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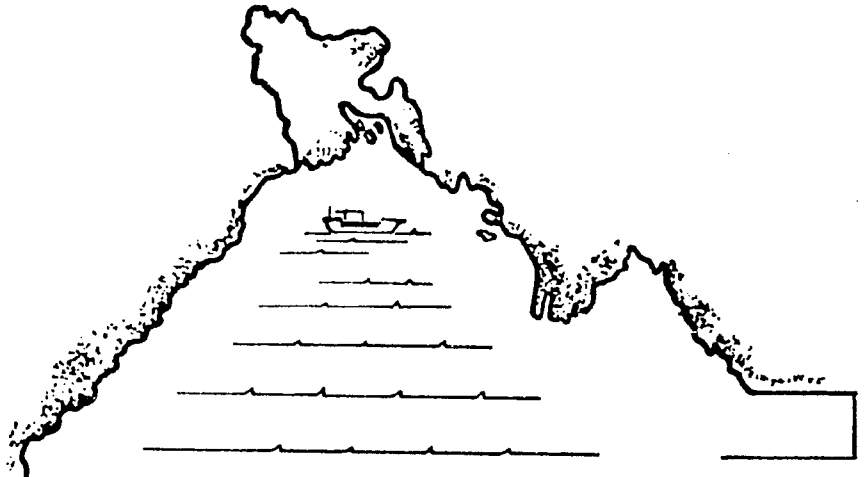

The Bangladesh Fertilizer Sector

1978

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MUSCLE SHOALS, ALABAMA 35660
October 1978

PREFACE

Few countries have suffered the travails of national development that Bangladesh has and is still undergoing.

The efficient production and use of fertilizer strains many more developed infrastructures than those which currently exist in Bangladesh. In light of this and taking all the adverse factors into account, the present functioning of the fertilizer sector in Bangladesh can be regarded as no small achievement.

Agriculture is the major sector of Bangladesh, and a sound fertilizer sector will become increasingly essential in meeting the grain requirements of this food deficit nation.

Many major studies have been carried out on the fertilizer sector of Bangladesh, but this short critique of the fertilizer sector and its problems should prove useful to all those involved with fertilizer use development, be they in the industrial or agricultural sector.

The International Fertilizer Development Center (IFDC) appreciates the very positive interactions held between IFDC staff, the Bangladesh Agricultural Development Corporation (BADC), and others in February of this year and trusts that this report will prove of value to them in approaching some of the difficult problems which lie ahead if fertilizer is to be moved as efficiently and cheaply as possible to the multitudes of small farmers who are the backbone of Bangladesh agriculture.

IFDC staff members gratefully acknowledge the time and assistance given by the many Bangladeshi and USAID/Dacca officials they met and for the frankness with which discussions were held.

Donald L. McCune
Managing Director
International Fertilizer
Development Center

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QUANTITIES AND WEIGHTS

1 lakh (lk) = 100,000
1 crore (cr) = 10,000,000
1 million (M) = 1,000,000
1 mile (mi) = 1.609 kilometers
1 kilometer (km) = 0.6215 mile
1 foot (ft) = 30.5 centimeters (cm)
1 acre (ac) = 0.40467 hectare
1 hectare (ha) = 2.47109 acres
1 bigha = 0.33 acre
1 square mile (mi^2) = 2.59 square kilometers (km^2) = 640 acres = 259 hectares
1 maund (md) = 40 seers = 82.27 pounds = 37.3 kilograms
1 seer = 2.056.5 pounds
1 pound (lb) = 0.4536 kilograms
1 kilogram (kg) = 2.2046 pounds = 1.07 seer = 1,000 grams
1 ounce (dry) = 28.35 grams
1 metric ton (mt) = 2,204.6 pounds = 26.82 maunds
1 long ton (lt) = 2,240 pounds = 27.22 maunds = 1.01605 metric tons
1 short ton (st) = 2,000 pounds = 0.90718 metric ton = 0.8929 long tons
1 bale of cotton = 329 pounds = 4.7637 maunds = 0.1492 metric tons
1 bale of jute = 400 pounds = 4.86 maunds = 0.18143 metric tons

ABBREVIATIONS

AIS	Agricultural Information Service
AS	Ammonium Sulfate
ASST	Assistant
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BCIC	Bangladesh Chemical Industries Corporation
BIWTC	Bangladesh Inland Water Transport Corporation
BIWTA	Bangladesh Inland Water Transport Authority
BRA	Bangladesh Railway Authority
BRC	Bangladesh Railway Corporation
BRTA	Bangladesh Road Transport Authority
BRRI	Bangladesh Rice Research Institute
C&F	Cost and Freight
CTG	Chittagong
DAP	Diammonium Phosphate
DEM	Directorate of Agriculture Extension and Management
DY	Deputy
EIU	Economic Intelligence Unit, Ltd.
FAO	Food and Agricultural Organization
FY	Fiscal Year
HYV	High Yielding Varieties
IADS	International Agricultural Development Service
IDA	International Development Association
IFDC	International Fertilizer Development Center
IJCS	Intensive Jute Cultivation Scheme
IRDP	Integrated Rural Development Program
JRI	Jute Research Institute
KSS	Krishi Samabaya Samities (Village Cooperative Societies)
LGRD & CO-OP	Ministry of Local Government, Rural Development and Cooperatives
LT	Long Ton
MP	Muriate of Potash
MPH	Miles per Hour
MT	Metric Ton
MOVT	Movement
NORAD	Norwegian Agency for Development
PPM	Parts per Million
SHIPG	Shipping
SFI	Soil Fertility Institute
SSI	Soil Survey Institute
TAO	Thana Agricultural Officer
TCCA	Thana Central Cooperative Association
TEO	Thana Extension Officer
TK	Taka (Bangladesh Currency)
TPD	Tons per Day
TSP	Triple Superphosphate
UAA	Union Agricultural Assistant
UNDP	United Nations Development Program
USAID	U.S. Agency for International Development
VEA	Village Extension Agent

INTRODUCTION

The purpose of this report is to acquaint the reader with the conditions and problems of the Bangladesh fertilizer sector and to recommend some of the in-depth studies and problem-solving projects that would strengthen the sector.

The conditions and problems of the Bangladesh fertilizer sector presented here are based on a 3-week consultation in Bangladesh by an IFDC team in February 1978 and on information cited in other studies.

The team visited with officers of several organizations involved in the fertilizer sector. In the Ministry of Agriculture, discussions were held with the Planning and Evaluation Cell, BADC, the Bangladesh Agricultural Research Institute (BARI), the Bangladesh Rice Research Institute (BRRI), the Soil Survey Institute (SSI), the Directorate of Agriculture Extension and Management (DEM), and the FAO/NORAD fertilizer program. The team met also with staffs from the Bangladesh Chemical Industries Corporation (BCIC), the Integrated Rural Development Program (IRDP), the Planning Commission of the Government of Bangladesh, USAID/Dacca, The World Bank, Amman and Whitney, and various consultant groups. With the assistance from USAID/Dacca, the team visited fertilizer district and thana warehouses, retail fertilizer dealers, the port facilities of Chittagong and Chalna, and fertilizer production facilities at Ghorasal and Chittagong.

The team appreciates the time and assistance given by the management and staffs of the organizations visited. The fertilizer sector organizations, particularly BADC and BCIC, are aware of many of the problems they face. There are limitations in finding solutions to their problems as they are handicapped by shortage of trained, experienced personnel, financial difficulties, lack of equipment and facilities, and pressures at national and local levels. In spite of these handicaps, they are taking steps toward solving the problems.

SUMMARY

Bangladesh will continue to be a major food and fertilizer importing country for the next several years. To attain food self-sufficiency, even with an effective family planning program,

a compound increase in food grain production of 4.0%-4.9%/year will be needed and the increase will have to come largely through irrigation, multiple cropping, use of high yielding varieties (HYV), and rapidly expanded use of fertilizer.

In spite of the significant increase in the country's fertilizer use since its first introduction in 1952, fertilizer use per cultivated acre in 1977 averaged only 21.2 lb of nutrient, far below the recommended rates.[1] In 1977, rice accounted for 80% of the annually cropped acreage and 81% of total fertilizer use.

Urea, triple superphosphate (TSP), and muriate of potash (MP) together supply 99% of the country's chemical fertilizer plant nutrient needs. Local production of urea and TSP has been inadequate to meet the domestic needs, but if the urea plants, including the new Ashuganj ammonia/urea project scheduled to be on stream in December 1981, can be operated at 80%-85% of design capacity, Bangladesh would have nitrogen production capacities not only for domestic consumption but also for limited export in 1982-85.

Except for domestically produced ammonium sulfate (AS), all other fertilizers are procured, marketed, and distributed by BADC, a government corporation under the Ministry of Agriculture.

The present distribution system is capable of handling and moving the current fertilizer tonnage from supply sources to thana-level warehouses. However, to meet the challenge of the projected rapid increase in fertilizer use and to help reduce the burden of subsidies on the Bangladesh government and donor countries, the current system's capabilities must be better utilized through improved organization, planning, coordination, monitoring, communication, and development and exchange of information. Additional port, transportation, handling, storage, and communication facilities also will be needed. The present goal of maintaining a 4- to 6-month buffer stock of fertilizer for the country is to circumvent existing transportation, communication, and coordination difficulties. Improved in-country transportation, communication, and procurement planning would result in better information exchange and coordination. It also could lead to a sizable cutback in buffer stock and, thus, lower costs for both the government and donor countries.

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1. Unless specified otherwise, all years used in this report refer to fiscal years which cover July 1 through June 30.

The fertilizer sector is highly subsidized directly and indirectly. To cover all the costs of production, import, and in-country distribution, the retail fertilizer prices would have to be increased by an average of 137% over the current official prices. However, the desirability of raising the price, particularly at this stage in time, requires careful study.

Agricultural research and extension work in the past has been highly fragmented and this has resulted in duplicated efforts and inadequacy of resources (money, manpower, and facilities) for each organization.

Aside from geographic and climatic factors, there are other problems affecting fertilizer supply and use. These are:

1. Shortage of fertilizer because of slippage in scheduled imports, low production levels from domestic fertilizer plants, and higher fertilizer consumption by farmers than previously projected.

2. Lack of coordination and communication (1) between donor countries for fertilizer grants, loans, and technical assistance; (2) between organizations responsible for various segments of the fertilizer sector at the ministry level in planning, agriculture, finance, transportation, ports, local government, rural development, and cooperatives; and (3) within each ministry.

3. Irregular availability of fertilizer to farmers at critical times because of inadequate advanced transport and inventory planning, poor transport carrier performance, and lack of adequate incentives for retail dealers to vigorously promote fertilizer sales and services to farmers in the more remote areas.

4. Low incentives for farmers to use fertilizer, because of difficulties faced in selling their crops at government incentive prices and acquiring needed fertilizers at the official retail prices; inaccessibility to low-cost institutional credit; and the land tenure system.

5. The inability of agricultural extension officers at the thana level to advise farmers on fertilizer use and the lack of location-specific fertilizer application research in the country.

6. Poor communication systems (telephone, telex, and mail) which hinder flow and exchange of information between and within

organizations, resulting in inadequate planning, coordination, and implementation.

7. Shortage and export of skilled (technical and management) personnel.

In addition to these current problems, as fertilizer use rapidly increases, the following problems will become increasingly important:

1. The funds to finance domestic production, fertilizer imports, as well as marketing and distribution systems.

2. The development of additional transportation and warehousing capabilities needed to meet the rapidly increasing projected fertilizer sales. These capabilities include equipment, facilities, and manpower.

3. The ability of the public sector to handle fertilizer marketing with the current poor logistics and marketing margins within the framework of the official retail prices.

RECOMMENDATIONS

To help solve some of the current and potential problems of the Bangladesh fertilizer sector, the IFDC team recommends that the following projects and studies be undertaken:

For Current Problems

1. An organizational study of the entire fertilizer sector--to improve the coordination and flow of information.

2. Development of formal long-term (e.g., 5-year) fertilizer supply and demand planning and implementation procedures to prevent fertilizer shortages or oversupplies.

3. Management training programs in marketing, production, distribution, finance, fertilizer technology, maintenance, safety, agronomy, extension, research, and information analysis.

4. Study of incentives for fertilizer wholesalers, retail dealers, and farmers.

5. A study of BADC which would lead to organizational developments capable of meeting future fertilizer service needs more effectively and efficiently. This study could include the possible merits of BADC becoming a separate entity.

For Potential Problems

1. An in-depth study of the government's direct and indirect fertilizer subsidies to develop more realistic estimates of the costs of fertilizer supply and marketing; to devise ways to decrease these costs; to evaluate the impact of alternative subsidy policy changes on the cost of fertilizer to farmers, on fertilizer use, on food production, on income distribution among farmers, on fertilizer dealer margins, on improvements in fertilizer production and distribution, and on the cost to the government; and to recommend more productive uses of subsidies.

2. Development of a transportation and warehousing model to determine future requirements for transportation equipment and warehousing, such as the number of locomotives and other rolling stock; the number, location and size of fertilizer warehouses; and the optimum level of inventory.

3. An in-depth analysis of the relative costs and advantages of building as compared to leasing of future needed warehouses.

4. A cost-benefit study of fertilizer use and its effect on fertilizer pricing.

5. An in-depth study of future P_2O_5 supply strategy.

6. A study of the feasibility of private-sector fertilizer wholesaling.

7. An evaluation of fertilizer bulk handling, bags, and bag service requirements.

8. Development of standard specifications for all fertilizers, domestic and imported, including official methods of analysis and testing.

AGRICULTURE

Agriculture is the dominant sector of the Bangladesh economy. It provides 60% of the gross domestic product, 75% of the total employment, and 90% of the foreign exchange earnings.

Bangladesh has a total area of 55,000 mi^2 or 35.2 million acres. Administratively, the country is divided into 4 divisions, 19 districts (or 20 for agriculture), 63 subdivisions, 419 thanas (or 420 for agriculture), 4,426 unions, and 64,493 villages. It has an estimated population of 82 million in 1977 with an annual compound growth rate of 2.8% and is the eighth most populated country in the world. Ninety-five percent of the total population lives in rural areas. The farm population is estimated to be 73 million and the number of farm families including landless, is approximately 12 million.

Some 22.5 million acres (64% of the total area) are under cultivation, but irrigation is available on only 2.7 million acres. The potential for development of new arable land is limited, less than 740,000 acres. One-third of the cultivated land is affected by flood each year.

With the average cropping intensity of 1.35 crops/year, approximately 30 million acres are cropped annually.[2] In 1977, rice was grown on 80% of the annually cropped acreage, jute on 5.3%, wheat on 1.2%, sugarcane on 1.2%, and other crops on 12.3%. Other crops included tea, cotton, pulse, tobacco, oil seeds, potato, sweet potato, spices, and vegetables.

The average farm size is 3.5 acres. Farms are heavily fragmented, with one-third of them divided into ten plots or more. About half of the farms are cultivated by owners and half by tenant farmers and hired farm labor. Most owner-cultivators are small subsistence farmers. The majority of tenant farmers are sharecroppers, although some lease the land with a fixed rental at the beginning of each crop season. Most of the sharecroppers pay for all agricultural inputs, assume all investment risks, and share the harvest with the landowner on a 50-50 or 60-40 basis. Quite often, tenant farmers lease the land on a season-to-season basis, and there is no guarantee that they can lease the same land the next season. Experience suggests that such tenurial arrangements do not encourage farmers to use high fertilizer application rates.

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2. The average cropping intensity is defined as the ratio of cropped acres to cultivated acres in a year.

Rice accounts for 75%-90% of the total food grains consumed in Bangladesh. There are three crop seasons in a calendar year--Aus, Aman, and Boro (figure 1). Generally, the Aus season is from mid-March to August, the Aman season from June to December, and the Boro season from October to May. The start and duration of a season, however, depends on the rice planting method used and on the start of the monsoon. There are three rice plantings for the Aus season--local, broadcast HYV (high-yielding varieties), and transplanted HYV. There are two plantings for the Boro dry season--transplanted local and transplanted HYV. The Aus and Aman rice are rainfed, except for some irrigated transplanted Aman HYV. The Boro plantings are all irrigated. As a percentage of the total rice cropped acreage, Aus local accounts for 28%, Aus HYV for 4%, Aman local for 52%, Aman HYV for 6%, Boro local for 4%, and Boro HYV for 6%.

