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UNCLASSIFIED  
 CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) - PART I

Report Symbol U-447

1. PROJECT TITLE  Fertilizer Distribution Improvement			2. PROJECT NUMBER  388-0024	3. MISSION/AID/W OFFICE  USAID/Bangladesh
5. KEY PROJECT IMPLEMENTATION DATES			4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) <u>80-2</u>	
A. First PRO-AG or Equivalent FY <u>78</u>	B. Final Obligation Expected FY <u>80</u>	C. Final Input Delivery FY <u>82</u>	6. ESTIMATED PROJECT FUNDING A. Total \$ <u>750,000,000</u> B. U.S. \$ <u>150,000,000</u>	
			7. PERIOD COVERED BY EVALUATION From (month/yr.) <u>March 1979</u> To (month/yr.) <u>April 1980</u> Date of Evaluation Review <u>May 16, 1980</u>	

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
1. <u>Fertilizer Storage</u> - The National Storage Plan is now under preparation and is expected to be complete by July 1980. The plan is expected to call for new storage of about 450,000 tons capacity at about 82 sites. Per the project paper, USAID has planned to construct only about 173,000 tons capacity and other donor commitments are very small thus far. Upon completion of the National Storage Plan a decision needs to be made as to how much of the additional storage capacity required will be USAID funded and in what ways USAID might assist with engineering or planning of the other donor financed construction. The decision needs to be made prior to amendment of the Project Paper to add FY 81 and FY 82 funding.	Chairman, BADC	August 1980
2. <u>Nutrient Requirements</u> - Reliable data does not exist on the best application of macro or micro nutrient fertilizers in Bangladesh. This single fact may be a major constraint in obtaining maximum increased yields from fertilizer use. USAID needs to arrive at a clear action oriented policy to assist Bangladesh in this area.	Chief, F/AGR USAID	July 1980

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS			10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT		
<input type="checkbox"/> Project Paper	<input type="checkbox"/> Implementation Plan e.g., CPI Network	<input checked="" type="checkbox"/> Other (Specify) _____	A. <input checked="" type="checkbox"/> Continue Project Without Change		
<input type="checkbox"/> Financial Plan	<input type="checkbox"/> PIO/T	<input type="checkbox"/> Other (Specify) _____	B. <input type="checkbox"/> Change Project Design and/or		
<input type="checkbox"/> Logical Framework	<input type="checkbox"/> PIO/C		<input type="checkbox"/> Change Implementation Plan		
<input type="checkbox"/> Project Agreement	<input type="checkbox"/> PIO/P		C. <input type="checkbox"/> Discontinue Project		

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)		12. Mission/AID/W Office Director Approval	
Mr. Dean Alter, F&A <u>DIA</u>	Mr. L. Crandall, PRO <u>LC</u>	Signature <u>[Signature]</u>	
Mr. Charles Antholt, F&A <u>CA</u>	Mr. W. Oliver, DD(A) <u>WO</u>	Typed Name <u>Richard L. Podol</u>	
Mr. M. Sullivan, PRO <u>MS</u>	Mr. R. Allen, PRO <u>RA</u>	Date <u>May 23, 1980</u>	
Mr. E. Callahan, RDE <u>EJC</u>			

