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REPORT

to

The Agency for International Development
concerning

FARM IMPROVEMENT

SEED PROCESSING PLANTS, DRYING AND STORAGE FACILITIES

for the

East Pakistan Agricultural Development Corporation
Government of Pakistan

by

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INTRODUCTION

Rapidly expanding populations in the developing countries are putting strains on food supplies. The people look to the farmer for help. But the farmer does well to feed himself and his family. He knows the capability of his land. He should, since he has been farming it the same way his father and grandfather before him. In fact, farmers in a large part of the world are using methods many generations old.

A new day is at hand now in many places and rapidly approaching in many others. It is the day of "new technology". The technology is not entirely new, but it has some new components, primary of which is a sense of urgency. The U. S. Technical Assistance Program, the FAO, the Rockefeller Foundation, and others, as well as a few leaders in developing countries have felt this urgency for about 25 years, but only in very recent years has the knowledge that the world is on the verge of a serious problem received much attention from world leadership.

Finally, governments are recognizing the source of their food and finding out that their agriculture is ill-prepared to cope with the problem by traditional methods. Fortunately, the last two decades has seen international programs of one sort or another, most originating in the United States, conduct meaningful research, train agricultural scientists, and advise administration and technical leaders of developing countries on the problems and approaches in agricultural development. As a result, the application of known scientific knowledge and materials in the form of improved seed, fertilizers, irrigation, insecticides, fungicides, herbicides, improved cultural methods, credit, and technical assistance, the farmer can easily move the "world starvation date" 30 years further into the future. In the meantime, he hopes to get some help on the population control front.

Modern technology does work. Its wise application will produce increasing amounts of food. And as local research is strengthened, expanded and applied, this technology will continue to produce more food – at less cost. When set in a favorable social, economic, and political climate it will not only produce more food but will help build a firm base for a strong economy.

Recognizing the value of improved seed as an essential input of modern agricultural technology, the Government of Pakistan has requested a loan from the Government of the United States for use in the province of East Pakistan. This loan would be used to purchase equipment and to construct facilities for improving seed multiplication farms and associated seed facilities under the management of the East Pakistan Agricultural Development Corporation (EPADC), a semi-autonomous government agency. The improvement of the farm operations and the construction and equipping of seed processing, drying and storage installations would enable EPADC to improve the quality and increase the quantity of planting seed, primarily rice, for use by the farmers of the province, which should in turn make more food available for a rapidly expanding population.

Mississippi State University was requested by the Agency of International Development (AID) to send a team to East Pakistan to study the plan, to report findings and to suggest program direction. Herein is the report.

Team members were those listed as authors of the report. Travel and subsistence were paid by the USAID/East Pakistan while all services and expenses were financed under the Mississippi State University/AID Contract-607. Travel to and within East Pakistan was performed within the months of May and June, 1968.

Prior to the Team's arrival in East Pakistan, the USAID office had acquired the services of Mr. John Propst, Agricultural Engineer, USAID/Nepal to make a study of land forming (cutting and leveling) and general farm improvement and to suggest equipment needs. This report was later (April, 1968) used by USAID/East Pakistan in the preparation of a Capital Assistance Paper (CAP) entitled East Pakistan Agricultural Development Corporation Seed Multiplication Farms – Mechanization Project. The Team was asked to evaluate and consider these reports in making its study and recommendations.

During the month in East Pakistan the Team studied and accumulated reports and records from the USAID offices, the EPADC office, the Ministry of Agriculture and others, conferring at length with personnel in these offices on pertinent matters. The Team traveled within the province for a period of ten days, visiting the 3000-acre farm, all 500-acre farms and one-fourth of the 100-acre farms of EPADC, walking over each farm, talking with farm manager, examining production cost and other operational farm records including proposed production schemes.

Generally speaking, farm improvement, which may include leveling, irrigation, mechanization, fertilization, and so forth and improved seed production are not necessarily one and the same thing. The primary purpose of farm improvement is to increase total production of farm products, one of which may be seed. But increased yield from a seed farm is of little value unless the seed so produced is handled in such a way as to insure purity of variety, relative freedom from weed seeds, and emergence of vigorous seedlings. Relating to the East Pakistan proposal, farm improvement alone will not make available better quality seed, although it will provide a greater total amount. Conversely, improving seed quality by strict production procedures and improving facilities for cleaning, drying and storage will result in quality seed, but at a cost which may be excessive unless accompanied by improved farming methods. The farms need the specialized seed equipment to produce quality seed and the seed division needs the increased yield to help pay for the quality seed.