At present, the Government of Bangladesh purchases rice as well as wheat from farmers at the same incentive price--TK 80/maund ($143/mt), with 13% or less moisture and 15% or less impurities. There is a countrywide network of 1,738 procurement centers, with a total storage capacity of 880,000 mt.

FOOD SELF-SUFFICIENCY

In the 1970's, agricultural production in Bangladesh, particularly food grain production, lagged behind the population increase, requiring food grain imports which have averaged 2.1 million mt/year between 1972 and 1977 and are projected at 1.81 million mt for 1978.

The main objectives for the agricultural sector, as presented by the Ministry of Agriculture in its interim 2-year plan (1979 and 1980), are:

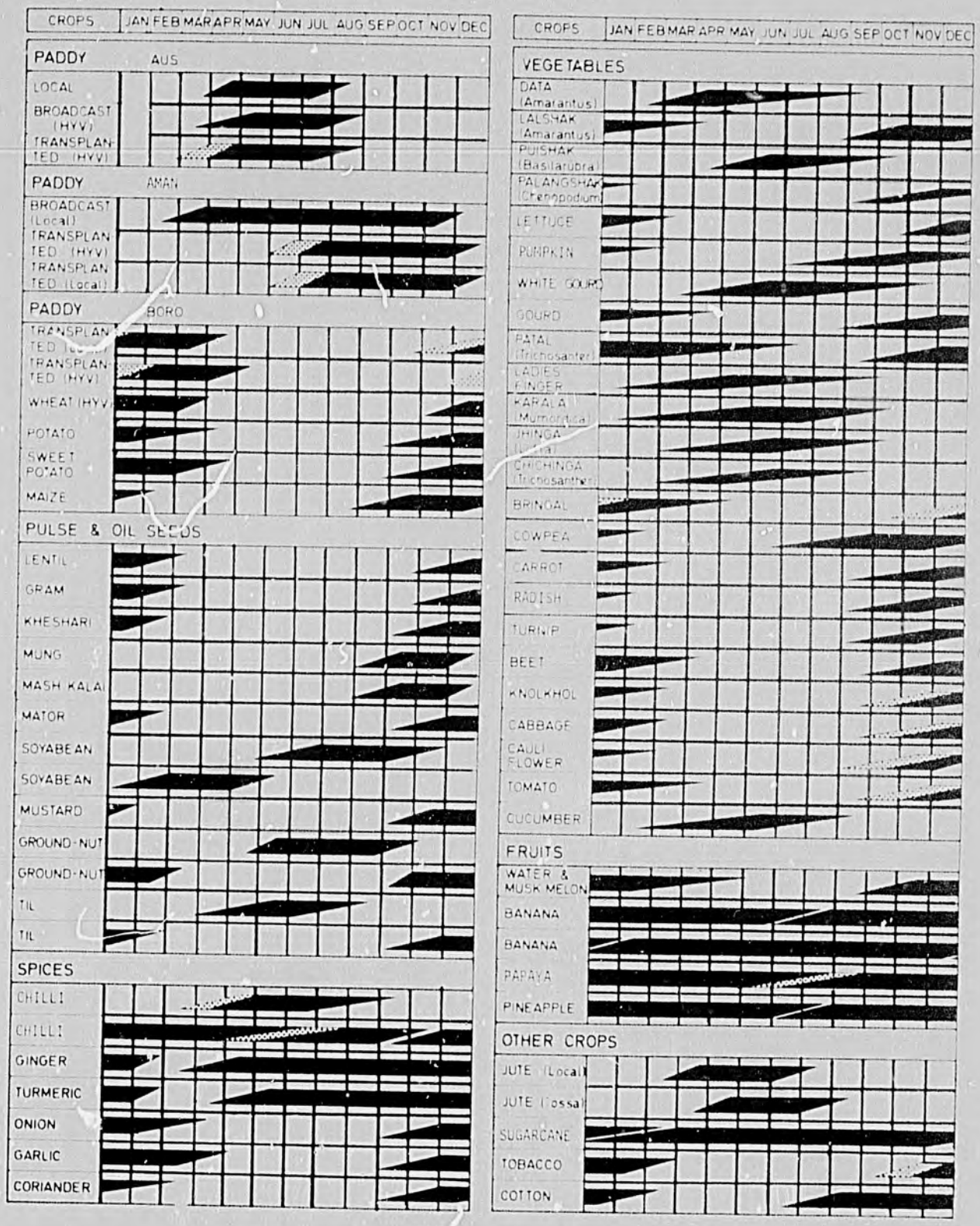
1. To increase food grain production on a sustained basis of 4% so as to achieve self-sufficiency by 1986;

2. To provide balanced nutrition to the entire population as soon as possible;

3. To increase the total area under HYV rice from targeted 4.2 million acres in 1978 to 5.2 million acres in 1980;

Figure 1. CROP CALENDAR OF BANGLADESH

Existing Cropping Seasons



Source: USAID/Dacca

4. To increase production of those agricultural commodities that provide the raw materials needed to meet the demand created by expanding domestic industries and export markets;

5. To ensure the rapid development of research on rice, jute, tea, and sugarcane so that per-acre yields can be increased substantially;

6. To generate rural employment to the maximum possible extent through continuation of labor-intensive production technology and to spread the benefits of agricultural development as widely as possible.

Some economists at USAID/Dacca have estimated that a compound increase in food grain production of 4%/year is needed to reach food self-sufficiency by 1986. A plan to reach this self-sufficiency has been proposed and, to some extent, is being implemented. This plan includes family planning and increase of food grain production through expanded use of high-yielding varieties and related technology

Population in 1986 has been projected at 103.8 million, based on an annual increase of 2.53%. For this projected population, a daily food grain requirement of 15.5 ounces per capita, plus a 10% allowance for seed, feed, and wastage, would require a total food grain production in 1986 of 18.2 million mt--an increase of 6.4 million mt from 1977. To meet this increase, fertilizer use, as estimated by a fertilizer requirement model prepared by USAID/Dacca, would have to be increased from 470,000 mt of product in 1977 to 1,123,000 mt in 1986.

FERTILIZER SECTOR OVERVIEW

Fertilizer use in Bangladesh has increased markedly since its first introduction in 1952, with some 3,000 mt of AS and reached 470,000 mt of all materials in 1977. However, in spite of this increase in fertilizer use, and the report that nearly all farmers have tried fertilizer at one time or another, fertilizer use averaged 21.2 nutrient lb/acre of cultivated land, one of the lowest in the world.

Urea, TSP, and MP are the three principal fertilizers used. These fertilizers together supply 99% of the annual chemical fertilizer plant nutrients used in Bangladesh; urea accounts for 69%, TSP for 25%, and MP for 5%. Total fertilizer use on all

crops, including food grains, in 1977 was 231,019 mt of nutrients (160,607 mt of N; 57,198 mt of P_2O_5; and 13,223 mt of K_2O).

Urea, AS, and powdered TSP are produced in Bangladesh by BCIC, a government corporation under the Ministry of Industries. The locations of fertilizer plants and gas fields are shown in figure 2. The urea plants are at Fenchuganj and Ghorasal. The Fenchuganj urea plant has a design capacity of 107,000 mt/year, and the Ghorasal urea plant has a capacity of 335,000 mt/year. A small AS plant at Fenchuganj has a design capacity of 11,000 mt/year. There are two separate TSP plants at the same complex in Chittagong; the No. 1 plant has a design capacity of 32,000 mt/year and the No. 2 plant, 120,000 mt/year. A urea plant with a design capacity of 520,000 mt/year is being built at Ashuganj and is expected to go into production in December 1981.

For feedstock, the TSP plants rely on imported phosphate rock and sulfur. The urea plants operate on local natural gas to produce ammonia. As of February 1978, the total proven gas reserve in Bangladesh was estimated at 9 trillion ft^3.

In 1977, urea production in Bangladesh reached 64% of the existing total design capacity and TSP production reached 30%. The domestic production of urea and TSP has not met the domestic needs. Since 1975, about 30% of the urea and 25% of the TSP used have been imported each year. All the MP (coarse grade) is imported. Most of the imported fertilizer has been procured under several foreign-aid grants and low-interest credit arrangements. The United States has been the largest supplier and has provided about 40% of the total imports. Other suppliers include West Germany, Sweden, Canada, Norway, Denmark, Holland, and, most recently, Saudi Arabia.

Except for AS, fertilizers are procured, marketed, and distributed by BADC, a government corporation under the Ministry of Agriculture. AS is marketed directly by BCIC to tea growers. BADC and the Thana Central Cooperative Associations (TCCAs) act as fertilizer wholesalers at the thana level, with BADC the major wholesaler. TCCAs are the cooperative groups sponsored by the Ministry of Local Government, Rural Development and Cooperatives (LGRD & Co-Op). Retail selling is carried out by private sector and TCCA fertilizer dealers.

There are now 35,425 authorized and 18,800 active retail dealers in the country. They receive their commission in the form of a discount from the government's official retail fertilizer prices. This discount averages around 8% of the official prices.

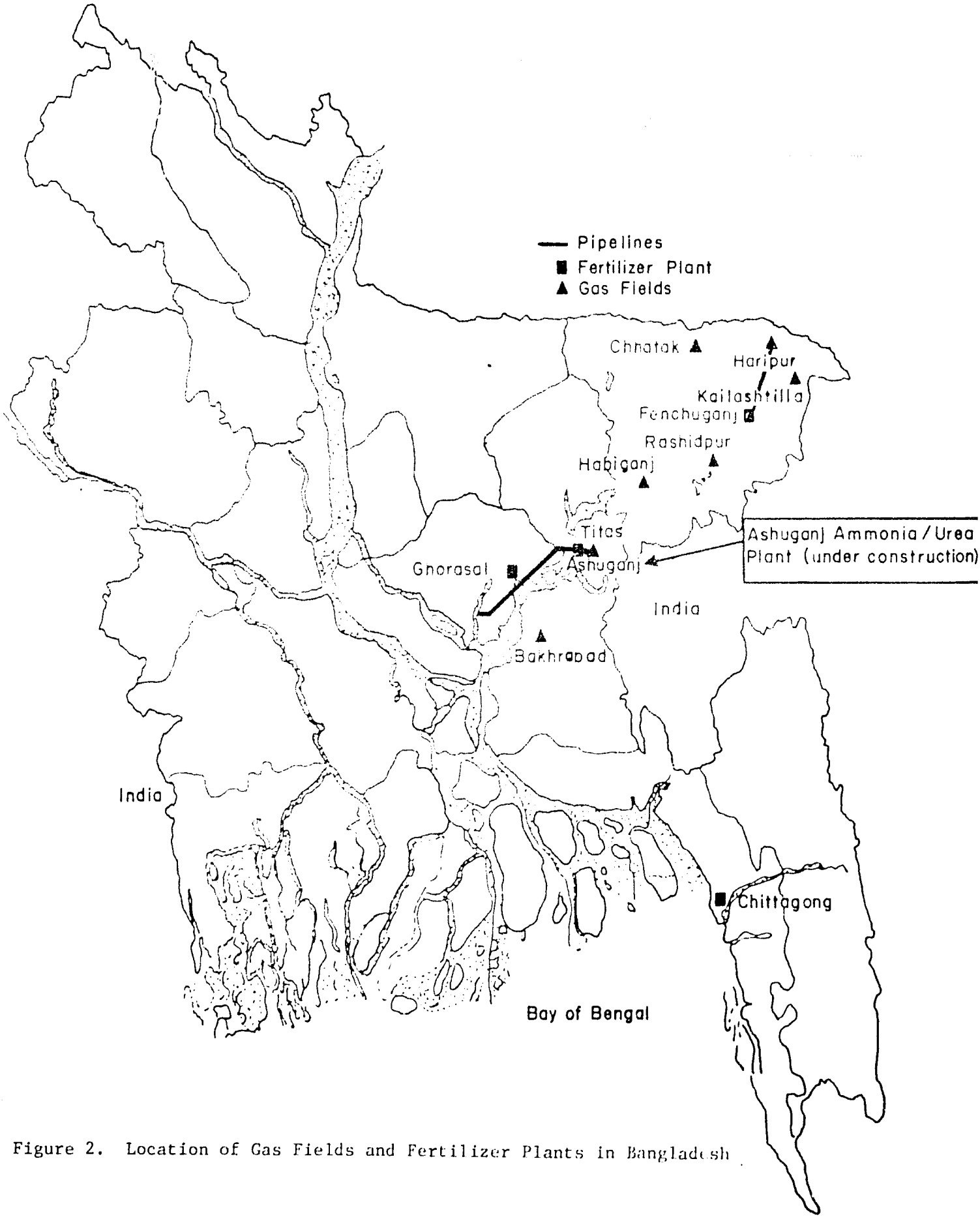


Figure 2. Location of Gas Fields and Fertilizer Plants in Bangladesh

The present official prices are TK 60/maund ($108.87/mt) for urea; TK 48/maund ($87.10/mt) for TSP; and TK 40/maund ($72.67/mt) for MP.

The fertilizer sector is subsidized directly and indirectly by the Government of Bangladesh. To cover all the costs of fertilizer production, importation, and in-country distribution and to eliminate direct government subsidies, retail selling prices would have to be increased by an average of 137% over the current official prices.

Most of the fertilizers are moved from production plants and ports of importation (Chittagong and Chalna) to farmers through several levels of warehousing--transit, district, thana, and dealer stores, but some fertilizers are shipped directly from factories or ports to district warehouses (figure 3). As of February 1978, BADC operated 3 transit warehouses, 54 district warehouses, 433 of 523 thana warehouses, and a bagged storage warehouse at the Port of Chittagong. TCCAs managed 90 thana warehouses. In addition, each fertilizer factory has its own storage facilities.

BADC is responsible for requesting transport equipment and monitoring transport of fertilizer through the distribution system from sources to thana warehouses. The transport coordination commi tee, a high-level government committee, allocates transport equipment of other government organizations and privately owned barges and coasters to BADC.

Fertilizers are moved from ports and production sites to BADC warehouses by railcars, barges, coasters, and trucks. TCCAs and retail dealers haul fertilizers from BADC district and thana warehouses to their sales outlets by bullock carts, small country boats, or trucks. The use of trucks is increasingly important in transporting fertilizers to TCCAs and retail dealers who are located on a good road and at greater distances from thana warehouses.

Agricultural extension services are provided by several agencies within the Ministry of Agriculture and by five other ministries--Industries; Commerce; Flood Control, Water Development, and Power; Forestries, Fisheries, and Livestock; and Local Government, Rural Development, and Cooperatives. Additional support of extension services is provided through international assistance and by 19 voluntary organizations, each with its own extension services. Agricultural research in Bangladesh is carried out within eight ministries.