Continuation.... Project Evaluation Summary (PES) - Part I

8. Action Decisions Approved by Mission or AID/W Office Director

A	B	C
<p>3. <u>Zinc Sulphate</u> - Sufficient data does exist to point to serious zinc and sulfur deficiencies in Bangladesh. The Ministry of Agriculture is considering initial introduction of zinc sulphate in Bangladesh. The initial import quantity and promotion program has yet to be determined. For this purpose, a meeting and exchange between the concerned agencies needs to be called to include BRRI, ARI, BADC, USAID and the Ministry of Agriculture.</p>	<p>Secretary, Ministry of Agriculture</p>	<p>June 1980</p>
<p>4. <u>Promotion</u> - DAP requires special promotion. A small supply of pamphlets on DAP were published by BADC but these quickly ran out. USAID has agreed to reimburse BADC for the costs of printing both pamphlets and posters on DAP. (If zinc sulphate is imported we would be willing to do the same thing for this product.) BADC should arrange for the printing and necessary distribution.</p>	<p>Chairman, BADC</p>	<p>July 1980</p>
<p>5. <u>DAP Imports</u> - DAP imports are more economical than TSP imports. BADC should establish a policy of purchasing DAP using other donor as well as USAID funds.</p>	<p>Chairman, BADC</p>	<p>June 1980</p>

### 13. Summary

The project is in its second year of implementation and this is the second regular evaluation. As summarized below, progress is satisfactory in relation to project design, with the exception that a nationwide drought held back increases in fertilizer use and resulted in lower than hoped for production.

The project was authorized for three years funding during FY 78-80. USAID is now planning to propose a two year extension for FY 81/82. This action would allow extension/consolidation of the results achieved by the first three years' funding.

Provision of project inputs proceeded as per design. Fertilizer imports, wheat seed imports, technical assistance in distribution, and design of storage and bulk handling were all provided during the period of evaluation.

Success was achieved in the areas of two principal project outputs: adequate in-country stock levels and expansion of the New Marketing System. The other two project outputs, storage construction and bulk handling, remained in the input (design) stage.

Progress was made toward the project purpose of increased fertilizer use with equity. While a national drought held fertilizer sales to a 9 percent increase during the first 10 months of 1979-80, this was judged to be a good increase considering the circumstances. The first volume of the "equity study" produced in draft indicated significant fertilizer use and benefits accrue to small farmers.

The project goal is increased foodgrain production especially among small farmers. While the drought caused reduced production in 1979, fertilizer use contributed to such output as did occur, and as the fertilizer "equity study" indicated, yield increases per acre resulting from fertilizer use were greater on small farms than on large farms.

#### 14. Evaluation Methodology

The purpose of this regular evaluation is to measure progress to date. The evaluation draws in some sections upon two draft special evaluations which are still under final preparation. The special evaluations are entitled "Bangladesh -- Equity Effects of Fertilizer Use" and "Second Evaluation of the New Marketing System" and are both under preparation by the International Fertilizer Development Center.

Other data and analysis have been collected and prepared by USAID staff from project files, BADC records, and other public sources of record.

#### 15. External Factors

Major assumptions all held on input, output, purpose and goal levels with one significant exception: a nationwide drought in 1979 affected both fertilizer use (purpose) and production (goal)

#### 16. Inputs

The USAID funded inputs to date are fertilizer imports, engineering services for fertilizer storage construction, study of bulk import alternatives and preparation of tender documents for the selected bulk import alternative, wheat seed imports, and technical assistance in fertilizer import programming, marketing and distribution. Inputs provided during the evaluation period of March 1979 through April 1980 are discussed below.

##### A. Fertilizer Imports

##### (i) DAP Imports During the Period of Evaluation

Approximately 42,175 MT of USAID funded fertilizer (DAP) arrived in 1979-80. Due to a nationwide drought in 1979, this purchase was much smaller than the 176,218 MT of fertilizer imports USAID financed in 1978-79. Still, although this year's imports constituted only 16 percent of the 260,000 tons anticipated DAP/TSP sales in 1979-80, they arrived at a critical time when DAP/TSP stocks had fallen to two month's supply, threatening a national shortage of phosphatic fertilizer. In addition, special significance is attached to this purchase of DAP since two of the four ship loads were experimental "bag-on-ship" shipments.

(ii) Bag-on-Ship Experiment

The purpose of this experiment was to determine whether significant cost savings could be achieved and technical problems could be overcome in importing fertilizer in bulk with manual bagging on board the ship. This method of import was to be compared against the standard practice in Bangladesh of importing bagged fertilizer.