AGRICULTURAL PRODUCTION TARGETS AND THE DEMAND-SUPPLY FOR SEEDS AT THE FARM LEVEL

Pakistan, like many other developing countries, has a population growth rate which exceeds that of food production. During recent years the consumption of food has been increasing faster than domestic production. The problem is even more acute in East Pakistan where the potential of bringing more land under the plow is very limited.

The President of Pakistan recognized the problem facing East Pakistan and directed the Government of East Pakistan to draw up an "Action Programme for Attainment of Self-Sufficiency in Food Production by 1969-70." This was done and published by the Agricultural Department, GOEP, October, 1967. The report not only pointed up the need for a larger volume of food but also for a better balanced diet.

Daniel G. Ritchie, working under the direction of USAID Agricultural Division, made a study of food needs in East Pakistan. This study, entitled "The Diversification of Agriculture in East Pakistan," was written with the cooperation of the Public Health staff of USAID and personnel of various GOEP departments and agencies. Published in February, 1968, this study also points up the great need for a better balanced diet, and shows that some diversification of resource use could result in higher total food production.

A. **Production targets** are expected to be achieved through increased productivity and more multiple use of land resources.

1. **Rice production targets may be difficult to achieve.** Rice represents the major food item in East Pakistan. Table 1 shows the 1964-65 benchmark production level of rice and the target for additional production through 1969-70 – the last year of the Third Plan period.

Rice production targets at 13.4 million tons in 1969-70 are almost one-third greater than the 1964-65 level. This is a rather ambitious program. Since there is a limited supply of improved seeds as well as other necessary inputs, there is some doubt that the self-sufficiency goal will be reached by the end of the Third Plan.

As shown in Table 1, 1.5 million tons of this planned increase is to come from IRRI rice and 1.7 million tons from improved local rice. Both represent very significant increases depending, to a large measure, on availability and use of improved seeds along with other inputs required.

2. **Wheat production targets set for almost threefold increase may not be attainable by the last year (1969-70) of the Third Plan.** A production target of 110,000 tons of wheat in 1969-70 compares with 40,000 for the 1964-65 benchmark period and 50,000 for 1966-67. Table 2 shows the 1964-65 benchmark level and targets for additional production by 1969-70.

As shown in Table 2, the production of Mexi-Pak wheat is expected to add 24,000 tons in 1967-68 and increase to 50,000 tons two years later. Improved local varieties are projected to add 3,000 tons in 1967-68 and increase to 20,000 tons by 1969-70. Although wheat is an important and fast growing source of food grain, it is doubtful that the 1969-70 target for 110,000 tons will be achieved. Availability and use of improved seeds as well as other inputs will determine the extent to which the 1969-70 goal is met.

3. **Vegetable production targets at almost 387,000 acres in 1969-70 represent a significant increase from the 282,550 acres reported for 1966-67.** An adequate supply of improved seeds, fertilizer, irrigation, and pest control coupled with a strong extension program could well result in a large movement toward the desired goal. Winter vegetable seed production on EPADC's Seed Multiplication Farms increased from just over 100 pounds in 1963-64 to over 6,000 pounds in 1966-67. This achievement represented 92 percent of the target set and now virtually meets the winter vegetable seed needs instead of importing some 4,000 pounds annually as in earlier years.

4. **Potato production targets reflect 86 percent increase** from just under 400,000 tons in 1964-65 to 734,000 tons in 1969-70. This increased production is expected to provide 29.9 grams and 21 calories per capita per day in 1969-70 compared to 17.2 grams and 14 calories available in 1965-66.

The major bottleneck of adequate supplies of disease-free improved seeds is expected to be largely overcome as the new cold storage facilities and registered grower programs get underway.

5. **Pulse production targets for the Third Plan are set 40 percent above the 1964-65 level.** The target for 1969-70 is 313,000 tons compared to 224,000 tons in 1964-65. De-

Table 1. Benchmark (1964-65) and Targets for Additional Rice Production in East Pakistan by 1969-70.

Item	1967-68	1968-69	1969-70
		1,000 Long Tons	
Benchmark production	10,200	10,200	10,200
Targets for additional production			
IRRI rice	458	866	1,473
Local rice	715	1,048	1,717
Total rice production targets	11,373	12,114	13,390

Source: *Programme for Attainment of Self-Sufficiency in Food Production in East Pakistan by 1969-70.*

Table 2. Benchmark (1964-65) and Targets for Additional Wheat Production in East Pakistan by 1969-70.