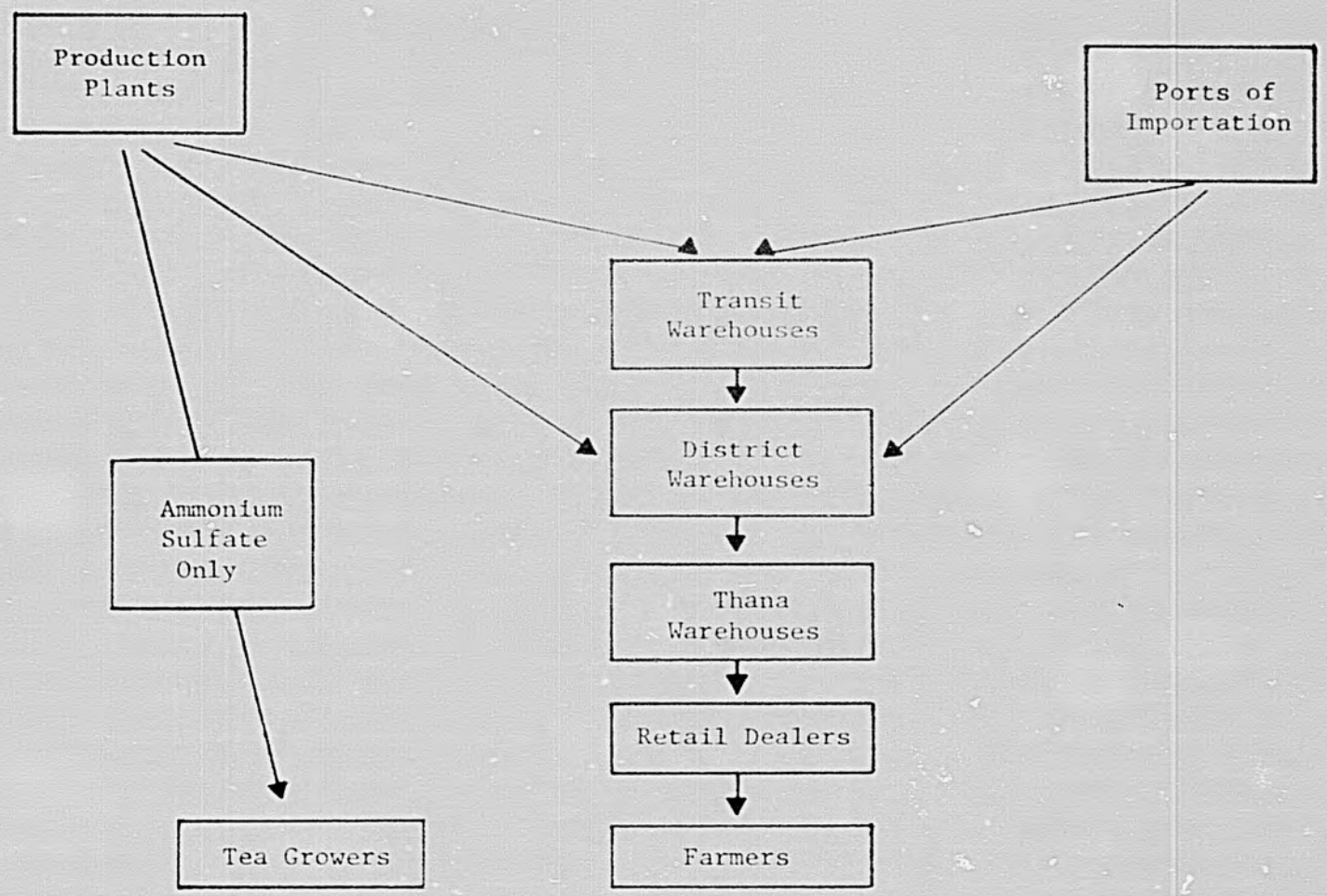


Figure 3. Current Physical Movement of Fertilizer in Bangladesh

In addition to international agencies, there are many Bangladesh organizations involved in the fertilizer sector. These organizations and their interrelationships are shown in figure 4. Some of the more important organizations are:

1. Economic Resources Division (Ministry of Planning)--Coordinates foreign assistance (loans, grants, technical assistance) and makes contractual agreements.

2. Planning Commission (Ministry of Planning)--Consists of four commissioners--water, infrastructure and power, general economics, and agricultural and rural development. The last of these is concerned with planning of national policy and with coordination of agricultural products and inputs, including fertilizer. The commissioners work closely with the Economic Resources Division and with other ministries of the government.

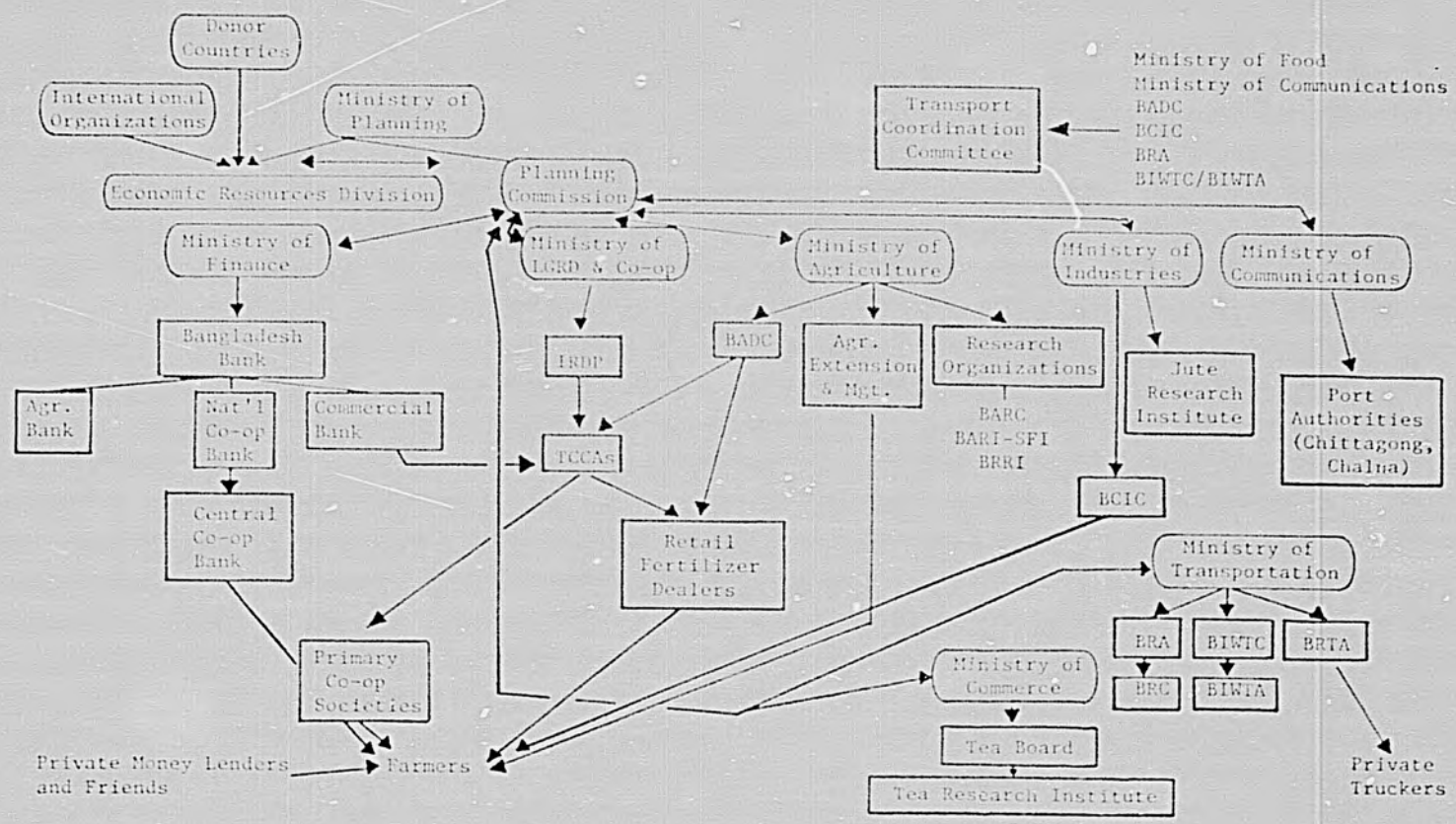
3. Ministry of Finance--The Ministry of Finance through its banking network--commercial, agricultural, and national cooperative banks--provides institutional credit to farmers under several programs.

4. Integrated Rural Development Program (IRDP)--Under the Ministry of Local Government, Rural Development, and Cooperatives, IRDP is responsible for rural development and field extension work directed principally through TCCAs which it sponsors.

5. Thana Central Cooperative Association (TCCA)--A thana-level organization group which functions as a fertilizer wholesaler and supplier of credit to member farmers at the thana level. TCCA also operates and maintains some of the thana-level fertilizer warehouses.

6. Bangladesh Agricultural Development Corporation (BADC)--As the largest organizational unit within the Ministry of Agriculture, BADC accounts for 70% of the annual ministry budget and is responsible for supplying all agricultural inputs. It is responsible for procuring (from domestic and import sources), marketing, storing, and distributing fertilizers (except for AS) down to the thana level. BADC also serves as the major fertilizer wholesaler at the thana level and maintains all transit warehouses, district warehouses, and most of the thana warehouses.

7. Directorate of Agriculture Extension and Management (DEM)--One of the largest agencies in the Ministry of Agriculture,



Legend-

BADC - Bangladesh Agricultural Development Corporation
BCIC - Bangladesh Chemical Industries Corporation
IRDP - Integrated Rural Development Program
TCCAs - Thana Central Cooperative Associations
BRA - Bangladesh Railway Authority
BRC - Bangladesh Railway Corporation
BIWTA - Bangladesh Inland Water Transport Authority
BRTA - Bangladesh Road Transport Authority
BARC - Bangladesh Agricultural Research Council
BARI - Bangladesh Agricultural Research Institute
BRRI - Bangladesh Rice Research Institute
SFI - Soil Fertility Institute
BIWTC - Bangladesh Inland Water Transport Corporation

Figure 4. Fertilizer-Related Organizations and their Interrelationships

DEM is responsible for agricultural extension and development and promotion of fertilizer use.

8. Bangladesh Chemical Industries Corporation (BCIC)--Under the Ministry of Industries, BCIC is responsible for domestic fertilizer manufacture. It markets and distributes ammonium sulfate directly to the tea industry. Besides fertilizer, BCIC manufactures pulp and paper, rayon, yarn, soap, silicate, caustic/chlorine, bleach, DDT, safety matches, chipboard, hardboard, and cellophane paper.

9. Bangladesh Railway Authority (BRA)--Under the Ministry of Transportation, BRA is responsible for regulating the operations of the government-owned Bangladesh Railway Corporation (BRC).

10. Bangladesh Railway Corporation (BRC)--The government agency responsible for the acquisition, operation, and maintenance of railcars and railroads for fertilizer and other commodities.

11. Bangladesh Inland Water Transport Authority (BIWTA)--This agency regulates the operations of the government-owned Bangladesh Inland Water Transport Corporation (BIWTC). BIWTA also regulates the movements of privately owned barges and coasters.

12. Bangladesh Road Transport Authority (BRTA)--This agency regulates the operations of the privately owned truck and automobile fleets for transport of fertilizer and other goods.

13. Transport Coordination Committee--A high-level government committee made up of representatives from BRA, BIWTA, BIWTC, BCIC, BADC, Ministry of Food, and Ministry of Communications. The Committee meets weekly to allocate the small number of available railcars, barges, and coasters among competing users such as food, fertilizer, and other commodities.

FERTILIZER PRODUCTION

Production at the Bangladesh fertilizer plants has been low and erratic, and this contributes to the difficulties of planning fertilizer supply. Design capacities, production, and operating rates of the fertilizer plants for 1977 are shown below:

Plant	Product	Design Capacity (mt/yr)	1977 Production (mt/yr)	1977 Operating Rate as % of Design Capacity
Fenchuganj	Urea	107,000	77,000	72%
	AS	11,000	9,000	82%
Ghorasal	Urea	335,000	208,000	62%
Ashuganj	Urea	520,000	-	U.C.
Chittagong				
No. 1	TSP	32,000	-	0%
No. 2	TSP	120,000	46,000	38%

U.C.--Under construction.

Fenchuganj began to produce urea in December 1961 and AS in September 1969 and the Ghorasal urea plant started up in July 1970. Production at the Fenchuganj urea plant fell to just over 50% of design capacity immediately after the Liberation War (1971). This plant is now operating at approximately 37% of design capacity. The plant was damaged during the war and has since suffered from poor maintenance. Aside from the usual problems of corrosion, instrument malfunctions, and lack of spare parts, as of February 1978 both the Fenchuganj and Ghorasal plants had dehumidifier problems in bulk fertilizer storage and difficulty in replacing the dehumidifier units. The Government of Bangladesh is now taking steps to replace these units. In addition, the Fenchuganj plant has had problems with both the underground-belt conveyor and the front-end loaders from bulk storage to the bagging operation.

In September 1976, BCIC negotiated with a Japanese firm for an overhaul of the Fenchuganj plant. This overhaul is scheduled for November 1978 and the plant is expected to be shut down for 6 months. After the overhaul, the plant is expected to be running at 80%-85% of design capacity for the next 5 years. Although the AS plant at Fenchuganj is badly corroded, it is not included in the negotiated overhaul.

The Ghorasal urea plant was shut down during the Liberation War. It was restarted in 1973, but it was shut down again for most of 1975 for major repair after a serious explosion in the control room. The plant suffers from a number of deficiencies that limit its operating rate to 70%-75% of design capacity. The current operating rate is approximately 35%.

The plant was shut down four times in the period October 1977 through January 1978. One source of trouble is poor process

control in the ammonia/urea unit because of insufficiency and malfunctioning of the instrumentation. Another source is the ineffective steam and water-level control in the ammonia unit which now has to be operated manually. Another source is the transporting of a small necessary amount of sulfuric acid from the TSP plant complex to the Ghorasal plant for the battery-operated power station serving the plant.

Another problem has emerged that will only compound the problems at both Fenchuganj and Ghorasal. Many engineers and operating personnel well experienced in plant operation have left or are leaving BCIC for employment in the Middle East.

The No. 1 TSP plant in Chittagong was completed in 1968 and started up in 1969. The No. 2 TSP plant was completed in 1970, but its startup was delayed until September 1974 because of the Liberation War. Each plant has its own sulfuric acid, phosphoric acid, and bagging units.

The No. 1 TSP plant has not been operated at capacity since its initial startup. The wrong kind of phosphate rock was used initially which resulted in considerable corrosion of agitators and pumps during the first few weeks of operation and necessitated shutdown of the plant. A legal dispute with equipment suppliers on their contractual liability forced the plant's closure until April 1977, and the plant has since been operated only intermittently. Intermittent operation has caused deterioration in the sulfuric acid unit, acid towers, and ducting. The plant was shut down again in October 1977, and it has remained closed since then.

In its first 3 years of operation (September 1974 to September 1977), the No. 2 TSP plant lost 657 days of production. Problems encountered included shortage of raw materials (sulfur, phosphate rock), electrical and mechanical equipment breakdowns and failures, lack of spare parts, disruption of electric power supply, and lack of fresh water having a satisfactory quality.

The production of the No. 1 and No. 2 TSP plants for the period September 1974 to September 1977 averaged 36,867 mt/year, about 24% of the total designed capacity. The current average operating rate of these two plants is approximately 16%. The complex will continue to face some problems that will affect plant performance. The first of these problems is that of power supply. From July 1974 to July 1977 there were 339 power failures, and from July to December 1977, there were 25 power failures. These failures were beyond the control of BCIC and TSP plant personnel. To eliminate this problem, the Asian Development Bank is financing

the installation of more power substations in the complex area, but the installation is expected to require 4 years for completion. Installation of two diesel power generators as an emergency power supply to keep certain vital plant units (such as agitators in the phosphoric acid reaction vessels) in operation has been considered. However, natural gas is not readily available for a gas-turbine generator, and a complete diesel installation is prohibitively expensive.

The second problem is that of a supply of fresh water for the sulfuric acid units and waste heat boilers. The fresh water required by the plants has come from local wells. When the plants were built, the water from these wells had an acceptable water salinity of 100 ppm chloride content, but the water quality has since deteriorated to as much as 1,400 ppm chloride. Water of unacceptably high salinity found its way into the distribution system and was fed to the economizers and boilers in the sulfuric acid units, thereby increasing equipment corrosion. Lack of availability of an acceptable water supply lowered the plant output to 50% of design capacity in December 1977. Solutions to this problem are being sought but no permanent feasible solution has been found.

All steam requirements are supplied by waste heat boilers in the sulfuric acid units. When sulfuric acid production is interrupted, the steam production stops and the phosphoric acid cannot be concentrated efficiently.

The dust at the TSP complex presents a problem. There are no dust collection systems and the dust corrodes bagging and rail equipment, rots jute bags, and may even affect workers' performance.

In late 1977 a British team under the sponsorship of the British High Commission-Dacca and the Ministry of Overseas Development looked into the possibility of installing a TSP granulation unit with a design capacity of 150,000-160,000 mt/year, but installation of such a facility has not yet been recommended.

Under the USAID funding, a consultant will make a detailed study for the Government of Bangladesh to determine the best use of the TSP facilities, taking into account the results of the studies by the British team and others.