A cost comparison of the various FCB and freight offers revealed that on a C & F basis bag-on-ship will save on the order of \$32 per ton for purchases from the U.S. and \$16 per ton for purchases from Korea. Some technical difficulties were experienced in the manual bagging operations, but workable methods were developed to deal with them. One of the ships carrying bulk fertilizer, the Al Roulf, was entirely unloaded per the specified bag weight range and within the specified rate per day. The local agent for the other ship carrying bulk DAP failed to recognize the Charter Party Terms and attempted to charge BADC with the cost of rebagging bags not within specified bag weight range. BADC has taken the firm position that this cost is at the account of the shipowner, and USAID agrees.

In balance, this experiment is seen as a good experience. It has led to increased confidence in BADC that bulk imports are possible in Bangladesh and to increased enthusiasm for establishing the portable bagging machine scheme described in 16.c. below. Another result of the experiment has been that it has led to improved Charter Party Terms for the next bag-on-ship tender. These terms define in detail the equipment and procedures which are now known to be needed to perform correctly. We are confident that these terms are likely to ensure an acceptable level of performance in bag-on-ship operations in the future.

(iii) The Need for DAP Promotion and More DAP Imports

DAP sales have been encouraging inspite of poor promotional efforts and the total lack of other donor funded imports. Of the 83,718 tons imported in 1979, all but about 6,000 tons have been sold as of April 30, 1980. Because DAP has 64 percent nutrient as opposed to TSP's 46 percent nutrient, its nutrient content is 39 percent higher than TSP's nutrient content. But the price of DAP is only about 30 percent higher per ton than TSP.

Therefore, there is approximately a 9 percent savings on the fertilizer purchase price. In addition, there is a further 39 percent savings on freight and storage costs due to the 39 percent higher nutrient content per ton of fertilizer. The savings on freight is somewhat less when TSP from a nearby (e.g. North Africa) source is compared to DAP from North America (e.g. USA), but even then there is usually a freight savings. The combined effect of the FOB savings and the freight/storage savings averages about \$30-\$45 per ton for each ton of DAP imported instead of one ton of TSP imported. This means that the cost of phosphate fertilizer imports can be reduced by about 10-15 percent by switching all TSP imports to DAP imports. Applied against the total of approximately 200,000 MT of DAP/TSP expected to be imported in 1979-80, the total cost savings of all DAP no TSP imports would probably have been on the order of \$6-\$9 million. Therefore, it is recommended that BADC should establish more active DAP promotion efforts and simultaneously shift from TSP to DAP imports to the maximum extent possible.

#### B. Engineering Services for Fertilizer Storage Construction

The shortage of adequate storage space is one of the most critical constraints to increased fertilizer use. BADC's owned storage capacity is currently only 168,000 tons. Of this about 60,000 tons capacity is located at thanas where sales centers are expected to be closed soon under the New Marketing System (NMS). A total of 250,000 tons capacity storage has been rented but almost all of it is in deplorable condition with such defects as mud floors and leaky roofs and walls. Most of this hired storage should be released as soon as possible. BADC's owned/adequate storage is very small when compared against the 1979-80 target of 1,000,000 ton sales and the associated need for approximately 400,000 tons storage capacity. Considering the expansion of sales to 2,000,000 tons which is expected under the National Storage Plan to occur sometime between 1985 and 1990, the need to rapidly and dependably expand storage capacity is seen as critical.

On September 26, 1979, USAID approved BADC's contract with the International Engineering Company, Inc. (IECC) for design and supervision of construction of fertilizer storage warehouses. The contract also provides for IECC to assist BADC in preparation of a National Storage Plan for fertilizer for 1985-90.

To date, IECC has submitted 22 site plans, preliminary specifications and drawings, and preliminary cost estimates for approval. Also a draft National Storage Plan has been drawn up. This plan has the strong support of BADC middle level management who participated in extensive revisions of it.