Item	1967-68	1968-69	1969-70
		1,000 Long Tons	
Benchmark production	40	40	40
Targets for additional production			
Mexi-Pak wheat	24	36	50
Local wheat	3	10	20
Total wheat production targets	67	86	110

Source: *Programme for Attainment of Self-Sufficiency in Food Production in East Pakistan by 1969-70.*

velopment of higher yielding varieties, availability and use of improved seeds, fertilizer and plant production will determine, to a large extent, the movement toward the Third Plan goal.

6. **Sweet potato production targets set at 190,000 acres by 1969-70 compared** to 144,000 acres in 1966-67. The projected increase in sweet potato acreage is reported to be easily attainable.

7. **Edible oil seed production targets for self-sufficiency extended into the Fourth Plan period** (1971-72). East Pakistan produces about one-third of its needs of edible oils and obtains the balance from West Pakistan and abroad at the cost of valuable foreign exchange.

The 1963-64 to 1966-67 four-year average shows consumption of edible oils at just over 110,000 long tons. Of this amount, 69,000 are imported compared to 41,000 tons produced in East Pakistan. Mustard, sesame, and peanuts are the three crops produced locally at an annual average of about 30,000, 7,000 and 4,000 tons, respectively.

Oil production per acre from mustard and sesame is only about one-third that of peanuts. This factor plus less land use, competition and the possibility of multiple crops per year gives an advantage to peanuts as the oilseed crop most likely fills the self-sufficiency gap for edible oils in the years ahead in East Pakistan. Some 32,000 tons of peanut seed are planned during the Kharif season of 1971-72 through a system of selected farmers. These seeds are estimated to plant 950,000 acres during the Rabi season of 1971-72 and to give a harvest of 500,000 tons of nuts. At the oil conversion rate of four to one, these peanuts would supply about 125,000 tons of oil – more than the total consumption of edible oils in 1966-67.

As with production targets for several other crops, the target for increased peanut production for oil is quite substantial and will likely be very difficult to achieve. However, any increases resulting in less imports of edible oils will reduce the need for foreign exchange in the area of food purchases.

8. **Sugarcane production targets are to be achieved through higher yields of cane and increased sucrose content of the cane.** If sucrose content of the sugarcane can be increased from its present level of 7.8 percent at a recovery rate of 9.5 percent achieved by India, the 425,000 acres now devoted to sugarcane would be adequate to meet the needs. Improved varieties and wide-scale adoption of inputs such as fertilizer, irrigation facilities, and plant protection measures are also essential in achieving the targets set for production of sugar and sugarcane.

9. **Fruit production targets are focused on rapid expansion of quick-growing fruits** like bananas, pineapples, and papayas. The Directorate of Agriculture is expected to make suckers and seeds of these fruits available. EPADC has planned for special expansion of Mango production in selected districts.

B. The total demand for seed over the next ten years appears to be rather constant; however, there is expected to be an increase in demand for "improved seeds." The increase in use of "improved seeds" will be influenced to a large degree by (1) producers' confidence in "improved seeds"; (2) producers' rate of acceptance of new highly publicized varieties of seed such as IRRI rice and Mexi-Pak wheat; (3) availability of credit to finance other essential inputs such as fertilizer, irrigation water, insecticides, etc.; and (4) producers' prices received for their production in excess of subsistence needs.

Total land area will remain limited and area devoted to rice production at or near the 22.5 million acres, average for recent years. Average per-acre rice seed needs are estimated at about 50 pounds. This reflects almost half of the acreage being planted in broadcast manner requiring one maund (82.29 pounds) per acre and just over half of the acreage being planted in transplant manner requiring one-fourth maund (20.57 pounds) per acre. At an average planting rate of 50 pounds per acre, the 22.5 million acres of rice would require about 500,000 long tons of seed each year.

Table 3 shows projections for rice consumption, yields, acreage available, total and improved seed needs, 1965-75. These data reflect an annual increase in consumption and in rice yields of 4.8 percent. The East Pakistan Government has placed major emphasis on self-sufficiency in food Production. The yield data projections reflect a belief that the 4.8 percent annual increase can be attained by rice producers in East Pakistan. Based on this increase and starting from the 1,000 pound per acre actual yield in 1965, the food grain production and domestic consumption may come into balance. East Pakistan's food grains can

Table 3. Projections for Rice Consumption, Yields, Acreage Available, Total and Improved Seed Needs, 1965-75.