The Ashuganj ammonia/urea project has not progressed as fast as was anticipated. The site has foundation problems and compaction of the site was underway in February 1978. The project

is beset by nontechnical problems also, such as too many financiers and technical advisors, and this has created problems in plant design, choice of equipment, and project scheduling.

FERTILIZER USE

The rate of growth of fertilizer use has varied widely from year to year, as shown in figure 5, especially since the Liberation War. The rate of growth was +57.5% for 1973, -2.9% for 1974, -27.6% for 1975. +64.6% for 1976, and +5.9% for 1977. Based on the most recent information, it now appears that the 1978 rate of growth will exceed 35%.

Approximately 81% of the total fertilizer is used on rice each year, and the rest is used on the other crops--wheat, jute, sugar, potato, sweet potato, gram and pulse, vegetables, spices, tea, oil seeds, and tobacco. Of the total fertilizer used on rice, Aus local takes 25%, Aus HYV 7%, Aman local 45%, Aman HYV 10%, Boro local 3%, and Boro HYV 10%.

There are three peaks for use of urea and TSP in the year. For urea the peaks are February-March, June, and September-October. For TSP, the peaks are January-February, July-August, and October-November. There is no obvious seasonal pattern for use of MP.

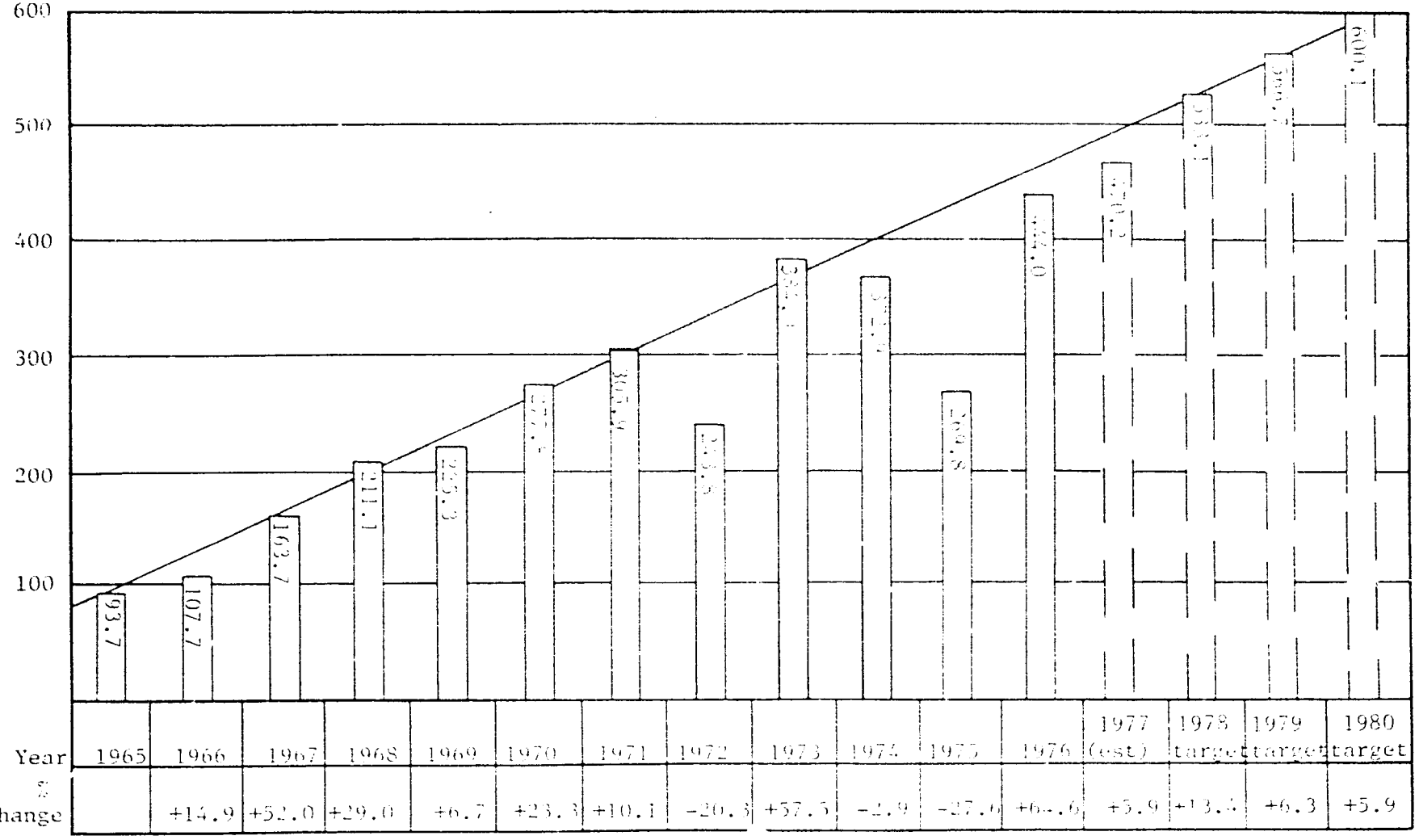
Geographically, the amount and rate of fertilizer application vary from district to district. Out of 20 agricultural districts in the country, Comilla, Dacca, and Chittagong are the three largest and most intensive users of fertilizer. This regional variation generally reflects the differences among districts in cropping patterns, in-country delivery of fertilizer, unwillingness of fertilizer retail dealers to serve remote areas, and inadequate incentives for farmers to use fertilizer.

For 1977, the average fertilizer application was only 21.2 lb of nutrient per cultivated acre.

Aside from geographic and climatic factors, there are some major limitations affecting fertilizer use. These are:

1. Erratic availability of fertilizer at the right time at the local level, because of the erratic and uncertain supply of fertilizer from domestic production and import between and within years; inadequate advanced transport and inventory

Figure 5. Total (Urea, TSP & MP) Fertilizer Offtake in Bangladesh, Fiscal Years, 1965-80



Source: USAID Agricultural Inputs Project III, January 1977.

planning; and lack of dealer incentives to vigorously promote fertilizer sales and provide service to farmers in more remote areas.

2. Low incentives for farmers to use fertilizer because of inability to sell crops at the official government price, and to buy needed fertilizers at the official retail prices, inaccessibility to low-cost institutional credit, and the land tenure system.

3. Lack of enough extension officers at the thana level to advise farmers on fertilizer use, and lack of location-specific fertilizer application research in the country, although FAO/UNDP and FAO/NORAD do considerable extension work with the small manpower resources available.

Food grain imports from the United States (under P.L. 480, Title III) and other countries and sale of these imports at a subsidized price have tended to depress the market price for domestically produced cereals.

Although institutional credit is available under various programs, only 5%-10% of the farmers have had access to it. For various reasons, including the general requirement of posting land as collateral, the low-cost institutional credit (10%-17%/year) has gone almost exclusively to a relatively small number of large landowners. The majority of farmers (small subsistence landholders and sharecroppers) borrow money from friends, relatives, and private lenders at a 40%-50% rate of interest per crop season or an approximate effective annual interest rate of 100%.

This high credit cost, coupled with lack of storage capacity and cash resources to meet pressing obligations, often forces farmers to sell produce at harvest when prices are low. Even though farmers are required to sell certain crops (particularly rice) to the government procurement centers at the announced higher government price, there are not enough government procurement centers conveniently located around the country and, accordingly, farmers are often willing to sell produce to local grain dealers for less. When farmers do decide to sell their produce to a procurement center, they often have to transport the produce over a considerable distance. Moreover, as farmers have difficulties in drying their produce, the total weight of the produce delivered to a government procurement center has often been discounted because of its moisture content. This discounting is often arbitrary and inconsistent. The government does not pay cash for the produce but issues chits which the farmer must take to a local bank to exchange for cash.

Few farmers purchase fertilizer at the official retail price set by the government. Most farmers must buy fertilizer from retail dealers at prices and terms set by the dealer. This situation is most acute when the national or local fertilizer is in short supply as in 1972, 1975, and since October 1977. In a severe shortage, as in 1975, farmers had to pay three or four times the official retail price. In the current tight supply situation, farmers reportedly pay 50%-100% over the official price.

FERTILIZER SUPPLY/DEMAND BALANCE

Current Balance

A fertilizer supply shortage is one of the major current problems of Bangladesh agriculture. This shortage has resulted from a lack of overall planning and coordination among the several organizations involved in the fertilizer sector, slippage in scheduled imports, demand by farmers greater than had been anticipated, and low levels of production of domestic plants. Competition among farmers for the available supply has raised reported actual market prices 50%-100% above the official retail prices.

The fertilizer offtakes from BADC warehouses for 1965-76 and BADC targets through 1980 are shown in figure 5. The offtake targets for urea, TSP, and MP for 1978 aggregate 533,100 mt; the actual offtake for the first 6 months was 387,453 mt or 72% of target. This marked increase in demand has been brought about by a combination of factors--good weather last year that produced a bumper Aman rice harvest, a major increase in the official rice prices, and 240,000 fertilizer mini-kit demonstrations by DEM during the Aman season.

Total inventories in BADC warehouses dropped from 198,766 mt in July 1977 to 111,665 mt in January 1978. The largest drop was in TSP (table 1).

Table 1. Stock Level of Urea, Triple Superphosphate, and Muriate of Potash (Metric ton, July 1977 through January 1978)

	Urea	TSP	MP	Total
July 31, 1977	70,915	111,567	16,284	198,766
September 30, 1977	53,331	95,350	18,911	167,592
October 31, 1977	47,826	80,648	16,794	145,268
November 30, 1977	40,896	61,063	12,777	114,736
January 31, 1978	61,157	37,834	12,674	111,665

Source: BADC and compiled by USAID/Dacca.

Projected Supply/Demand Balance

Domestic urea production is expected to increase from 310,000 mt in 1978 to 803,000 mt in 1986. A major increase is expected when the Ashuganj plant comes on stream, and this plant should be the single largest domestic supplier of nitrogen fertilizer. If the present plants at Fenchuganj and Ghorasal can also be operated at 80%-85% of design capacity by 1982, Bangladesh would then have capacity not only for domestic requirements but also for export in 1982-85.

Based on possible alterations and installation of granulation equipment under British assistance in July to December 1979, the TSP production at the Chittagong complex is projected to nearly double from 46,000 mt in 1978 to 85,000 mt in 1981 and to continue at that level through 1986. In spite of this projected sharp increase, however, domestic production of TSP will not meet the country's total phosphate requirement.

Projected consumption and production of urea, TSP, and MP from 1978 through 1986 are shown in figures 6 and 7. Projected consumption in figure 6 is based on the medium annual growth rates (case 1) assumed by the Economic Intelligence Unit (EIU) and projected consumption in figure 7 is based on the high growth rates (case 2).[3] Production projections are made by the IFDC team, based on the conditions stated in the Fertilizer Production section of this report.

3. The Economic Intelligence Unit, Ltd. 1977. Bangladesh Fertilizer Marketing and Distribution Study, Interim Report.

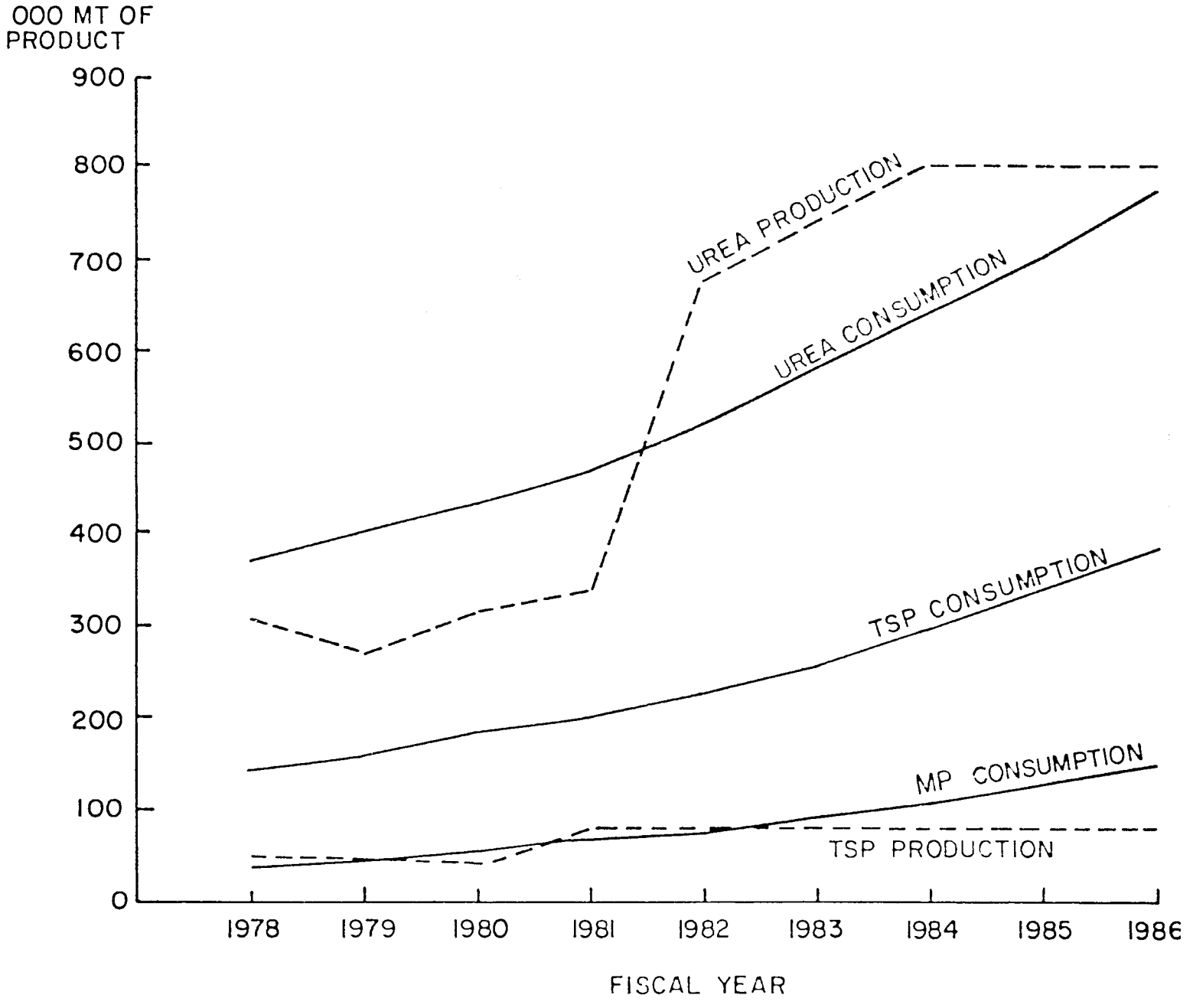


Figure 6. Projected Consumption and Production of Urea, Triple Superphosphate (TSP), and Muriate of Potash (MP) Under the EIU Medium Annual Consumption Growth Rates, Fiscal Years 1978-86.

