992	0	90	2	0	240	268	515	456	272	182	5	5	2035

Table 4 (Contd.)

Station : Peni

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	12	41	66	74	515	115	137	**	32	307	**	0	1299
1981	54	55	76	570	449	817	1190	375	330	9	0	1	3926
1982	0	16	4	413	159	719	637	709	302	63	45	0	3067
1983	47	84	166	557	840	591	779	960	272	467	34	49	4846
1984	18	0	3	48	647	436	1303	368	400	155	0	18	3396
1985	3	5	170	133	304	773	585	865	271	23	5	0	3137
1986	13	18	0	659	948	337	699	740	487	199	104	0	4204
1987	0	1	109	385	143	805	806	1010	525	59	41	14	3898
1988	0	36	54	147	499	383	670	815	516	207	131	0	3458
1989	0	23	15	125	225	597	1038	115	347	633	2	0	3120
1990	0	31	287	208	485	545	843	545	271	393	178	65	3851
1991	9	77	59	212	625	770	761	486	739	427	41	11	4217
1992	0	90	0	0	229	299	384	202	303	190	17	0	1714

Station : Hatiya

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	13	141	22	299	385	885	724	302	387	0	0	3158
1981	51	15	166	330	324	527	889	681	313	13	0	10	3319
1982	0	45	5	161	24	586	525	746	249	23	13	0	2377
1983	30	41	14	115	308	504	594	907	475	440	59	21	3508
1984	13	0	0	261	259	465	608	629	367	256	0	13	2871
1985	3	3	71	123	317	553	674	627	169	32	51	20	2643
1986	24	0	3	194	115	571	616	370	412	91	307	0	2703
1987	0	1	12	262	118	569	113	646	393	49	37	9	2209
1988	0	34	49	142	528	804	737	582	493	156	68	0	3593
1989	0	0	20	179	113	510	617	234	329	438	0	13	2453
1990	0	77	198	209	323	456	**	**	**	**	88	78	1429
1991	5	0	6	288	367	801	553	524	444	395	23	28	3434
1992	0	130	0	0	234	351	776	481	559	191	0	17	2739

Table 4 (Contd.)

Station : Rajshahi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	29	12	69	0	156	349	281	316	215	149	0	0	1576
1981	41	39	67	223	34	157	496	335	373	0	3	91	1859
1982	0	10	79	147	43	263	168	216	64	38	60	2	1090
1983	3	2	4	33	121	65	371	505	147	358	0	24	1633
1984	31	5	0	129	165	310	285	317	298	202	0	0	1742
1985	4	6	3	71	203	232	273	148	233	76	0	0	1249
1986	3	12	19	93	81	176	262	243	406	190	27	4	1516
1987	0	4	12	73	100	210	469	402	193	43	5	4	1515
1988	1	30	35	106	139	576	301	358	89	89	100	0	1824
1989	4	8	5	2	224	190	350	117	332	78	0	8	1318
1990	0	34	46	97	301	263	462	238	180	127	17	0	1765
1991	6	15	19	25	157	253	304	96	515	124	0	92	1606
1992	1	33	0	16	121	85	250	185	124	29	5	0	849

Station : Dinajpur

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	**	**	**	**	**	**	**	**	**	**	**	**	**
1981	15	47	0	78	503	103	704	279	182	0	5	44	1960
1982	0	0	3	111	16	252	221	357	168	40	29	0	1197
1983	11	0	20	55	141	137	735	371	302	145	0	17	1934
1984	46	4	0	10	336	456	467	221	499	29	0	0	2068
1985	0	5	1	17	182	515	481	278	326	282	0	7	2094
1986	0	0	0	79	205	344	357	320	279	362	0	37	1983
1987	1	37	70	202	122	245	1001	853	284	103	7	0	2925
1988	1	12	16	108	164	318	403	848	200	106	13	0	2189
1989	22	8	1	0	408	262	412	237	493	82	0	2	1927
1990	0	6	41	158	245	355	479	251	352	193	0	0	2080
1991	27	1	1	17	400	332	177	286	650	29	0	43	1963
1992	5	6	1	5	87	212	535	228	483	76	6	5	1649

Table 4 (Contd.)