IECC's schedule calls for completion of the National Storage Plan by July 1980; finalization of all plans, specifications, and tender documents for construction of the USAID funded "Phase II" storage program of construction of approximately 173,000 tons of storage capacity by August 1980; and contract award for construction services by January 1981.

IECC's effort appears to USAID to be inadequately organized and managed to meet the above schedule. Discussions are underway with IECC management and BADC concerning necessary corrective measures. While we anticipate some delays, we are confident of a construction award in early 1981 and active construction in the 1981-82 dry season.

The current outline of the National Storage Plan calls for new construction at 82 Primary Distribution Points (PDPs). New construction will total about 450,000 tons capacity required by 1985. When the plan is finalized, USAID and BADC need to meet to decide how much of the required storage will be built with USAID funding and in what ways USAID might assist BADC with engineering or planning of the other donor financed construction. This decision needs to be made prior to amendment of the project paper to add FY 81 and 82 funding.

C. Study of Bulk Import Alternatives and Preparation of Tender Documents for the Selected Bulk Import Alternative

An estimated 15 to 20 percent of the cost of all fertilizer imports in Bangladesh is a result of the fact that imports are in bags rather than in bulk and bagged mechanically in Bangladesh. At current prices of about \$300 per MT CIF and at the current level of import of about 600,000 MT per year, it is estimated that all bulk imports with mechanical bagging in Bangladesh would result in a net cost savings of \$45-\$60 per ton and would total \$27-\$36 million per year.

The need to move to mechanical bagging as opposed to bag-on-ship in Bangladesh is clear from the following considerations (i) the per ton savings are estimated to be much higher than the bag-on-ship \$16-\$32 per ton savings due to the facts that unloading and bagging will be by the receiver (BADC) not the shipowner and that mechanical bagging will allow much more rapid unloading, (ii) bag weight and machine stitching will be at a much higher standard and reliability and (iii) With bag-on-ship problems are likely to arise from time to time given the differing nature of various ship owners. Therefore, bag-on-ship is unlikely to be acceptable for all donors and benefits could not be extended to all imports. However, with mechanical bagging, all fertilizer imports in bulk would be feasible.

Soros Associates completed their feasibility study of bulk handling at Chittagong and Chalna Ports in April 1979. Three addendums to this study were produced dated December 1979. The principal recommendation was construction of large bulk storage and high speed mechanical unloading systems at both Chittagong and Chalna. Although the capital cost of this alternative was high, it appeared also to offer the greatest potential cost savings in quick ship turn around and maximum draft allowing a larger more economical average vessel size.

The principal feasibility issue remaining unresolved in the Soros Study was the human and organizational element. Considering this factor, and also the difficulties of obtaining funding for a capital intensive effort, BADC decided to develop tender documents for a portable bagging machine scheme.

The first draft of the Request for Technical Proposals (RFTP) was prepared by USAID at the request of BADC in December 1979 and January and February 1980. Comments were obtained from various offices of AID/W, equipment suppliers, and shipping industry sources. A second draft of the RFTP was produced in March 1980 and distributed to BADC, USAID, and others for comment. All comments received have been positive including commitments of cooperation from the ports of Chittagong and Chalna. Therefore, a final version of the RFTP is under preparation.

In brief, the concept envisioned is approximately five portable bagging machines placed along dock side at each Chittagong and Chalna. The bulk fertilizer will be unloaded from mother vessel or lighter into hoppers above each bagging machine. All fertilizer will be bagged at dockside and placed on board waiting transport.

In preparation of the scope of work, emphasis has been placed on sound design of organizational and service elements in conjunction with rigorous technical specifications for the bagging equipment. All service elements including lightering, operation of the bagging machines, stevedoring, and clearing and forwarding are a part of the bagging service contractor's scope of work. These items are to be performed in addition to provision of the equipment by the bagging services contractor.