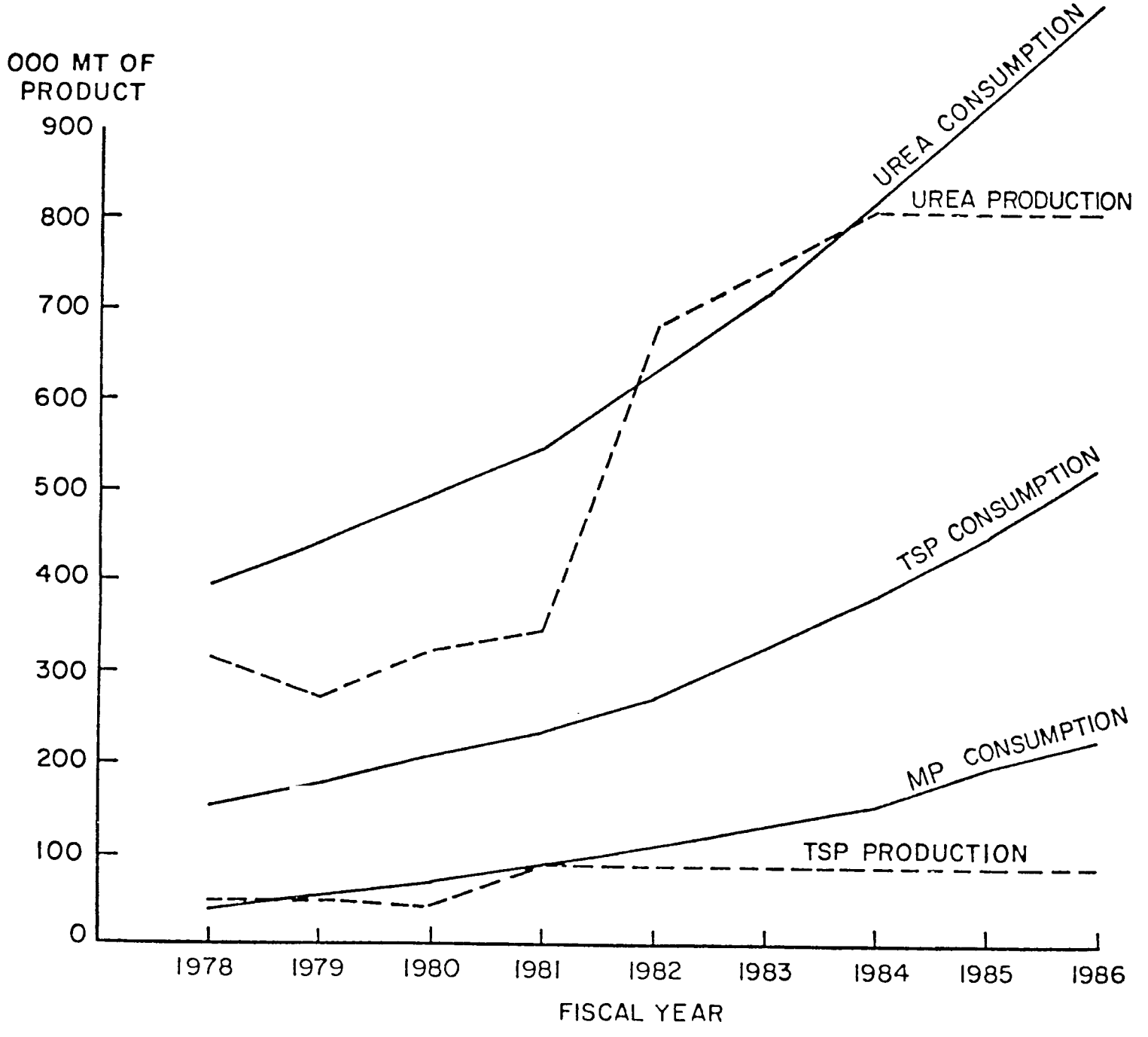


Figure 7. Projected Consumption and Production of Urea, Triple Superphosphate (TSP), and Muriate of Potash (MP) Under the EIU High Annual Consumption Growth Rates, Fiscal Years 1978-86

In case 1, EIU assumes the annual average growth rate to be 8%-10% for urea, 13% for TSP, and 15%-20% for MP from 1977 to 1986. In case 2, it assumes growth rates of 12%-13% for urea, 16%-17% for TSP, and 15%-25% for MP. Case 2 represents the most optimistic outlook, but case 1 appears to be more realistic, since it assumes more moderate rates at which fertilizer demand might be increased so that food grain production could rise to domestic self-sufficiency by 1986.

In both cases, consumption of urea is assumed to grow at a slower rate than that of TSP and MP, but this assumption seems to be questionable. In the past, consumption of TSP and MP in Bangladesh has been growing slower than that of urea.

To satisfy domestic consumption and meet the current considered goal of maintaining a 6-month buffer stock all year, Bangladesh would need to import urea from 1978 to 1981 and in 1986 under case 1 and, under case 2, from 1978 to 1981 and from 1983 to 1986. It is also expected that Bangladesh would import TSP or diammonium phosphate (DAP, 18-46-0) continually through 1986 under both cases. All MP is expected to be imported.

For case 1, total combined imports of urea, TSP, and MP are expected to peak in 1981 at 362,000 mt, with an estimated cost of approximately $55 million, cost and freight (C&F) and drop in 1982. Imports are expected to reach 348,000 mt in 1984 and grow to 500,000 mt in 1986, with an estimated import cost of approximately $95 million C&F. For case 2, total combined imports are also expected to peak in 1981 at 527,000 mt with a cost of approximately $82 million C&F. Total imports are expected to reach 417,000 mt in 1983 and grow to 1,070,000 mt in 1986 with an imported C&F of around $193 million.

The projections of supply and demand point out the critical nature of planning and coordination needed between the Government of Bangladesh, BCIC for domestic supply, donor countries for imports, and BADC. This is essential if supply shortages are to be prevented, for these shortages would decrease food production and prevent small farmers from obtaining needed fertilizer.

The 6-Month Buffer Stock

The goal of maintaining a 6-month buffer stock would become unworkable by 1982. Total inventories would then reach 417,000 mt under case 1 or 508,000 mt under case 2 while projected total

consumption of urea, TSP, and MP is 834,000 mt in case 1 and 1,015,000 mt in case 2. In either event, warehouse construction cost, value of inventory, and interest charges would become a serious financial burden on BADC, the Government of Bangladesh, and the donor countries.

It is suggested that BADC retreat from the 6-month buffer stock goal after 1982 to a 40% or even lower level of buffer stock. A retreat to 40% buffer stock would reduce inventory by 200,000 mt in 1986 if the expected case 2 growth is realized. This would imply a drop of approximately $40 million in inventory value and a decrease of about $47 million in capital required for construction of warehouses.

The inventory policy needs to be well planned on the basis of projections of consumption and seasonal demand and balanced against improvements in coordination between importation, domestic production, distribution, and warehousing.

RETAIL FERTILIZER DEALERS

The retail sale of fertilizers since 1966 has been handled by dealers appointed by BADC. Except for 1975 and 1976, the number of dealers has increased every year. There are 35,425 authorized dealers of which 18,800 are reported to be active.

Each dealer purchases fertilizer from a local thana-level warehouse 25 miles from his store. For hauls no longer than 6 miles the fertilizer is moved by bullock cart or country boat, and for longer hauls use of trucks increases.

Most fertilizer retail dealers are small village-level businessmen who sell, in addition to fertilizer, a wide range of products (such as sugar, drugs, paper, stationery, timber, pots and pans, and groceries). For many dealers, fertilizer is only a seasonal business. There are some dealers whose principal activity is farming, but they sell fertilizer as a secondary and supplementary source of income. A fertilizer dealer also has the advantage of purchasing his own fertilizer at discounted prices.

Fertilizer dealers receive a commission from BADC in the form of a discount from the official retail prices the government sets for different fertilizers. This discount is now based on a 4-tier distance system. The dealer receives a discount of TK 3.5/maund

(US .63¢/kg) if his store is within 3 miles of the thana warehouse, TK 4/maund (US .72¢/kg) if 3-6 miles away, TK 4.5/maund (US .81¢/kg) if 6-9 miles away, and TK 5/maund (US .89¢/kg) if more than 9 miles away. This commission (or gross margin) is about 8% of the weighted average official retail price, TK 1,525/mt, and is supposed to cover costs of transportation, warehousing and overhead, product losses, and profit. Transportation costs alone consume most of the commission, however, and so leave little incentive for dealers when sales are made to farmers at the official retail prices.

The average active dealer sold about 25 mt (670 maunds) of fertilizer in 1976. At the current official retail prices and the 1976 national sales mix of 70% urea, 25% TSP, and 5% MP, the fertilizer dealer averaged an earned gross margin of about TK 3,000 ($200), a net profit of TK 500-600 ($33-$40), and a return on sales of about 1.5% a year from his fertilizer sales before the cost of fixed and working capital was deducted.

According to dealers visited by the IFDC team, the commission a dealer receives barely covers transportation and other operating expenses. This is particularly true during a rainy season when transportation is difficult and for those dealers located at some distance from thana warehouses. Most dealers purchase a very small amount of fertilizer at a time. During the slow season, some dealers cease trading in fertilizer altogether. When dealers purchase fertilizer, they usually use their own available cash and seldom borrow additional money to purchase a larger amount of fertilizer.

Dealers have very limited storage facilities. Many dealers operate out of their own homes in which they stock fertilizer to the extent of the available space. Even if a dealer has storage space, however, he seldom stores a reserve supply of fertilizer. Dealers situated within 5 miles of the border with India are now rationed the amounts of fertilizers required to meet local needs to discourage the sale of fertilizer across the border where fertilizer can be sold at a price 50% above the official retail price in Bangladesh. There is no dealer price discount for volume purchases of fertilizer, but some kind of quantity price discount system is being considered.

There are six dealer-related problems for which solutions should be devised and implemented.

The <u>first</u> problem is that there are too many small, nonprofessional, part-time, inefficient fertilizer retailers in the country. On the average, there are 84 authorized dealers in each thana or 8 dealers in each union. The average thana area is

10-15 mi^2 and there are 10-11 unions per thana. A typical dealer serves two villages and 0.66-0.75 mi^2 of the cultivated land. With so many dealers in each thana or union, sales per dealer are quite small. If the current ceiling or legal maximum limit of 9 authorized dealers per union were to be raised to, for example, 15 authorized dealers per union, the problem of an oversupply of inefficient dealers would only be aggravated. An excessive number of dealers makes the annual sales volume per dealer so inadequate as to make it unlikely that the dealer will invest time and resources to handle fertilizer efficiently. Furthermore, continuation of the requirement that all dealers operate only out of their registered store address and limit their sales to farmers located in certain areas of their union compounds the problem, discourages competition, and decreases incentives for the dealers.

The criteria for becoming an authorized dealer needs to be established and inactive dealers should be weeded out. Inactive dealers dilute the attempts of dealer education and assistance programs. They hurt rather than help the development of an effective retail distribution system.

The second problem is that the present dealer commission system is unrealistic. The commission the dealer receives under the present system not only barely covers actual costs, but also tends to favor dealers near the thana warehouses, and discourages fertilizer sales to farmers in remote areas. With inadequate commission and a small annual sales volume, a dealer can hardly be expected to invest his time, energy, and money in fertilizer and improving his operating efficiency. Furthermore, he will be tempted to resort to questionable ways of making his return from fertilizer sales more reasonable. For example, the dealer could decide to sell fertilizer to farmers at a price higher than the official price, on credit with a high interest rate, or in exchange for a particular crop if that crop's price is favorable.

The third problem is that dealers do not always know how much fertilizer will be available or when it might be available to them for each crop season. This uncertainty arises from a number of sources, including inadequate coordination between donor countries; inadequately integrated planning of fertilizer imports, domestic production, marketing, transportation, and inventory control and sales; delayed shipments from import sources; the erratic performance of domestic fertilizer plants; inadequate control of the availability in time and place of the needed transportation equipment; inadequate monitoring and dissemination of information on the fertilizer inventory at various levels of warehousing; lack of fertilizer transfer between thana warehouses; and inconsistency in allocation of fertilizer to dealers in times

of shortage. Since October 1977 fertilizer purchases by dealers have been under allocation. The amount of fertilizer a dealer in a particular union can obtain is changed from week to week and is determined jointly by the union chief and BADC's thana inspector. This gives these officials the power to determine which dealer will be allowed to make a profit.

The fourth problem is the lack of low-interest institutional credit for retail fertilizer dealers. Most dealers have to borrow money from private moneylenders at the rate of 20%-50%/year. Such a rate discourages a dealer from borrowing the necessary capital to finance larger fertilizer purchases or enlarge his own fertilizer storage facilities.

The fifth problem is that dealers have little knowledge about fertilizer and fertilizer application. Most dealers have no formal training in fertilizers or their use; thus, they are not competent to advise farmers about fertilizer use. The Agricultural Extension officers at the thana level seldom give advice to dealers on fertilizer use.

The sixth problem is the difficulty of transporting fertilizer from a thana warehouse to the dealer's store or home. In the flood season country boats cannot be used, and in the rainy season farm roads are usually impassable. Even when the roads are passable, they are so narrow and bumpy that bullock carts or trucks can only move slowly.

Unless these six problems are solved, it will be difficult to make private sector dealers into effective and efficient agents for fertilizer promotion and sale.

FERTILIZER SUBSIDIES

Direct Subsidies

The fertilizer sector is subsidized directly and indirectly. Two organizations that receive direct subsidies are BCIC and BADC who receive funds annually from the Government of Bangladesh to make up for losses that result from the policies that keep fertilizer retail prices low and from operating problems within these two organizations.

In 1976, BCIC sold its urea and powdered TSP to BADC at TK 1,716/mt and TK 4,420/mt, respectively, even though its production costs were reported to be TK 1,912/mt for urea and TK 8,500/mt for TSP. Similarly, BADC sold its procured fertilizer at the official retail prices of TK 1,633/mt for urea, TK 1,307/mt for TSP, and TK 1,000/mt for MP, even though its procurement costs from domestic and imported sources were considerably higher. BADC's imported costs of urea, TSP, and MP in 1976 were estimated to be TK 3,811/mt, TK 2,700/mt, and TK 1,950/mt, respectively. Subsidies by source and product were as follows:

Fertilizer	February 1976 Retail Price per mt in Bags TK	$ US	Total Cost per mt TK	$ US	Subsidy %
Domestic					
Urea	1,633	108.87	2,524	168.27	55
TSP	1,307	87.13	9,112	607.47	597
Imported					
Urea	1,633	108.87	4,423	294.86	171
TSP	1,307	87.13	3,312	220.08	153
MP	1,088	72.53	2,562	170.80	135

Note: See detailed worksheet in appendix B.

On the basis of information from a number of papers and reports, the IFDC team developed an estimate of the total direct subsidies to BADC/BCIC for 1976. Based on product availabilities and other figures shown in appendix B, the weighted average direct subsidy was:

	Weighted Average Product Cost	Weighted Average Selling Price	Weighted Average Direct Subsidy
TK/mt	3,483	1,469	2,014
$ US/mt	232.20	97.93	134.27

This weighted average direct subsidy represented 58% of the total weighted average cost of fertilizer. To cover all costs of BADC

and BCIC, the average retail selling price would have been increased by an average of 137%.

Indirect Subsidies

In addition to direct subsidies, there are a number of indirect subsidies, but these have not been evaluated in the several reports on the fertilizer industry. Some of these indirect subsidies include:

1. Transportation by government-owned railways and in-country water transport at rates below operating and maintenance costs.

2. Retail fertilizer credit programs that have very poor repayment records, some as high as 60% defaults.

3. Fertilizer mini-kits and other promotional programs provided by the Ministry of Agriculture.

4. Interest-free funds supplied to BADC--such as donor-imported fertilizer and a large interest-free account with BCIC.

Study of Subsidies

A detailed study is needed of the costs of these subsidies to the Government of Bangladesh and the donor countries. The government's subsidy policy should be reevaluated, taking into account such factors as the cost of fertilizer to the farmer, fertilizer use, crop prices, incentives for farmers to increase production, distribution of income among farmers, margins for fertilizer dealers, improvements in fertilizer production and distribution, and the overall impact on the national budget.

The IFDC team does not suggest the increase of retail fertilizer prices as a means of lowering government subsidies at this time. A decision to raise fertilizer prices should be made only after a careful study of the situation.

FERTILIZER TRANSPORT

BADC Movement Operations

BADC owns very little transport equipment, and fertilizer is moved by other government corporations (such as BRC and BIWTC) and private contractors. BADC controls neither the availability of the transport equipment nor the timing of its arrival. This situation has contributed to difficulties in planning and implementing regularly scheduled shipments and in maintaining inventory control.

Railcars, barges, and coasters are currently allocated to BADC on a weekly basis by the Transport Coordination Committee. From 21 to 50 days may elapse between the date fertilizer is requested by a dealer and the date the shipment is received. Because of the difficulties BADC faces in attempting to control the availability and timing of transport equipment, there is a general feeling within BADC that increase of buffer stock and total warehousing capabilities would alleviate these difficulties.

To increase BADC's ability to plan, schedule, and implement fertilizer shipments on a regular basis, consideration should be given to the development of a new movement organizational structure within BADC. The current and suggested organizational structures are shown in figures 8 and 9.