Station : Bogra

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	9	3	15	69	263	326	410	237	195	89	0	0	1616
1981	87	18	55	157	287	186	378	287	219	0	0	82	1756
1982	0	1	33	48	120	239	360	268	118	30	11	1	1229
1983	7	10	34	77	312	112	247	268	302	376	6	27	1778
1984	11	15	6	38	144	521	448	106	165	173	0	2	1629
1985	0	4	10	44	318	459	235	168	331	135	2	2	1708
1986	3	4	0	128	209	163	446	234	462	467	17	13	2146
1987	0	3	17	132	178	268	525	620	145	31	19	3	1941
1988	0	28	65	87	347	754	486	234	292	43	91	1	2428
1989	0	16	2	4	462	229	605	102	282	28	0	4	1734
1990	0	27	24	53	282	377	499	265	320	227	6	0	2080
1991	4	14	8	48	416	240	404	207	733	105	0	112	2291
1992	0	14	0	30	140	202	289	159	424	108	3	0	1369

Station : Rangpur

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	3	14	22	38	354	426	276	579	340	68	0	0	2120
1981	20	10	13	137	433	104	577	461	490	0	0	45	2290
1982	0	7	5	94	99	653	332	346	380	64	8	5	1993
1983	60	0	46	43	260	326	633	341	255	281	0	28	2273
1984	23	4	17	131	341	969	808	318	686	172	0	54	3523
1985	0	33	44	237	352	569	770	321	398	127	4	21	2876
1986	0	0	0	105	265	383	498	283	521	196	27	32	2310
1987	0	21	84	57	155	485	1308	557	353	216	6	0	3242
1988	0	33	37	165	285	369	451	633	496	19	35	1	2524
1989	7	18	2	0	335	219	719	110	414	48	4	2	1878
1990	1	57	82	314	354	393	307	396	439	325	0	0	2668
1991	38	1	7	34	298	592	163	230	725	106	2	29	2225
1992	13	10	0	89	245	348	247	367	552	129	4	2	2006

Table 4 (Contd.)

Station : Ishurdi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	13	6	22	0	381	269	206	101	**	210	0	0	1208
1981	28	76	64	355	323	223	488	211	423	13	0	48	2252
1982	0	8	85	133	166	227	209	200	155	31	67	1	1282
1983	15	36	54	56	367	155	328	188	205	201	9	21	1635
1984	11	0	0	73	114	450	261	288	266	82	0	0	1545
1985	2	0	19	36	155	224	208	182	245	108	0	0	1179
1986	3	10	5	57	83	138	374	198	431	165	29	0	1493
1987	2	0	25	61	133	74	413	643	228	19	17	9	1624
1988	0	32	63	30	312	313	292	187	159	82	73	2	1545
1989	0	51	2	3	279	93	614	109	174	92	0	13	1430
1990	0	59	128	157	207	277	422	234	481	95	34	0	2094
1991	2	9	28	42	152	360	215	189	424	141	2	78	1642
1992	0	40	0	18	132	73	252	206	295	38	5	3	1062

Station : Khulna

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	101	151	23	222	348	300	421	137	126	0	1	1830
1981	22	42	220	286	233	255	376	268	186	28	0	65	1981
1982	0	15	23	134	30	342	339	402	267	23	30	3	1608
1983	50	59	40	54	473	209	203	304	169	273	1	0	1835
1984	32	0	0	99	225	772	296	436	159	82	0	6	2107
1985	9	6	30	35	154	304	161	344	143	138	12	0	1336
1986	8	0	1	147	260	238	388	208	842	171	152	1	2416
1987	2	3	55	134	113	315	518	497	189	41	48	7	1922
1988	0	46	18	53	305	599	326	302	68	95	140	0	1952
1989	0	8	2	55	186	254	239	81	262	330	0	1	1418
1990	0	62	212	53	261	261	435	206	204	156	77	4	1931
1991	10	54	36	38	100	421	229	318	342	159	0	47	1754
1992	13	203	0	2	192	160	255	198	111	90	0	0	1224

Table 4 (Contd.)