Completion of the competitive process and award to the low bid prequalified firm is expected to require approximately six months. Mobilization of equipment and services is expected to require an additional six months. Therefore, we are hopeful that start up of the portable bagging machine scheme will be possible about one year from now.

#### D. Wheat Seed Import

Import of wheat seed was not an anticipated input in this project. However, rapid expansion of wheat acreage from 467,000 acres in 1977-78 to 1.7 million acres in 1979-80 provided an excellent and unique opportunity to forward the purpose (increased fertilizer use) and goal (increased foodgrain production) of the project. In 1979 USAID financed about 9,600 tons of wheat seed imports. One serious failure occurred when the entire cargo of 3,325 tons on board the Khalij Sea was infested to the point where it was no longer useable as seed. The other wheat seed imports of 6275 tons however were all sold and planted; accounted for an estimated fertilizer use of 7500 tons; and resulted in local wheat production estimated at 100,000 tons.

#### E. Technical Assistance in Fertilizer Import Programming Marketing and Distribution

On January 5, 1979, USAID approved BADC's contract with the International Fertilizer Development Center (IFDC) for technical assistance in fertilizer import programming, marketing and distribution. These services were therefore active during the entire period covered by this evaluation. USAID feels that the assistance has been well executed and in balance the results have been invaluable. The detailed and complex nature of this technical assistance, however, makes it difficult to describe what has been accomplished in a concise fashion. Some of the major events are described below.

IFDC assisted BADC with preparation of a monthly newsletter, the principal document used in programming fertilizer imports. Various technical advice was given on import prices and alternatives. A review was performed of the incidental costs of the fertilizer scheme. The New Marketing System for fertilizer was monitored, studied, and modified. BADC began the process of determining positions, duties, and responsibilities of the new staffing which will be necessary under the New Marketing System. The equity study was begun and the first report published in draft. The need for a BADC internal telecommunication system was discussed and it was determined to establish such a system to link all districts and transit points. The BADC library was established in the Headquarters office and IFDC provided fertilizer materials for it. IFDC hosted meetings between BADC, IECO and USAID to work out complex issues of the National Storage Plan. The need for dealer training was discussed in light of the increasing wholesale nature of fertilizer dealers. Some pamphlets were published for DAP promotion and the awareness of the need for this type of activity was increased. New terms were drafted and implemented for fertilizer movement contracts and shipping agent contracts. National projections of fertilizer use were made and discussed. BADC management awareness of the need for a central fertilizer inventory control system increased. Numerous donors and other foreign visitors were provided with information and assistance in preparation of their projects and/or papers. A national fertilizer transport movement plan was drawn up. The concept of unit train movement of fertilizer was adopted by the World Bank in their Fertilizer Transport Project. Participant training was provided in the United States and India. Cordial counterpart relationships were established. Disposition of damaged stocks was reviewed. Advice was given on bulk import.

The above is admittedly a rambling list of events and also doesn't come to a logical end. The list could be continued for several pages. In balance, the efforts have been very valuable. Some efforts however have been frustrating and not yet clearly fruitful. This has led to a change of approach in a number of areas and considerable thought and discussion on the scope of work for the contract extension for July 1, 1980 to June 30, 1981. It is hoped to agree on a final scope of work and to amend the contract in June.

#### 17. Outputs

Progress towards the four planned project outputs is assessed below:

A. Adequate Fertilizer Stock in Country

This output has been fully achieved and maintained. During the entire period of this evaluation, fertilizer stocks have been held at the minimum planned five months in country supply. The fact that sales were less than targeted reduced the need for imports, but adequate imports had been arranged to meet the need if the target sales had been achieved.

This good supply situation is a tremendous improvement from the national fertilizer shortage which persisted from late 1977 until early 1979. At that time, 176,218 MT of USAID financed imports arrived and in conjunction with stepped up imports from other donors put an end to the shortage. As a result, fertilizer prices to the farmers have been relatively close to the regulatory prices and availability to the farmer has been constant.