The current organizational structure allows the fertilizer movement officers at the Port of Chittagong and the Port of Chalna to report through two separate lines of authority. The Deputy Manager of Shipping, responsible for movement at Chittagong, reports to the General Manager of Supply, but the Deputy Manager of Movement at Chalna reports to the Manager of Movement who in turn reports to the General Manager of Supply. This complicates the coordination of fertilizer imports, ship scheduling, and transport equipment movements to and between ports. Furthermore, under the current structure there are too many persons at various physical movement levels reporting to the Manager of Movement. In addition to the Deputy Manager of Movement at Chalna, there are seven other deputy managers for movement at production plants and districts reporting to the Manager of Movement. With so many persons directly reporting to him, their responsibilities tend to be fragmented or overlapped and their authorities unclear. This makes the effective coordination of all functions by the Manager of Movement more difficult, time-consuming, and virtually impossible.

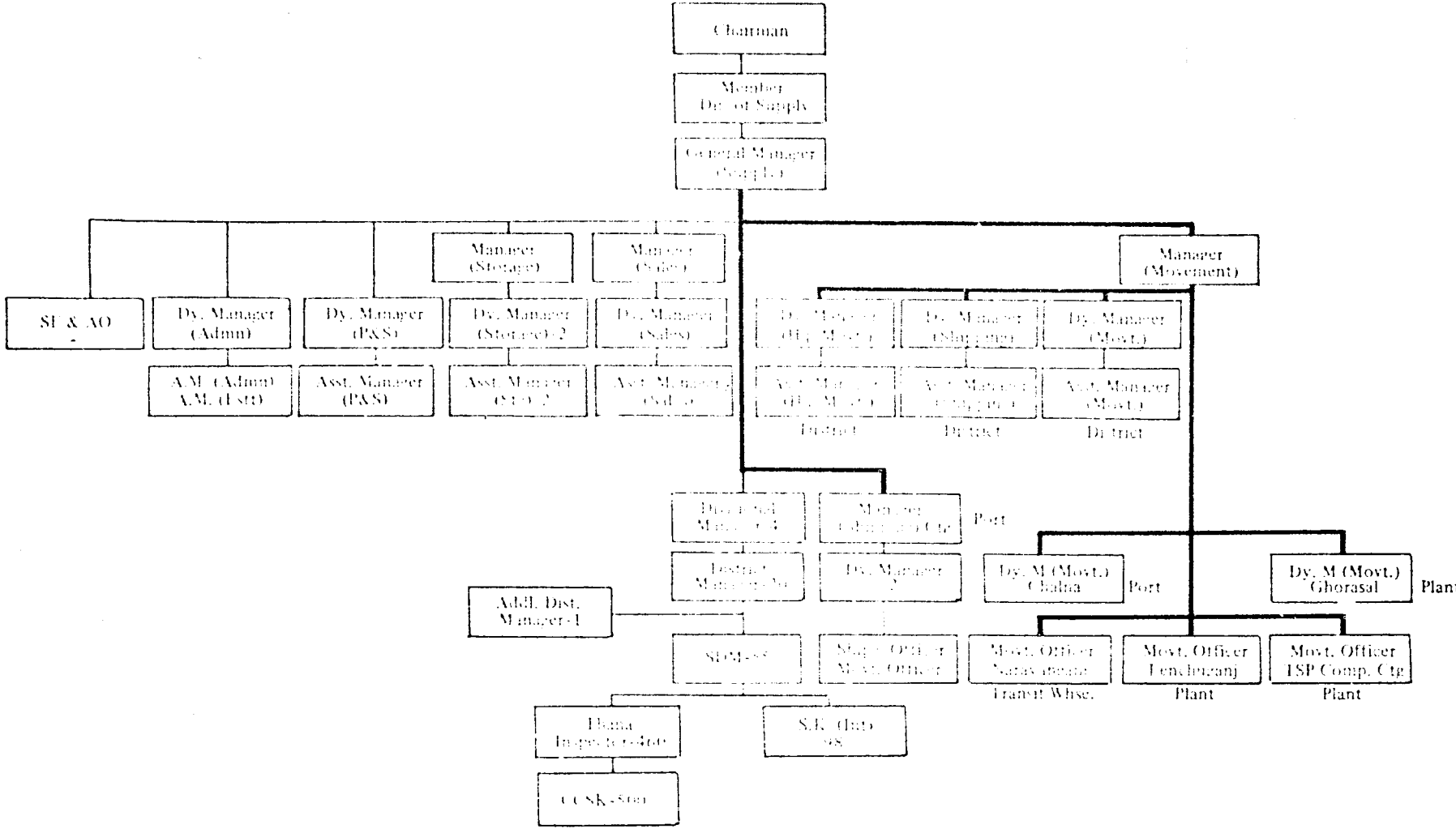


Figure 8. Current Organization Structure for BADC Fertilizer Supply Scheme

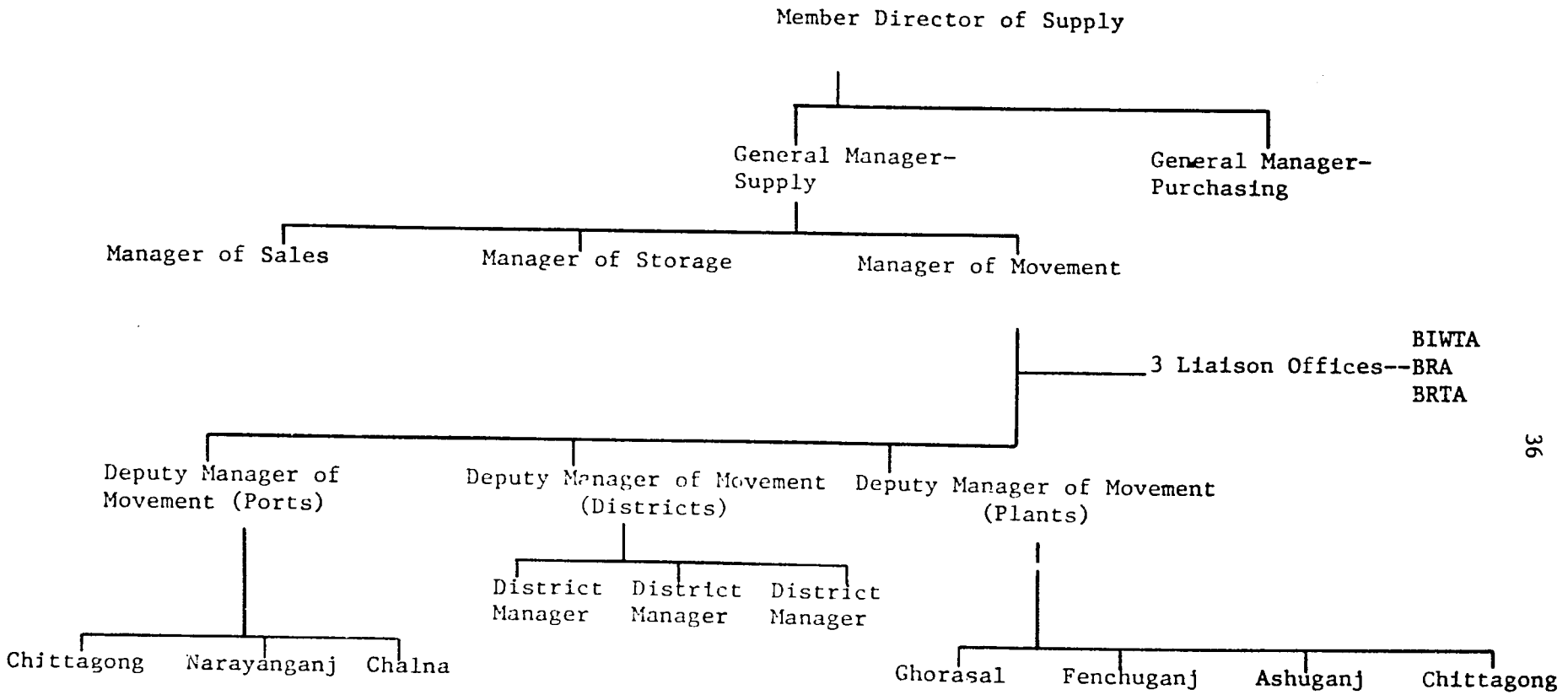


Figure 9. A Suggested Fertilizer Movement Organization for BADC

The new organizational structure suggested by the IFDC team calls for only three movement offices, each to be headed by a Deputy Manager of Movement reporting to the Manager of Movement--one for movements from all production plants, one for movements to and at ports, and one for movements in districts. This simplifies the organizational structure and makes the overall coordination easier. To effectively plan and coordinate the various transportation equipment needs for all the movement offices and to ensure the availability of the equipment, the structure also calls for the establishment of three liaison offices under the Manager of Movement. These liaison offices will work with BADC movement officers and government transport authorities such as BIWTA, BRA, and BRTA.

Port Logistics

Approximately 33.8% of the total fertilizer used in Bangladesh is imported through the Port of Chittagong and 20.9% through the Port of Chalna.[4] Chittagong supplies 1.2% of bangladesh's fertilizer to the northwestern region and 2.0% to the southwestern region of the country. More than 50% of Chittagong imports and TSP production stay within the southeastern region. The Port of Chalna, through its present on-shore discharge point (Khulna), supplies 10.9% of the total fertilizer to the northwestern region and 10.0% to the southwestern region. Thus, approximately 50% of the fertilizer imported through the Port of Chalna remains in the southwestern region. To supply fertilizer to the northwestern and southwestern regions from the Port of Chittagong, transshipment by ocean coaster across the Bay of Bengal is required.

The northwestern region receives the least amount of fertilizer in the country, but this area has the greatest potential for expansion of arable land and increased fertilizer use, especially in the districts of Rangpur and Bogla.

Since 1972 fertilizer imports through Chittagong have grown more slowly than those through Chalna Anchorage, partly because Chalna is becoming a more attractive port than Chittagong and partly because of its proximity to a growing market for fertilizer. Chalna Anchorage has better protection from high winds and tides, and ocean vessels do not require ocean coasters for lightering as does the Chittagong Outer Anchorage.

4. Frederick R. Harris, Inc. 1978. Fertilizer Transport in Bangladesh, New York.

Based on the EIU fertilizer projections and the team's estimated import requirements through 1982, it appears that an annual fertilizer tonnage as large as 270,000 mt will have to move through the Port of Chalna, and as much as 225,000 mt through the Port of Chittagong. From 1971 to 1977 the average annual fertilizer throughputs were 168,205 mt at Chittagong and 52,471 mt at Chalna. The present average daily discharge rate from Chittagong is 811 mt and that from Chalna Anchorage is 479 mt.

The Port of Chalna includes Chalna Anchorage (the anchorage in the Pussur River), the new jetties currently under construction at Mongla, and the Khulna Roosevelt Jetty. Chalna Anchorage is about 60 miles inland from the Bay of Bengal and provides a year-round sheltered anchorage. A draft of 31 feet will be available when dredging is complete at the entrance to the river and alongside the new jetties at Mongla which are on the east bank of the river. These jetties have no rail or road access, and utilization of their potential will probably require construction of three bridges (one large span and two smaller spans) in addition to rail and road connections to Khulna on the west bank.

Until there is rail or road access, a barge-bagging system at midstream in Chalna Anchorage could be utilized to receive imported bulk fertilizer. Such a system would require:

1. Entry of bulk fertilizers in 15,000-mt vessels, with empty bags on board, into Chalna Anchorage. These ships should be equipped with working gear and grabs and be capable of discharging 60 mt/hour with a 12-day turnaround at the Anchorage.

2. Two 500-mt self-propelled barges with a fully loaded draft of 8 feet. These barges should be equipped with three mechanical weigh-hopper baggers, with sewing machines and spares, three 15-mt steel elevated charge hoppers, three electrical generators, and galvanized metal sheds to cover the bagging units.

3. Leasing or purchasing five additional self-propelled barges for transporting bagged fertilizers to the Roosevelt Jetty. These barges should have a speed of 9 knots and a fully loaded draft of no more than 8 feet.

4. Priority allocation of berthing space to discharge fertilizer at the Roosevelt Jetty for connection with road and rail systems.

Use of the midstream discharge and bagging operation will allow the system to handle the required tonnage of fertilizer imports and also decrease the need for ocean coasters between Chittagong and Chalna. When adequate transportation facilities are available at Mongla jetties, fertilizer can be bagged in the shoreside warehouses and the barges may then be used for internal distribution of fertilizer on inland waterways. Based on the EIU report, importation of bulk fertilizer and bagging in Bangladesh probably would save $25/mt.

Ship Scheduling

Arrival of ships at the ports tends to be bunched during the three periods, March-April, August-September, and November-December. These arrivals should be spaced more evenly for improved port discharge, better scheduling of rail, road, and inland water services to the port, and better utilization of warehouse space.

Under present conditions, BADC headquarters (Dacca) notifies the ports of fertilizer ship sailings within 10 days after the date of sailing. The vessel then notifies the port of its estimated arrival time about 72 hours prior to arrival and calls for pilot assistance after reaching the entrance to the Pussur River at Chalna or at the Outer Anchorage of Chittagong.

Road Transport

Road transport of fertilizer is used primarily for hauling fertilizer from district warehouses to thana warehouses and from thana warehouses to retail dealers.

Freight rates for road transport are unregulated. According to 1977 BADC figures, truck rates range from TK 25 to TK 31/ton-mile, 25% above rail rates and 32% above water rates. Normally, truck replacement costs are not included in these rates.

Main roads consist of some 2,000 miles of hard surfaced roads, approximately 27% of which are concrete and 73% bituminous. Concrete roads are almost all single-lane, and most bituminous roads are 12 feet wide or less. The average speed on main roads is about 20 mph. There are nearly 10,000 miles of district roads,

mostly surfaced with brick and 30,000-40,000 miles of unsurfaced local thana roads.

When the Ghorasal and Fenchuganj plants were built, all-weather road access was not constructed to these plants. When railcars and barges are not available, fertilizer cannot be moved from these plants.

Rail Transport

Bangladesh has two types of railroads--broad gauge (5'6") and meter gauge (3'3-3/8"). There are 1,740 total miles of railroad, 590 miles of broad gauge and 1,150 miles of meter gauge. Most meter-gauge railroads are in the eastern half of the country, and most broad-gauge railroads are in the western half.

Rail equipment, of course, is not interchangeable between broad-gauge and meter-gauge railroads. Interconnections between these two types of railroads will continue to increase the cost of transport through lost time and additional handling of material until rail gauges are uniform throughout the country. Such a conversion, however, is not to be expected in the foreseeable future because of the large capital expenditure that would be required.

About 387,900 mt of fertilizer is expected to be moved by rail in 1978.[5] The Bangladesh Railway Information Book 1976 states that the average annual total freight for all cargos was 4,637,000 mt, omitting 1971. If the same freight tonnage is moved in the country in 1978, BADC's projected rail fertilizer movement for the year would be 8.3% of the total tonnage. Thus, fertilizer would rank equally with such major freight items as fresh fruit and vegetables, raw jute, rice, and wheat. This 8.3%, however, appears to be an ambitious expectation unless the government is willing to give fertilizer priority over other commodities in the allocation of railcars.

For 1976 and 1977, availability of railcars for BADC and BCIC ranged from a low of 4% to a high of 60% of requests made (table 2). The problem of unsatisfied requests results largely from the lack of adequate timely planning of railcar requests and of allocation to the competitive users. Car capacities are 18.5 mt for meter gauge and 22.0 mt for broad gauge.

5. Frederick R. Harris, Inc. 1977. Bangladesh Bulk Fertilizer Handling and Bagging Site Selection Report, New York.

Table 2. Number of Railcars Requested Versus Received by Various Fertilizer Distribution Points, Fiscal Years 1976 and 1977

Distribution Point	1976 Req.	1976 Rec.	1976 %	1977 Req.	1977 Rec.	1977 %
Chittagong port	1,782	1,064	60	2,409	1,134	47
Chittagong TSP plants	3,600	829	2.3	3,900	971	25
Chalna port	7,200	2,908	40	7,200	1,475	20
Ghorasal urea plants	7,320	1,013	14	7,320	267	4
Fenchuganj urea plant	N.A.			7,025	3,634	52
Narayanganj transit warehouse	7,300	2,955	40	7,300	2,807	38
Total	27,202	8,769	32	35,154	10,288	29

N.A.--Not available.
Source: Fertilizer Transport in Bangladesh, Frederick R. Harris, Inc., March 1978.