Station : Satkhira

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	3	166	**	11	**	**	**	209	104	110	**	**	603
1981	31	40	86	261	185	198	569	288	273	9	0	99	2039
1982	0	60	31	96	79	206	206	385	228	27	19	1	1338
1983	16	57	22	130	200	201	193	422	251	286	4	5	1787
1984	40	5	0	101	124	647	323	341	170	72	0	5	1828
1985	13	6	38	75	146	291	206	317	271	142	0	0	1505
1986	13	0	8	36	172	257	370	228	685	137	181	0	2087
1987	0	5	15	120	87	163	320	406	317	34	53	2	1522
1988	0	46	45	69	198	583	262	248	172	19	106	0	1748
1989	1	0	3	52	240	208	292	178	206	184	0	0	1364
1990	0	47	150	25	176	213	530	279	292	168	44	7	1931
1991	34	47	50	67	28	516	342	325	213	103	5	37	1767
1992	9	115	0	8	134	208	384	280	247	95	1	0	1481

Station : Jessore

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	8	60	57	**	193	214	309	309	**	119	0	0	1269
1981	35	107	45	294	263	97	276	376	244	0	0	15	1752
1982	0	4	52	224	71	314	171	184	230	5	21	1	1277
1983	33	22	55	61	327	152	195	417	246	149	0	15	1672
1984	51	1	0	19	304	821	292	322	167	54	0	0	2031
1985	14	4	50	4	177	311	257	329	238	189	0	0	1573
1986	9	0	27	90	136	337	338	177	637	183	159	6	2099
1987	1	0	58	165	52	327	389	714	193	136	14	10	2059
1988	0	27	93	148	298	518	257	312	117	87	100	0	1957
1989	0	3	2	39	293	201	277	127	168	234	0	1	1345
1990	0	54	183	25	162	335	369	137	197	99	126	10	1697
1991	24	10	47	54	67	407	202	336	216	145	0	76	1584
1992	27	77	0	1	223	303	307	152	204	36	3	0	1333

Table 4 (Contd.)

Station : Barisal

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	55	47	30	235	272	526	297	197	282	0	0	1941
1981	31	44	114	424	280	436	518	216	172	54	0	33	2322
1982	0	57	17	177	65	463	222	593	218	6	34	11	1863
1983	8	36	20	190	317	269	286	569	305	201	47	19	2267
1984	16	0	1	135	258	1023	459	405	220	335	0	6	2858
1985	1	2	46	58	222	365	255	301	180	20	8	0	1458
1986	6	0	7	102	182	254	377	252	527	315	268	1	2291
1987	4	3	8	150	57	69	568	436	225	93	37	0	1650
1988	0	20	37	96	300	543	433	488	193	155	121	0	2386
1989	0	14	1	89	162	214	453	199	413	451	0	0	1996
1990	0	79	182	139	352	386	457	299	190	194	70	30	2378
1991	10	35	37	151	191	683	358	324	232	445	4	16	2486
1992	4	98	0	1	205	190	299	326	210	98	8	0	1439