It appears prospects are good to maintain an adequate stock level for the next year or so. At that time, hopefully, the Ashuganj Fertilizer Factory will be at near full production and will greatly reduce the pressure of urea fertilizer imports.

B. Increased Fertilizer Storage Capacity

The USAID "Phase I" program, BADC's own "Hard Core" program, and increased renting and purchase of storage space increased BADC's reported storage capacity to some extent during the period of evaluation. But fertilizer storage construction under this project is still at the input level as described above and has not reached the output stage yet.

C. Fertilizer Bulk Handling and Bagging

As described in 16.A above the bag-on-ship approach to bulk imports was tried and proven. However, the portable bagging machine scheme per 16.C above remained in the input stage.

D. New Marketing System (NMS) for Private Dealers Adopted

Considerable success was achieved on this output. The NMS introduced in Chittagong Division on December 1, 1978 was expanded to Dacca and Khulna Divisions on January 1, 1980. On July 1, 1980 when the NMS is extended to Rajshahi Division, it will cover all of Bangladesh.

IFDC with assistance from BADC and USAID has been preparing the second evaluation of the NMS. The first draft has been prepared for review and the major findings relating to operation of the NMS in Chittagong Division for the last 18 months are given below:

- Farmers' access to buying sources has increased by about 130 percent.
- Prices farmers pay for fertilizer are lower under the NMS.
- Sales from 16 Primary Distribution Points (PDPs) in Chittagong Division represent 80.8 percent of total division sales and 70 of the 114 Thana Sales Centers (TSCs) have been closed. This represents definite progress towards the NMS goal of consolidation of BADC points of sale to PDPs.
- Any person is free to register as a dealer and buy direct from BADC without restrictive licensing requirements. Dealers under the NMS report this freedom as being a major positive feature of the NMS.
- Dealers are permitted to sell fertilizers anywhere and have been observed to move fertilizers long distances (over 100 miles) to fill up local shortages.
- Whereas previously cooperatives enjoyed fertilizer wholesales monopolies in some thanas of Chittagong, Noakhali and Comilla Districts, under the NMS they have been forced to compete. Data on their performance is available only for Comilla and Noakhali Districts. In those districts so far the cooperatives have proven ineffective and their sales have dropped to 17 percent of the previous level. This indicates that other private sector dealers are more effective.
- The movement towards fertilizer wholesalers who can assume some of the storage and distribution burden from BADC has begun. In Chittagong Division, 40 percent of active PDP dealers are operating as wholesalers selling 50 percent or more of their sales to sub-dealers. The wholesalers on the average sell to four sub-dealers.

Sales in the division as a percentage of national sales have remained unchanged. The principal reason for this is seen as being that the drought was on the average more severe in Chittagong Division than in the rest of Bangladesh. A related factor is that initial introduction of the NMS caused a tremendous upheaval in the dealer population. Many small dealers went out of business or had to regroup as sub-dealers.

Perhaps the greatest measure of success of the NMS is that BADC management is now fully convinced of its value and committed to its success. The considerable extent of skepticism in BADC which existed prior to introduction of the NMS has now virtually disappeared.

#### 18. Purpose

The project purpose is increased fertilizer use on an equitable basis.

##### A. Fertilizer Use

During 1977-78, the year before start of this project, fertilizer sales in Bangladesh increased by 42 percent. Fertilizer use increased by 3 percent during 1978-79, the first year of the project. So far (July - April), fertilizer use has increased by 9 percent during 1979-80. This progress is measured against an objective of 15 percent annual increases in overall fertilizer sales.

Adverse climatic conditions (drought) are seen as largely responsible for holding down the progress of sales inspite of the good stock situation and progress made on the supply side. However, it also appears that in a number of areas, sales are sluggish due to a lower than normal yield response to the basic macro nutrient fertilizers sold in Bangladesh, and in a significant number of cases this is suspected to relate to soil deficiencies in micronutrients. This suspicion leads to the recommendation in item 8 above that USAID attempt to arrive at a clear action oriented policy to assist Bangladesh in this area.