FERTILIZER WAREHOUSING

Aside from storage at the factory level, fertilizer is warehoused at five other levels--port, transit, district, thana, and private dealer. BADC operates the first three levels and most of the fourth. TCCAs manage some of the thana warehouses.

The bag warehouse at the Port of Chittagong is owned by BADC. There is no port warehousing at Chalna Anchorage where ships' cargos are lightered and transported to Khulna for discharge.

Transit warehouses are used as transshipment points to district warehouses. They are currently located in Chittagong District, Khulna, and Narayanganj. Each of the 20 districts has at least one major district warehouse with a storage capacity of 500-2,000 mt that supplies the thana warehouses. BADC plans to turn the thana warehousing over to the private sector by 1982 and the district level warehousing in later years.

The total fertilizer warehousing capacity in the country is now 413,800 mt, about 35% (144,300 mt) of which is BADC owned. This capacity is distributed as follows: 32,000 mt at the port

level; 16,190 mt at the transit level; 182,125 mt at the district level; and 213,485 mt at the thana level. BADC owns 100% of port warehousing, 49% of the transit warehouses, 29% of the district warehouses, and 28% of the thana warehouses.

Of BADC-owned warehouses, 22% are at the port level, 5% at the transit level, 31% at the district level, and 42% at the thana level.

Additional storage capacity requirements have been projected to 1982 by BADC, EIU, and the IFDC team. These projections are:

Bangladesh Agricultural Development Corporation

Type	Capacity (mt)	Number	Total Capacity (mt)
Bagged	508	182	92,456
Bagged	1,016	93	94,488
Bagged	2,032	9	18,288
Bagged	3,048	6	18,288
Bagged	5,080	2	10,160
Bagged	10,160	1	10,160
Bulk	101,600	1	101,600
Total			345,440

Economic Intelligence Unit

Type	Capacity (mt)	Number	Total Capacity (mt)
Bagged	203	34	6,902
Bagged	406	36	14,616
Bagged	508	205	104,140
Bagged	1,016	108	109,728
Bagged	2,032	14	28,448
Bagged	3,048	7	21,336
Bagged	5,080	1	5,080
Bagged	7,112	1	7,112
Bulk	23,375	1	23,375
Total			320,737

International Fertilizer Development Center

Ports	78,798 mt	(Bagged/Bulk)
Transit	6,586 mt	(Bagged)
District	129,720 mt	(Bagged)
Thana	132,684 mt	(Bagged)
Total	347,788 mt	

On the basis of the IFDC projection, additional new warehouse capacities would result in the following distribution of the total capacity.

Ports	22.5%	110,798 mt	(Bagged/Bulk)
Transit	2.9%	14,586 mt	(Bagged)
District	35.3%	173,721 mt	(Bagged)
Thana	39.3%	192,984 mt	(Bagged)
Total	100.0%	492,089 mt	

The IFDC team has not attempted to suggest the location, physical size, or ownership of individual warehouses, but the estimated total warehouse requirements at each level may serve as a guide in determining locations and sizes of new warehouses.

FERTILIZER BAGS AND BAGGING

Bag Materials, Sizes, and Costs

Bangladesh, being one of the world's largest producers of jute, uses this material for fertilizer bags in an attempt to reduce foreign exchange costs.

BCIC uses 25-kg bags consisting of 10-ounce jute outerbagging and 2.7-mil polyethylene free liners at the Ghorasal and Fenchuganj urea plants. It also uses 50-kg bags consisting of 10-ounce jute outerbagging and 4-mil polyethylene free liners for bagging TSP at the Chittagong plants.

Fertilizer materials received from donor countries arrive in many different types of 50-kg bags. Some of the outerbagging used for fertilizers are closely woven polypropylene without ultraviolet inhibitors, open-weave polypropylene with ultraviolet inhibitors, and 10-ounce woven jute outerbagging. The polyethylene liners range from 2.7 mils to approximately 4.0 mils thick. Bag and liner closures include hand-tied jute string ties, twisted wire ties, machine-sewn closures, and jute twine hand-sewn closures.

As of March 1977, bags similar to those used at the Fenchuganj and Ghorasal urea plants cost TK 4.35 (US 29¢) for a 25-kg jute outerbag and TK 2.00 (US 13¢) for a 2.7-mil polyethylene liner.

A 50-kg woven polypropylene bag sells for 2 TK on the open market for reuse by the local populace.

Product and Bag Losses

Hooks are used in Bangladesh in the discharge of fertilizer cargos, a practice that results in destruction of about 2% of outer bags and liners. As reported by BADC, the average physical product losses at ports, in transit, and at warehouses by type of fertilizer are as follows:

Product	Port Loss	Transit Loss	Warehouse Loss	Total Loss
	%			
Urea	0.50	0.50	0.30	1.30
TSP	0.50	0.33	0.43	1.26
MP	0.50	0.25	0.47	1.22

These reported losses appear to be low. Based on the EIU report, physical product losses for 1975-76 were: urea, 1.9%; TSP, 7.4%; and MP, 2.3%.[6] Proper stock control and inventory procedures should be instituted and monitored to determine the actual physical losses and disappearance.

6. The Economic Intelligence Unit, Ltd. 1977. Bangladesh Fertilizer Marketing and Distribution Study, Interim Report.

Bagging Equipment Operations

Each fertilizer plant has bagging problems that have prevented attainment of design bagging rates. Standardization of the bagging equipment by manufacturer is underway, but not by model. Whether this is a deliberate action or not, standardization by both manufacturer and model probably would result in more effective bagging operations and maintenance.

The TSP plants have major limitations in material flow design among the bulk finished product storage areas, bagging units, and truck and rail loading facilities. Although the plants receive raw materials from ships by conveyor, there is no bag conveyor to load vessels. This material flow design problem seriously limits achievement of design bagging capacities and the plants' production capabilities.

There is a high concentration of TSP and rock phosphate dust, particularly in the bagging areas. Inoperable exhaust fans in the bagging areas required a 7-day plant shutdown in 1977.

Powdered TSP also causes corrosion of equipment and operating problems for personnel, equipment, and bag materials.

Bagging rates at the Fenchuganj and Ghorasal urea plants are less than design rates, primarily due to the type of liner closure used.

Vessel Discharge Capacity at Chittagong TSP Plants

The largest ship that has been handled at the TSP jetty was 12,000 mt. To discharge such a vessel normally requires 10-12 days. An average discharge rate of 1,000 tpd can be maintained at the TSP jetty using grab cranes. Portable grab cranes are normally used for discharge to the belt conveyor.

The belt conveyor from the TSP jetty handles both rock phosphate and powdered sulfur and has a maximum rated capacity of 1,500 mt per 24-hour day.

Hand baskets have also been used to discharge fertilizer to the conveyor, but this method requires approximately 50% more time to discharge the same amount of material.

The present materials handling system is not designed to permit receiving and bagging of imported bulk finished fertilizers.

FERTILIZER PHYSICAL PROPERTIES

Domestically produced TSP is bagged in the powder form. "Green" TSP is cured for 10 days in bulk storage before bagging. Imported bagged TSP is in the granular form. It is not known whether the physical properties of all finished TSP are monitored by the plants as to product size, caking, and hardness.

The physical properties of all finished TSP should be identified to assist improvements in such areas as in-plant material handling, possible granulation of domestic TSP, bagged finished product movement and storage, and field application.

Domestically produced urea and imported urea from Saudi Arabia and Kuwait contain noticeable amounts of fines. The Kuwait and Saudi Arabian urea stored in the Chittagong transit warehouse had caked. High-quality Dutch prilled urea stored at the Gumal-Bai thana warehouse was free flowing. This had been treated with a conditioner and appeared to have a high crushing strength.

Physical and chemical properties of domestically produced and imported urea and TSP should be analyzed and complied with established standards.

Uniform product specifications and test methods should be developed for BADC's use in procuring all fertilizers. This is especially important in view of BADC's plans for a 4- to 6-month buffer stock.

AGRICULTURAL EXTENSION AND RESEARCH

Extension

Several organizational units within the Ministry of Agriculture are now engaged in extension services. DEM, one of the most important units within the Ministry, provides the basic

agricultural extension work throughout the country. There are five other authorities involved--the Directorate of Plant Production, Intensive Jute Cultivation Scheme (IJCS), the Cotton Development Board, the Horticulture Development Board, and the Tobacco Development Board.

Outside the Ministry of Agriculture, agencies within five other ministries also provide field extension services--Sugar and Food Industries Corporation (Ministry of Industries), Water Development Board (Ministry of Flood Control, Water Development and Power), Tea Board (Ministry of Commerce), IRDP (Ministry of Local Government, Rural Development and Cooperatives), and Directorate of Livestock (Ministry of Forestries, Fisheries and Livestock). There are nine extension support projects with international assistance, and some 19 bilateral international volunteer groups or missionary organizations have their own extension activities.

DEM is supported by the Agricultural Information Service (AIS), a separate unit within the Ministry of Agriculture. AIS has a daily broadcast program for farmers, operates mobile units, and prepares exhibits and pamphlets.

Extension services by DEM have been hampered by staff shortages, inavailabilities of rapid and convenient means of transportation, lack of incentives for extension staff, and absence of close mutually interacting links with research organizations.

DEM has 517 thana agricultural officers (TAO), 158 thana extension officers (TEO), and 4,333 village extension agents (VEA) and union agricultural assistants (UAA). They visit farmers by bus, bike, or on foot. Their salaries are low, their living conditions are poor, and their travel and daily allowances are paid irregularly. Their overall morale is low and their knowledge of fertilizer is limited.

The ratio of all the above extension workers to farm families is 1:2,400 and to the authorized fertilizer dealers is 1:6. DEM's extension workers have many duties to perform, one of which is fertilizer extension.

The aim of IRDP is to extend rural development and improved agricultural practices. The program is intended to use local cooperatives (Krishi Samabaya Samities--KSSs--grouped into TCCAs) for coordinating and integrating such services to farmers as farmer training, credit, inputs, marketing, and rural works activities.

Research

Research in agriculture in Bangladesh is fragmented among eight separate ministries of the government. As coordination is poor, this results in overlapping and competition for qualified staff and the limited resources.

The Bangladesh Agricultural Research Council (BARC) was established in 1973 and has substantial statutory powers to plan and coordinate the country's agricultural research activities. The council's mandate does not cover the important crops such as jute, sugarcane, and tea, but the council contains representatives from the research institutions that deal with these crops.

To enable the BARC to fulfill its role, it is receiving assistance from technical advisors (USAID, the Ford Foundation, and the International Agricultural Development Service--IADS) that is meant to strengthen its research programming and coordinating capabilities.

BRRI was established as an autonomous body within the Ministry of Agriculture in June 1973. It is charged with the improvement of the varieties of rice and their production, the establishment of regional centers and demonstration projects, and the training of extension officers and farmers.

BARI, another autonomous body within the Ministry of Agriculture, was established in 1976 on an equal status with BRRI. Through its four regional stations and 15 substations, the Institute has done commendable work on wheat, oilseeds, soybeans, and cotton. The BARI consists of 14 separate divisions, and reorganization has been proposed as part of a major program of improvement of BARI that includes relocation of the headquarters to a site adjoining BRRI at Joydevpur, about 20 miles from Dacca.

The Soil Fertility Institute (SFI) was established in 1963 as the Soil Fertility and Soil Testing Institute. SFI is now a division of BARI and is responsible for most of the fertilizer research work in Bangladesh. Although many thousands of tests have been made, many of these tests could not be supervised properly because of lack of transportation and other problems, making many of the test results doubtful. Since 1974, several hundred studies have been made on transplanted Aman rice and on wheat. This program is now receiving support for the period, 1975 to 1980, from an FAO/NORAD project and from the agronomist in the UNDP/FAO Interpretation of Soil Survey Project.

SSI, under the Ministry of Agriculture, makes countrywide physical soil classification. Although not classified as a research organization, SSI has close ties with SFI's research.

The Jute Research Institute (JRI) is under the Ministry of Jute and is responsible for research on production of jute. With support from UNDP/FAO, the Government of Bangladesh has negotiated a loan from the Asian Development Bank for development of a program of seed production in Bangladesh.

Data on past Bangladesh fertilizer research and information gained from conversations with research workers indicate that much work is needed to define fertilizer requirements for the various crop varities, soils, and seasonal growing conditions.

INFORMATION AND COMMUNICATION

Improvements in BADC communications and information flow will permit timely reporting of product availabilities, product movement, warehouse inventories, sales, and demand. Furthermore, rapid analysis of this data will give management a tool to make faster and better decisions. Improved management decisions will permit better use of available transport equipment and warehouse capacities and more effective allocation of products to where they are needed.

The flow of timely information in Bangladesh is currently poor. Necessary and vital information frequently is unavailable, outdated, or not readily accessible, and when it is accessible, it may not be in a readily usable form. Before September 1977, BADC did not have a system to constantly monitor fertilizer sales and stock at the thana level.

Although there is a public telephone system, it is not available at many thanas. Even where available, line quality is poor, and it takes 4 or 5 days to get access to the line. Only police stations and the military have special phone lines of their own. The public telex system is available at only some locations. For its internal and external communications, BADC has had to use public telephone, mail, or hand-carried messages. The mail system is reported to be slow.

Over the years, BADC appears to have collected many facts and figures, but much of the key data needed for management planning and control are not collected or analyzed. Hand methods and large

old-fashioned desk calculators are used for data processing and information analysis. Battery-operated pocket-size calculators are used by a few. There are two large IBM 360 computer systems in Dacca where BADC has its headquarters; one is leased by the Bangladesh Bank and the other by the Bureau of Statistics of the Ministry of Planning. In addition, the Atomic Energy Commission has a smaller computer. BADC has not attempted to utilize the unused capacity of these computers. In view of the steady decrease in the price of desk-top microcomputers, some of these instruments could be utilized at the BADC headquarters with proper training of the existing manpower. These microcomputers would free some of the analysts' time, permitting them to assist management in developing more vital information.

Since 1977, an Arthur D. Little management consultant has been working under a 2-year Ford Foundation Grant with BADC to develop a corporate management information system. The system will assist BADC management and staff in identifying key information and developing a more efficient system of data collection, analysis, and dissemination.

The International Development Association (IDA) is now funding a study to improve communications among agencies within the Ministry of Agriculture. This study does not include communications within BADC.

BADC's procurement officers as well as others involved in the fertilizer sector, such as fertilizer dealers and USAID/Dacca, lack current information on the world fertilizer market and prices. This situation is critical because Bangladesh will continue to be a major fertilizer importer for some years and, thus, some arrangements should be made for faster access to and dissemination of reliable information on fertilizer markets and prices.

APPENDIX A

BASIC DATA (Bangladesh)

Population: 82 million (1977); annual growth rate, 2.8%/year; rural population, 95% of the total; farm population, 73 million; number of farm families (including landless), 12 million

Gross National Product: US $110 per capita (1976 preliminary)

Daily Wages (8 hours/day): TK 6-7 (US 40¢-47¢) for farm labor; TK 7-9 (US 47¢-60¢) for nonfarm labor

Adult Literacy Rate: 23%

Land: Total area--55,000 mi^2 (or 35.2 million acres)
Land under cultivation--22.5 million acres (64% of the total area); one-third of cultivated land affected by flood each year
Cultivable wasteland--less than 740,000 acres
Land under irrigation--2.7 million acres

Agriculture: 60% of gross domestic product; 75% of total employment; 90% of the foreign exchange earnings

Average Cropping Intensity: 1.35 crops/year

Cropped Acreage (1977):

1. Total acreage (based on 1.35 cropping intensity)--30.4 million acres
2. Acreage by crop:
   Rice--24,418,815 acres (80% of total)
      Aus--7,951,805 acres
      Aman--14,355,050 acres
      Boro--2,111,960 acres
   Jute--1,603,000 acres
   Wheat--395,000 acres
   Sugarcane--357,000 acres
   Tea--105,000 acres
   Cotton--13,000 acres
   Other crops--3,508,000 acres
   Other crops include pulse, tobacco, oil seeds, potato, sweet potato, spices, and vegetables.