Year	Consumption[1]	Yields[2]	Acreage Available[3]	Total Seed Needs[4]
	Mil. L. Tons	Lbs/Acre	Mil. Acres	1,000 L. Tons
1965	10.05	1,000 act.	----	----
1966	10.53	----	----	----
1967	11.04	----	----	----
1968	11.57	----	----	----
1969	12.12	1,206	22.5	500
1970	12.71	1,264	22.5	500
1971	13.32	1,325	22.5	500
1972	13.96	1,388	22.5	500
1973	14.63	1,455	22.5	500
1974	15.33	1,525	22.5	500
1975	16.06	1,598	22.5	500

[1]Data for 1965, 1970, and 1975 represent projections by S.A. Abbas in Supply and Demand of Selected Agricultural Products in Pakistan 1961-1975. All other years based on annual increase of 4.8 percent – same as reflected by the 1965, 1970, and 1975 data.

[2]Data calculated by dividing consumption by acreage available – reflecting the 4.8 percent annual increase.

[3]Acreage available for rice production is assumed to continue at about 22.5 million acres.

[4]Average seed needs of 50 pounds per acre resulting from broadcast acreage seeded at 82.29 pounds per acre and transplanted acreage at 20.57 pounds per acre.

remain in balance through 1975 if the 4.8 percent rate can be maintained.

Wheat consumption in East Pakistan according to S.A. Abbas in **Supply and Demand of Selected Agricultural Products in Pakistan, 1961-75**, is expected to increase at an annual rate of about 2.9 percent. Appendix Table 1 shows that the 100,000 tons consumption level of 1965 would increase to 146,000 tons by 1975.

East Pakistan farmers have never produced large amounts of wheat as reflected by the 34,000 ton production of 1965. However, the introduction of Mexi-Pak wheat has created a great deal of interest in producing wheat. As additional land comes under irrigation, there are indications that the demand for wheat may well be met by expanding production during the dry winter months when much of the land resources are normally idle. The 1975 acreage requirement of 260,000 and related yield of 1,246 pounds per acre, shown in Appendix Table 1, can be met if seeds of Mexi-Pak or some other good high-yielding varieties are available. ADC's SM farms are now estimating their Mexi-Pak wheat yields at 1,234 pounds per acre.

Vegetable seed demand will expand some as extension and other organized groups promote vegetable growing as a means of improving diets and more nearly meeting the food needs of the province. ADC's SM farms have developed their vegetable seed production program quite fast over the past few years. Vegetable seeds produced by SM farms, at some 6,000 pounds annually, about meet the needs of the province and have eliminated an annual import of some 4,000 pounds costing scarce foreign exchange. There appears to be no reason why vegetable seed production needs of the types that can be produced in East Pakistan will not continue to be met by SM farms or other growers under their jurisdiction.

Demand for "improved seeds" is expected to increase with each year over the next decade. The rate of increase is not predictable, especially for rice and wheat. However, there are indications that use of "improved seeds" will be speeded up significantly due to the recent introductions of the new highly publicized IRRI varieties of rice and Mexi-Pak wheat. Development and implementation of a quality seed production program, coupled with a better seed distribution system, a stronger extension program, and an adequate supply of other necessary inputs, including credit, are expected to influence use of "improved seeds" as never known before in East Pakistan.

Total annual "improved rice seed" needs are estimated at 500,000 long tons as shown in the previous table. Table 4 shows that in 1969 there are estimated to be 20,000 tons of "improved rice seeds" available. This represents about 4 percent of total seed needs. ADC's SM farms and registered growers are each projected to furnish 3,000 tons or a total of 6,000 of the 20,000 tons. Other improved seeds include some IRRI and other varieties that may be imported by ADC and also a significant amount of "improved seeds" coming from farmers who have seed one or two years from ADC's seed improvement system.

Table 4 points out recommendations of the Mississippi State University Team as reflected by holding ADC's SM farm production and registered growers at 5,000 tons each representing a total of 10,000 acres and an amount thought to be manageable in a seed multiplication program.

Table 4. Projected Total Annual Rice Seed Needs, Improved Seeds, Total and Amount Provided by ADC's SM Farms, Registered Growers and Others, 1969-1975.

Year	Total Seed Needs[1]	Percent of Total	Improved Seeds[2] Total Amount	ADC's SM Farms	Registered Growers	Others
	1,000 L. Tons	Percent	1,000 L. Tons			
1969	500	4	20	3	3	14
1970	500	4	22	4	4	14
1971	500	5	24	5	5	14
1972	500	5	26	5	5	16
1973	500	6	28	5	5	18
1974	500	6	30	5	5	20
1975	500	6	30	5	5	20

[1]Data from preceding table on rice projections.
[2]Mississippi State University Team estimates based on projections in Third Plan Schemes for SM Farms and registered growers, actual accomplishments to date, and MSU Team's estimates of likely development for registered growers and recommended level for the SM farms.