Station : Bhola

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	144	144	42	749	435	678	308	180	322	0	0	3002
1981	51	16	119	415	258	558	561	378	285	4	0	26	2671
1982	0	56	16	208	93	560	218	578	246	112	29	0	2116
1983	10	33	17	239	434	573	526	490	353	400	41	35	3151
1984	9	0	0	170	189	922	453	454	294	144	0	0	2635
1985	1	3	47	80	438	364	282	273	240	52	21	0	1801
1986	10	0	4	201	306	293	447	424	529	155	237	0	2606
1987	0	10	19	232	131	139	716	843	176	25	20	28	2339
1988	0	49	67	75	417	654	417	459	258	149	110	0	2655
1989	0	19	0	70	127	540	385	185	378	251	0	0	1955
1990	0	84	156	118	245	358	370	287	186	322	83	35	2244
1991	17	39	37	164	170	753	390	396	361	412	3	17	2759
1992	1	126	0	0	208	275	382	211	269	154	0	1	1627

Table 4 (Cont.)

Station : Patuakhali

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	**	**	**	**	**	**	**	**	**	**	**	**	**
1981	36	13	341	336	254	606	824	367	202	18	0	3	3000
1982	0	114	0	179	53	1002	553	829	607	69	5	0	3411
1983	63	29	12	307	797	768	961	565	232	192	49	31	4006
1984	11	0	0	82	203	700	408	618	121	167	0	2	2312
1985	3	3	49	19	297	285	386	345	196	80	38	0	1701
1986	3	0	6	57	191	231	558	196	827	229	292	0	2590
1987	0	0	9	229	151	503	335	810	188	120	101	0	2446
1988	0	19	8	40	204	463	661	422	267	162	167	0	2413
1989	0	2	1	55	239	315	126	252	379	397	0	1	1767
1990	0	95	161	132	245	295	608	221	587	218	0	29	2591
1991	4	11	28	191	106	576	476	438	437	273	3	19	2562
1992	2	100	0	1	208	282	560	479	392	244	3	1	2272

Station : Khepupara

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	17	47	21	272	502	560	649	232	308	0	0	2608
1981	35	13	113	203	156	413	588	356	362	110	0	14	2363
1982	0	6	4	106	65	603	526	888	298	8	29	0	2533
1983	20	50	34	7	140	957	443	432	307	147	41	12	2590
1984	10	0	0	96	141	820	498	681	194	60	0	0	2500
1985	2	25	26	64	320	592	558	340	406	127	19	0	2479
1986	1	0	0	46	159	396	608	246	911	146	267	6	2786
1987	0	2	153	225	132	351	751	798	320	120	41	14	2907
1988	0	79	4	76	226	424	618	597	345	161	131	0	2661
1989	0	2	1	100	165	237	581	201	444	552	0	0	2283
1990	0	121	163	73	185	286	1028	299	501	262	98	40	3056
1991	4	0	4	247	87	816	552	502	221	566	10	29	3038
1992	2	134	0	0	241	297	480	292	410	336	7	4	2203

Table 4 (Contd.)

Station : Dhaka

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	3	32	54	147	414	323	380	269	296	300	0	0	2218
1981	10	42	108	274	411	325	356	187	320	82	9	35	2159
1982	0	15	81	104	154	514	140	346	258	146	51	0	1809
1983	18	63	138	318	348	298	181	408	322	253	0	18	2365
1984	13	1	7	124	797	635	690	309	477	58	0	0	3021
1985	8	1	195	176	300	399	262	314	306	79	0	10	2050
1986	6	0	23	231	191	308	450	171	687	237	172	3	2479
1987	3	0	33	230	109	116	526	462	363	104	7	33	2186
1988	0	45	74	282	517	579	255	169	196	213	153	3	2486
1989	0	32	0	85	228	319	347	59	305	240	0	12	1627
1990	0	36	151	154	202	229	567	227	207	181	103	6	2063
1991	27	8	46	53	529	320	318	345	692	392	14	106	2850
1992	1	47	0	25	153	132	386	182	148	83	2	0	1159