Average Farm Size: 3.5 acres (one-third of farms having 10 plots or more)

Land Tenure: 50%-55% of farms cultivated by owners
50%-45% of farms cultivated by tenant farmers or hired farm labor--most of the owner-cultivators and tenant farmers are small subsistence farmers. Tenant farmers are 50-50 or 60-40 sharecroppers or pay a fixed rent at the beginning of each crop season.

Crop Production (1977):
Rice--11,567,140 mt
Aus--3,011,435 mt
Aman--6,905,580 mt
Boro--1,650,125 mt
Wheat--255,000 mt
Cotton--4,000 bales
Sugarcane--6,401,000 mt
Jute--4,806,000 bales
Tea--74,000 million lb

High-Yielding Varieties (Rice)
Aus-rainfed--IR8, BR1, BR2, BR3
Aus-irrigated--IR8, BR1, BR2, BR3
Transplanted Aman--IR5, IR20, BR4
Transplanted Boro--IR8, purbachi, BR1, BR2, BR3

Rice Seasons (approximately)
Aus season (about one-third of the total rice acreage)--Aus seeding is done between mid-March and beginning May; the crop is harvested between beginning July and mid-August.
Aman season (nearly 60% of the total rice acreage)--Seedlings are raised in June-July; the crop is harvested between mid-November and end-December.
Boro Season (winter) crop--Seeds are planted from November on; the crop is harvested between the end of April and May.

Fertilizers
Ammonium sulfate (AS)--21% N
Triple superphosphate (TSP)--46% P_2O_5
Muriate of potash (MP)--60% K_2O
Complex fertilizers (NPK)--containing, in any combination, nitrogen, phosphorus and potassium
Rock phosphate--phosphate ore from which soluble fertilizers are made
Urea--46% N

Fertilizer Prices (Government's official retail prices, January 7, 1976, to date):

Urea--TK 60/maund (US $108.87/mt)
TSP (powder or granular)--TK 48/maund (US $87.10/mt)
Muriate of potash (granular)--TK 40/maund (US $72.67/mt)

Crop Prices (Government procurement prices, February 1978)

TK 80/maund (US $143/mt) for rice and wheat with 13% or less moisture and 15% or less impurities

Climate: Tropical and also subtropical

Rainfall: 76 inches/year average; heavy during the monsoon season (July-October); contributes an additional 200 million acre feet of water; combined average annual drainage for the country, 1,070 million acre feet

Currency: US $1 = TK 15.0

Administrative Units (number): (See the map, Administrative Units in Bangladesh)

Divisions--4
Districts--19 or (20 for agricultural districts)
Subdivisions--63
Thanas--419 (police precincts) or 420 (agriculture)
Unions--4,426
Wards--13,278 to 22,130
Villages--64,493

Transportation Systems: (See the map, Bangladesh Transportation)

Sea ports--Chittagong and Chalna: The Chalna port covers the outer anchorage, port facilities under construction at Mongla, and Khulna Roosevelt Jetty (the present cargo discharge point).

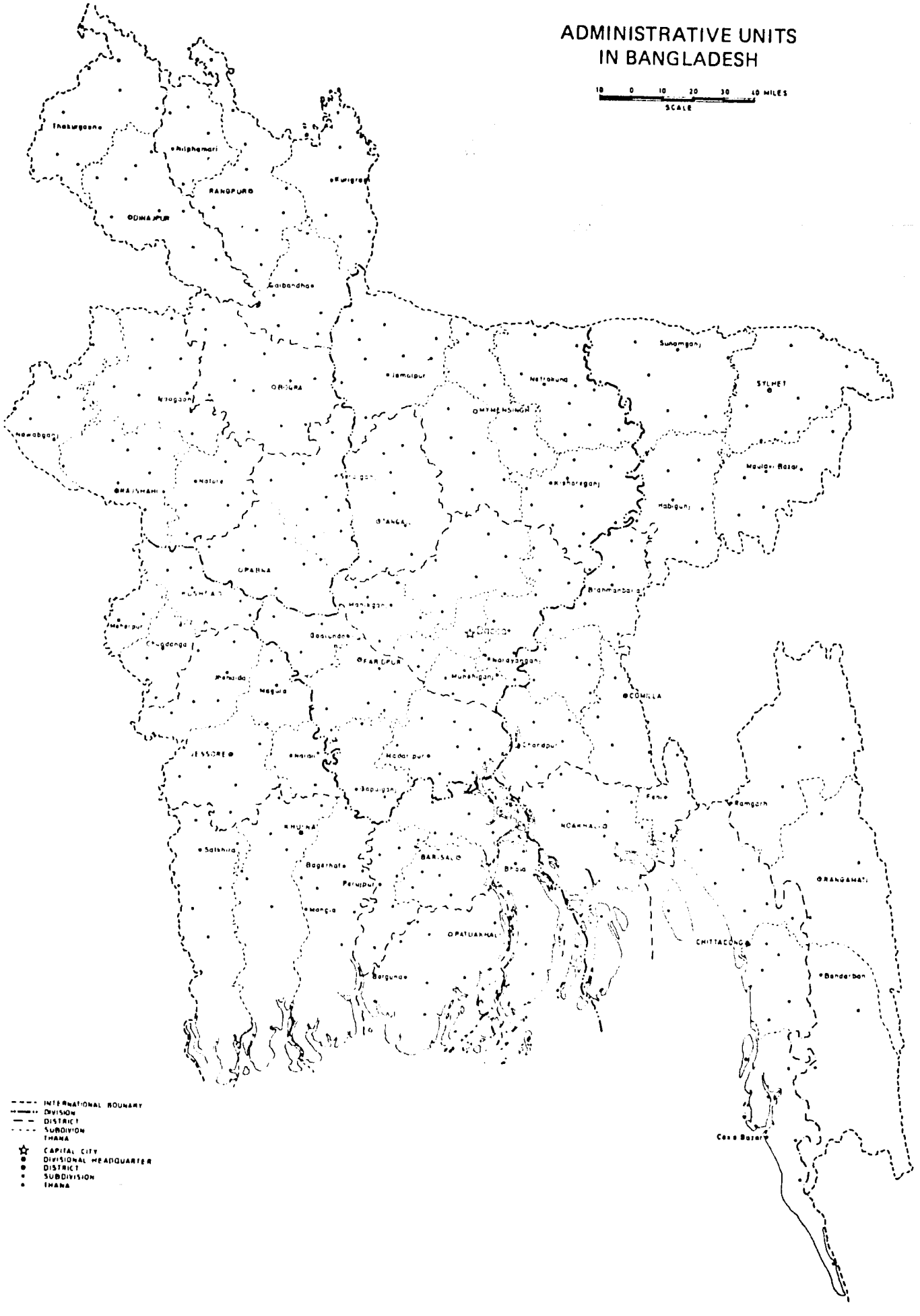
Railroads (1977)--475 stations over 1,740 route miles; 590 mi (broad gauge, 5'6") and 1,150 mi (meter gauge, 3'3-3/8"); 450 locomotives; 1,168 passenger carriages and 363 other coaching vehicles; and 16,802 freight wagons

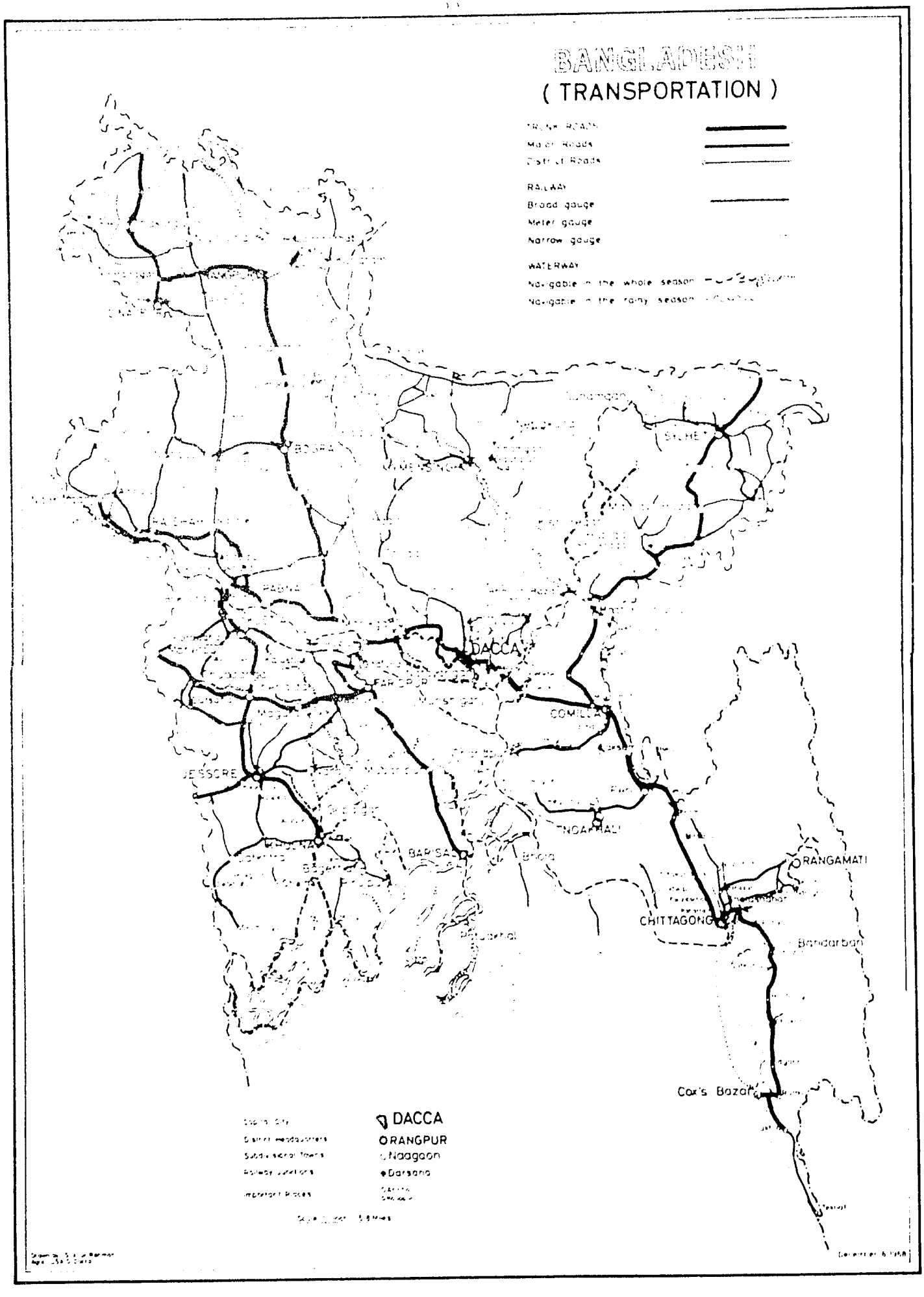
Highways: Main roads--Some 2,000 mi of bituminous and concrete surface roads; concrete roads (27% of total) almost all single-lane; bituminous roads (mostly 12 ft or less in width)

District roads--nearly 10,000 mi, mainly surfaced with brick

Local thana roads--30,000 to 40,000 mi

Riverways--10 main rivers--As of end of 1976 BIWTC inland water cargo fleet includes 25 coasters, 59 bay crossing


ADMINISTRATIVE UNITS
IN BANGLADESH
SCALE
RANGPURO
DINAJPUR
BOGRA
MYMENSINGH
SYLHET
Sunamganj
Netrakona
Habiganj
Maulavi Bazar
Brahmanbaria
Comilla
Feni
Ramgarh
Rangamati
Chittagong
Bandarban
Cox's Bazar
Barisal
Bhola
Patuakhali
Barguna
Pirojpur
Bagerhat
Khulna
Satkhira
Jessore
Magura
Jhenaida
Chuadanga
Meherpur
Kushtia
Pabna
Rajshahi
Naogaon
Nawabganj
Rajbandhar
Jamalpur
Kishoreganj
Narayanganj
Munshiganj
Madaripur
Shariatpur
Faridpur
Gopalganj
Manikganj
INTERNATIONAL BOUNARY
DIVISION
DISTRICT
SUBDIVISION
THANA
CAPITAL CITY
DIVISIONAL HEADQUARTER
DISTRICT
SUBDIVISION
THANA


BANGLADESH
(TRANSPORTATION)
Major Roads
District Roads
RAILWAY
Broad gauge
Meter gauge
Narrow gauge
WATERWAY
Navigable in the whole season
Navigable in the rainy season
DACCA
COMILLA
JESSORE
BARISAL
CHITTAGONG
RANGAMATI
Bandarban
Cox's Bazar
DACCA
RANGPUR
Naogaon
Darsana

barges, 300 dumb barges, and 11 self-propelled barges; private sector fleet consists of 22 coasters, 400 barges, 90 tugs, and 190 cargo launches and self-propelled barges. Airline--BIMAN (government owned)

Exports: Jute and jute products, tea, hides and skins, oilcake, shrimp, paper, coriander seeds, coffee beans and wheat bran, molasses, cotton yarn, frog legs, chillies, safety matches, etc.

Imports: Food grains, cotton, fertilizers, machineries, pharmaceuticals, agricultural and other chemicals, coal, etc.

APPENDIX B

Rough Estimates for FY 76
Costs and Direct Subsidies to BCIC and BADC as Related to Individual Product Retail Prices

BCIC Domestic Production Only

Product	(1) FY 76 Production mt	(2) BCIC Production Cost TK/mt	(3) Sales Price to BADC TK/mt	(4) BCIC Subsidized Loss TK/mt	(5) Total BCIC Subsidized Loss TK ('000)	(6) BADC[a] Distribution Cost TK/mt	(7) Dealer Commission TK/mt	(8) (3+6+7) Total BADC Cost TK/mt	(9) Retail Selling Price TK/mt	(10) (8-9) BADC Subsidized Losses TK/mt	(11) (10x1) BADC Losses TK ('000)	(12) (5+11) BCIC and BADC Total Subsidized Losses on Domestic Production TK ('000)	TK/mt	(13) % Retail[b] Price Increase to Cover Costs
Urea	277,000	1,912	1,716	196	54,292	451	161	2,328	1,633	695	192,515	246,807	891	55%
TSP (powder)	48,000	8,500	4,420	4,080	195,840	451	161	5,032	1,307	3,725	178,800	374,640	7,805	597%
Total	325,000				250,132 or TK 770/mt						371,315 or TK 1,092/mt	621,447 or TK 1,862/mt		

BADC Imports Only

Product	(1) FY 76[c] Imports mt	(2) Import Cost C&F TK/mt	(3) BADC[a] Distribution Cost TK/mt	(4) Dealer Commission TK/mt	(5) (2+3+4) Total BADC Cost TK/mt	(6) Retail Selling Price TK/mt	(7) (5-6) BADC Subsidized Loss on Imported Product TK/mt	(8) (7x11) BADC Total[d] Anticipated Losses on FY 76 Imports TK ('000)	(9) % Retail Price Increase to cover Costs
Urea	71,000	3,811	451	161	4,423	1,633	2,790	198,090	171%
TSP	219,000	2,700	451	161	3,312	1,307	2,005	439,095	153%
MP	37,000	1,950	451	161	2,562	1,088	1,474	54,538	135%
Total	327,000	2,856 (weighted average)						691,723 or TK 2,115/mt	

a. Average cost for distribution and overhead (TK 200 million) divided by mt sales, this cost does not distinguish between domestic or import products.
b. (BCIC production cost + BADC distribution cost + dealer commission) ÷ retail selling price - 1.00 = % retail price must be raised to cover all costs or (TK/mt loss by BCIC and BADC)÷ TK/mt retail price = % retail price must be raised to cover costs.
c. No breakdown as to ratio of sales in FY 76 as to imported or domestic product. Imports represent arrivals only and not BADC sales.
d. Losses and subsidy payments will result in the year of sale. Imports + domestic production were greater than sales in FY 76.