##### B. Equity of Fertilizer Use

The International Fertilizer Development Center (IFDC) has produced a "preliminary draft for discussion only" of their first phase report "Bangladesh -- Equity Effects of Fertilizer Use." The discussion below is based on the findings contained in this draft report which is called for short "the equity study".

The study was done of the transplant aman (T.aman) crop of 1979. The study was done jointly with the Bangladesh Agricultural Research Council (BARC) and the BARC was responsible for collection of all of the field data. Every attempt was made to collect data of high reliability and statistical validity.

Ten areas in ten different districts were purposively selected to obtain geographic distribution, but survey populations in each area were randomly selected. In each area, 120 farms were continuously monitored by resident enumerators stationed in the area to observe throughout the crop season. The objective was to obtain reliable data on at least 100 farms in 10 areas. This was to allow the principal investigators to discard data on up to 20 farms in each area. In the end, 1053 sets of farm data were determined to be acceptable and form the basis of the results summarized below:

(i) Percentage of Farmers Using Fertilizer by Farm Size

A larger percentage of pure tenants and farmers owning up to one acre were found to use fertilizer than other farmers.

<u>Farm Size</u>	<u>Percentage of Fertilizer Users</u>
Landless (no homestead even)	68
0 - 1 acre	71
> 1 - 2.5 acres	61
> 2.5 - 5.0 acres	63
> 5.0 - 7.5 acres	60
> 7.5 acres	61

(ii) Average Levels of NPK Plant Nutrient Use

The average levels of fertilizer (NPK) use were:

- highest on small and medium size farms and lowest on large owner operated farms
- much higher on owner operated land than on rented-in land
- on rented-in land only highest on the smallest farms with marked decline at the medium and large farm sizes.

<u>Farm Size</u>	<u>Pounds Per Acre</u>	
	<u>Owner Operated Land</u>	<u>Rented-In Land</u>
Landless	-	31.2
0 - 1 acre	37.6	18.4
> 1 - 2.5 acres	34.4	11.2
> 2.5 - 5.0 acres	36.0	4.0
> 5.0 - 7.5 acres	30.4	5.6
> 7.5 acres	24.8	2.4

(iii) Use of Other Inputs in Association with Fertilizer Use

It was found that the use of other inputs and the use of fertilizer have a positive statistical relationship. This illustrates the well known fact that inputs are interdependent.

<u>Input</u>	<u>Percentage of Fertilizer Users Using Input</u>	<u>Percentage of Fertilizer Non Users Using Input</u>
HYV	42	7
Irrigation	12	2
Farm Manure	59	46
Pesticides	41	10
Hired Labor	88	70

(iv) Hired Labor Employment

On the T. Aman crop on farms where fertilizer was used an average of 28.4 work days of hired labor were employed per cultivated acre whereas on farms where fertilizer was not used an average of 19.2 work days of hired labor were employed per cultivated acre.

It should be noted that not all of the increase in labor use is due to increased fertilizer use alone. It is rather a result of a combination of inputs being interdependent. In the equity study, an attempt is made to isolate the effects of fertilizer use through regression analysis. This analysis indicates that perhaps 2.7 of the 9.2 work day difference given above could be caused by fertilizer use.

(v) Estimated Distribution of Benefits of Fertilizer Use to Farms of Different Sizes

In the equity study, regression analysis is used to estimate yield responses to fertilizer which in turn are used to estimate the direct taka benefits of fertilizer use. The benefits of fertilizer use per acre by farm size have to be adjusted for the proportion of cultivated land sharecropped within each farm group. This is done by adjusting for the proportion of the crop which is paid in rent. When this exercise is performed, it is found that small farms derive a much higher benefit per acre from fertilizer use than larger farms do.