Station : Mymensingh

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	2	11	16	84	723	289	309	464	214	209	0	0	2321
1981	12	48	46	278	360	103	683	276	161	22	0	0	1989
1982	0	16	65	66	350	662	582	337	218	28	8	0	2332
1983	4	3	65	92	546	155	434	866	302	454	0	19	2940
1984	0	0	0	40	399	513	686	249	470	221	0	0	2578
1985	9	37	2	190	255	251	558	243	259	99	0	5	1908
1986	4	0	0	402	195	245	684	373	669	377	86	18	3053
1987	7	0	20	141	362	380	403	512	373	10	17	14	2239
1988	0	45	115	113	734	583	587	411	321	92	120	13	3134
1989	6	22	2	23	369	370	789	170	416	284	0	6	2457
1990	0	83	66	116	390	445	480	244	319	213	7	1	2364
1991	2	15	44	77	679	603	322	237	835	520	0	77	3411
1992	6	36	0	20	156	270	380	155	318	241	2	0	1584

Table 4 (Contd.)

Station : Faridpur

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	3	99	54	98	397	341	312	243	213	290	22	0	2072
1981	10	58	141	336	268	285	348	560	189	18	19	92	2324
1982	0	24	63	159	191	211	232	268	147	25	56	0	1376
1983	4	50	87	173	194	181	284	572	204	356	0	3	2108
1984	0	0	46	78	469	793	321	280	314	179	0	0	2480
1985	2	2	133	175	201	219	233	215	255	56	0	0	1491
1986	3	0	4	220	189	225	257	209	831	127	149	2	2316
1987	0	8	38	105	157	384	351	409	456	47	3	23	1981
1988	0	34	98	133	510	468	241	243	128	169	149	0	2173
1989	0	5	5	124	324	260	393	95	241	178	0	9	1634
1990	0	36	215	157	315	288	403	140	189	168	48	4	1963
1991	27	58	59	103	265	332	305	186	360	350	1	103	2149
1992	4	61	0	5	216	238	387	209	95	120	0	0	1335

Station : Madaripur

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	32	87	54	247	231	381	291	**	266	0	0	1589
1981	46	35	150	340	294	195	417	147	157	**	0	0	1781
1982	0	2	47	128	101	457	244	370	476	53	61	0	1939
1983	3	5	95	145	638	312	319	699	527	429	32	6	3010
1984	27	0	25	235	602	1687	727	1117	650	174	0	2	5246
1985	0	0	41	431	398	910	546	606	364	167	0	0	3463
1986	0	0	8	359	434	671	1052	493	696	172	170	0	4055
1987	2	1	83	138	142	339	683	481	158	135	47	0	2209
1988	0	59	70	130	437	493	265	233	182	135	124	0	2128
1989	0	31	2	98	173	260	283	133	287	30	0	0	1297
1990	0	66	217	156	215	253	455	177	268	210	105	9	2131
1991	11	17	57	104	297	595	334	525	241	346	15	40	2582
1992	4	87	0	0	187	245	316	297	168	96	2	0	1402

Source : Bangladesh Meteorological Department.

Note : ** Denote Data Not Available.

Table 3 - - MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURES °F (NORMAL)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cox's Bazar	79.6 56.2	82.1 59.5	86.3 64.4	88.7 73.4	88.8 75.9	86.3 76.4	85.3 76.4	85.3 76.1	86.4 75.9	87.1 73.6	84.4 61.9	79.7 58.7
Chittagong	78.8 55.0	82.3 58.7	87.1 67.2	88.8 73.2	88.9 75.5	86.1 76.8	86.0 76.7	85.9 76.4	87.1 76.4	86.9 73.4	83.6 59.1	79.0 56.4
Hoakhal	78.1 57.5	81.1 61.1	86.6 70.5	89.0 76.4	89.1 77.6	86.2 76.4	85.4 77.8	85.7 77.4	85.9 78.1	86.6 75.6	83.3 64.1	78.5 57.9
Cowilla	78.5 52.9	82.2 57.5	89.7 67.1	92.3 73.3	91.1 74.9	87.5 76.8	87.7 77.1	87.5 76.9	88.4 76.9	88.2 73.4	84.0 59.7	79.2 54.8
Brahmanbaria	78.4 51.3	82.7 55.2	90.0 63.5	93.1 71.0	92.0 72.4	86.6 74.1	87.9 75.3	87.4 75.6	86.0 75.9	87.6 73.7	83.4 62.6	79.8 55.0
Naryanganj	77.9 55.5	81.7 59.0	89.8 68.1	92.4 74.0	91.1 75.8	89.2 78.1	87.8 78.7	87.8 78.8	88.7 78.6	88.2 75.3	83.9 63.3	79.5 57.5
Mymensingh	76.9 53.6	79.6 56.7	88.0 64.7	91.1 71.7	89.3 74.2	87.8 76.9	87.9 77.9	87.7 77.1	86.2 76.2	87.1 73.9	82.9 61.9	77.7 55.8
Faridpur	75.9 53.5	80.1 56.2	89.3 63.8	93.8 73.0	91.7 74.9	89.2 76.4	85.4 77.1	87.1 78.7	87.8 77.9	86.9 73.5	82.3 58.4	76.4 54.1
Barisal	77.8 55.4	81.9 60.1	89.6 68.8	92.0 75.1	91.7 76.9	88.8 78.3	87.3 78.4	87.0 78.3	88.1 78.2	87.6 74.9	83.2 64.0	79.1 56.6
Kahulna	78.5 55.2	83.0 59.8	91.6 68.4	94.2 75.3	92.9 77.0	90.6 78.9	87.9 77.4	87.9 77.0	89.0 78.5	88.1 73.2	83.5 61.6	78.7 57.3
Jessore	78.6 49.2	81.8 55.5	91.9 64.8	96.6 73.5	93.9 75.8	90.7 77.5	88.1 77.6	88.1 77.0	89.3 77.3	88.0 71.1	84.2 53.6	78.9 51.5
Satkhira	80.2 52.8	81.8 58.3	93.7 67.9	97.0 75.6	95.4 77.4	91.8 78.8	87.3 77.6	88.1 77.4	89.6 78.3	86.1 72.3	85.2 58.4	80.6 53.4
Bogra	75.8 52.1	80.3 54.9	90.7 63.0	95.6 71.5	92.4 74.3	89.8 77.2	89.2 78.3	88.8 77.2	89.1 77.9	87.8 72.7	82.4 60.0	76.7 54.5
Dinajpur	75.4 49.6	79.3 53.3	89.2 60.9	94.3 70.0	91.8 74.2	89.5 76.7	89.2 78.9	89.0 77.5	87.3 76.7	87.8 71.1	82.5 57.0	77.1 52.0
Srimangal	79.5 47.5	82.7 51.9	90.2 61.5	92.1 69.3	91.1 72.2	89.9 75.5	90.3 76.4	90.1 76.1	85.1 75.3	88.4 70.2	82.5 53.6	80.4 49.5

Compiled from India Weather Review (Monthly Weather Reports), 1944, and slightly adjusted from figures obtained from Pakistan Met. Dept. in 1951.