Average Benefits in Takas Per Acre

<u>Farm Size</u>	<u>Not Adjusted</u>	<u>Adjusted</u>
0 - 1 acre	55.87	18.18
> 1 - 2.5 acres	28.80	20.35
>2.5 - 5.0 acres	8.17	5.63
>5.0 acres	7.27	5.61

The equity study is admittedly still in the draft stage and still needs editorial revision in a number of areas. USAID, however considers the report to be basically well done and to contain sound analysis. It is planned to extend the equity study through at least one complete additional year of all crop seasons repeating over again the T. Aman season.

The results of the study are the first such results available. Therefore, it is not possible to compute the percent annual increase in fertilizer sales to cultivators of two acres or less as a measure of purpose achievement in the equity aspect. That sales to this group of farmers is increasing, however, can safely be assumed from the general increases in fertilizer use and the widespread use of fertilizers by small farmers which is indicated above.

19. Goal

The project goal is increased foodgrain production, especially by small farmers.

Crop production statistics are estimated in Bangladesh on the local level and compiled to obtain national level estimates for each crop such as T. aman for instance. However, the estimation method is approximate and also, national production varies from year to year for many reasons both related and not related to fertilizer use.

In the case of the T. aman data collected under the equity study, regression analysis was used to estimate the effect of fertilizer use on yields per acre. Fertilizer use was estimated to have resulted in a 4.3 percent increase in production on the T. aman crop. This low yield response may be attributable, at least in part, to the drought situation. Whatever the explanation, if the equity study average increase in yields due to fertilizer use is applied to the entire 10 million acres in T. aman production in 1979, it results in an estimated 260,000 tons increment in production. Given the severe hunger situation which prevailed during 1979, such a production increment is significant.

Another significant point to note is that the equity study average of 37.4 pounds of fertilizer used per acre is far below the recommended application rate of over 200 pounds per acre. As the use of fertilizer increases, the increment in yields is also predicted to increase.

## 20. Beneficiaries

In the equity study regression analysis was used to estimate the effect of fertilizer use on yields per acre by farm size. The results indicate that the small farmers obtain the highest yield per acre for fertilizer use:

<u>Farm Size</u>	Average Fertilizer Use (NPK) in <u>Lb. per acre</u>	<u>Percent Increment in Yields Attributed to Fertilizer Use</u>
0 - 1 acre	44.4	6.1
> 1 - 2.5 acres	33.6	4.2
> 2.5 - 5.0 acres	34.5	3.3
> 5.0 acres	<u>29.5</u>	<u>2.8</u>
All sample	37.4	4.3

21. Unplanned Effects

Not pertinent at this time.

22. Lessons Learned

Some of the principal lessons learned are:

- Fertilizer use by small farmers is widespread.
- A major shift in control of fertilizer distribution from the public sector to the private sector is taking place. Attitudes resisting this shift have considerably lessened.
- Fertilizer use even in a severely bad agricultural year can be of value in increasing scarce food availability and small farmer yields.
- Project assistance in the fertilizer sub-sector of agriculture is a viable concept in Bangladesh. A similar approach may be equally applicable in other countries.

23. Special Comments or Remarks - Subsidy

AID/W has raised once again the subsidy issue. We believe that the World Bank has been taking an effective position on price increases this year and our likely action is to confirm that we support the overall fertilizer price increases planned by the BDG and supported by the World Bank. We will do so in the multilateral context and in conjunction with negotiation of this year's Project Agreement Amendment. We are equally concerned, however, to effect cost reductions to reduce subsidy and we hope that this side of the subsidy issue will not be lost sight of. Specifically, we note that the current project incorporates three major areas of cost reduction. As described in the Project Paper and in items 16.A., 16.C. and 17.D above, these are: reduced distribution costs arising from the transfer of the marketing function from the public to the private sector; the shift to bulk handling and bagging at the ports; and the substitution of DAP for TSP as the major phosphate fertilizer in Bangladesh.