TABLE -- 6 MEAN MONTHLY PRESSURE (MILLIBARS) 9 HOURS I.S.T. AND RAINFALL IN INCHES (NORMAL)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall
Cox's Bazar	1015.00 0.14	1013.30 0.47	1011.20 1.49	1009.10 4.20	1005.60 12.74	1003.20 31.14	1001.20 35.52	1002.70 27.75	1006.10 15.25	1010.10 7.16	1012.50 3.26	1014.50 0.98	140.10
Chittagong	1013.70 0.24	1012.30 1.10	1009.70 2.46	1007.30 5.93	1004.00 10.42	1000.50 20.99	999.40 23.53	1000.10 20.42	1004.50 12.64	1008.60 7.09	1011.50 2.17	1013.50 0.64	107.63
Noakhali	1016.00 0.25	1014.30 0.97	1011.60 2.37	1008.90 5.47	1005.70 11.45	1001.60 20.56	1001.00 23.56	1002.70 24.33	1006.30 16.10	1010.70 8.13	1013.80 1.53	1015.90 0.28	115.00
Comilla	1015.80 0.32	1014.20 1.22	1011.20 3.01	1008.40 5.85	1005.50 12.39	1001.30 18.28	1001.90 16.42	1002.80 17.18	1006.00 11.35	1010.60 6.72	1013.70 1.29	1015.90 0.30	94.33
Brahmanbaria	1016.50 0.44	1015.20 1.07	1012.00 3.47	1010.00 6.22	1004.90 12.07	1001.50 15.20	1000.70 11.20	1003.90 12.11	1007.20 9.82	1010.30 5.35	1012.10 0.88	1013.90 0.24	78.27
Narayanganj	1016.10 0.32	1014.10 1.24	1011.20 2.39	1008.30 5.40	1005.30 9.64	1001.00 12.39	1000.30 12.97	1002.10 13.26	1005.80 9.76	1010.70 5.27	1013.80 0.95	1016.00 0.27	73.79
Wymensingh	1015.20 0.32	1013.10 0.86	1010.20 1.84	1007.40 5.51	1004.60 12.46	999.30 17.60	999.60 16.02	1001.30 15.49	1005.00 14.09	1009.80 6.32	1013.00 0.88	1015.10 0.09	91.48
Faridpur	1015.60 0.43	1013.80 1.19	1010.60 2.10	1007.40 4.67	NA 9.62	999.50 12.79	999.70 12.74	NA 12.13	1005.20 9.26	1010.20 4.85	1013.60 1.10	1015.90 0.15	70.80
Barisal	1016.70 0.42	1014.40 0.94	1011.60 2.05	1008.80 4.23	1005.60 8.25	1001.20 16.05	1000.60 16.32	1002.30 14.94	1006.10 10.08	1010.80 6.14	1014.00 1.54	1016.10 0.25	81.21
Khulna	1016.80 0.44	1014.50 0.93	1011.50 1.64	1008.20 2.91	1005.00 7.75	1000.50 12.46	999.60 14.44	1001.70 13.79	1005.90 7.92	1011.00 4.26	1014.40 1.12	1016.70 0.19	67.85
Jessore	1016.50 0.37	1014.30 1.30	1011.00 1.93	1007.70 3.53	1004.60 8.12	1000.20 12.22	999.60 12.22	1001.40 11.04	1005.40 8.48	1010.60 4.59	1014.20 0.95	1016.50 0.18	64.93
Satkhira	1016.60 0.38	1014.30 1.03	1011.10 1.84	1008.10 2.93	1004.60 6.87	999.20 12.20	999.30 13.50	1001.30 11.57	1005.60 8.78	1010.90 4.50	1014.30 0.74	1016.50 0.17	64.51
Bogra	1015.10 0.43	1012.70 0.79	1009.40 1.14	1006.30 2.53	1003.60 8.40	999.30 13.04	998.60 12.83	1000.40 13.00	1004.40 11.29	1009.30 5.13	1012.80 0.77	1015.10 0.09	69.15
Dinajpur	1012.80 0.36	1010.50 0.61	1007.10 0.69	1004.00 2.14	1001.40 7.84	997.00 13.64	996.40 15.47	998.10 13.71	1002.00 13.05	1007.30 4.75	1011.10 0.44	1013.00 0.06	72.26
Srisaigal	NA 0.42	1012.70 1.5	1010.70 3.39	NA 9.71	NA 15.79	NA 18.86	NA 13.91	NA 14.3	1005.30 11.77	1009.80 7.06	1012.65 1.41	1014.50 0.25	98.37

For detailed rainfall figures and normals, see Daily Rainfall Records of the Agriculture Department, East Bengal Government and New Ind. Met. Dept., vol. XXVII, part V, Simla, 1949. NA=not available.

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