Table 5. Production of Improved Rice Seeds as Estimated and Reported in Third Plan Schemes for SM Farms and Registered Growers and MSU Team Estimate.

Item	1966-67	1969-70
	Long Tons	
Seed Multiplication Farms		
Scheme estimated[1]	3,054	6,760
Actual reported[1]	2,294	xx
MSU Team estimate	xx	3,000
Registered Growers		
Scheme estimated[2]	5,537	11,928
Actual reported[2]	1,571	xx
MSU Team estimate	xx	3,000
Total scheme estimates	8,591	18,688
Total actually reported	3,865	xx
Total MSU Team estimate	xx	6,000

[1]Source: ADC's 1966-67 Annual Report and Third Plan Scheme for SM Farms.

[2]Source: Third Plan Scheme for Production of Improved Seeds through Registered Growers. See Appendix Table 2 for details.

By 1975 "improved rice seed" use is expected to approach 30,000 tons - 50 percent above the 1969 level - as full implementation of the improved program by ADC's SM farms and registered growers can become a reality. This represents about 6 percent of the total rice seed needs at that time.

Table 5 shows the estimates of "improved rice seeds" for 1969-70 as listed in the Third Plan Schemes for both SM farms and registered growers as well as the MSU Team's estimate. In addition, actual procurement and distribution for the 1966-67 period is shown in Table 5. Seed Multiplication farms actually produced 75 percent of their scheme plans in 1966-67. Lack of facilities, equipment, and trained technicians, no doubt, influenced the quality of the seed reported. Registered growers' seed production as shown in Table 5, amounted to only 28 percent of that planned in the scheme. Both SM farms and registered growers are projected for 3,000 tons each in 1969-70.

"Improved wheat seed" use is also expected to expand rather rapidly as the new Mexi-Pak or some other high-yielding varieties provide good alternative use for land resources during the winter months. Table 6 shows "improved wheat seed" use projected at 1,500 tons in 1969 and 27 percent of the total seed needs. Appendix Table 2 shows the program of "improved wheat seed" production by ADC's SM farms and registered growers with a goal of

Table 6. Projected Wheat Acreage, Total Seed Needs, and "Improved Seeds," 1969-75.

Year	Projected Acreage	Seed Needs[1]	Improved Seeds	
			% Total	Amount
	1,000 acres	1,000 L. Tons	Percent	1,000 L. Tons
1969	200	5.5	27	1.5
1970	210	5.8	29	1.7
1971	220	6.1	31	1.9
1972	230	6.4	33	2.1
1973	240	6.6	35	2.3
1974	250	6.9	35	2.4
1975	260	7.2	35	2.5

[1]Seed needs based on 62 pounds of wheat seed used per acre of wheat planted.

4,408 tons by 1969-70. Expected procurement and distribution are given as 1,286 tons for that same year. According to Table 6 the total wheat seed needs in 1975 will be about 7,200 tons. Improved seed use is projected at 2,500 tons and 35 percent of the total needs. This high percentage use of "improved seeds" is based on assumptions that most of expanded wheat acreage being planted to "improved seeds" and seed storage from one season to the next continues to be a serious problem for most farmers.

There will be several sources of "improved rice and wheat seeds" including ADC's SM farms, registered growers, and not the least may be growers themselves. Where season-to-season storage facilities are satisfactory, many farmers will carry their own "new" seeds (just one year or so from registered growers) to the next season for planting. In addition, some will establish a sideline of selling small amounts of their own "new" seeds - all of which will contribute to more use of improved seeds that are likely to increase crop yields.

It must be emphasized that demand for improved seed is going to be the influencing factor on whether a supply will be available. The demand in turn will be determined not only by existence and availability of superior seed but also upon the availability of the other necessary inputs - chiefly fertilizer, insecticides, fungicides, and credit - at prices which will make the use of them profitable. For example, an efficient domestic fertilizer industry could put fertilizer materials within the financial reach of every farmer. Since improved seed usually responds to increased fertilizer rates, the demand for improved seed should closely parallel the use of fertilizer.

How much improved seed will actually be available for meeting projected targets? In answer, most any base can be selected as a starting point. But consider 20,000 long tons (referenced earlier) to be a realistic prediction for 1969. This amount of seed will plant about 900,000 acres (sowing rate = one maund/acre for broadcast rice and one-fourth maund/acre for transplanted rice - about equal amounts of each and weighted average of 50 pounds per acre.)

East Pakistan allocated additional resources to food production. Since the cultivatable area of East Pakistan is limited, any substantial increase in agricultural production can be brought about only by better cultural practices and more efficient production methods. The Programme for Self-Sufficiency has two main objectives. In the first place, it will be necessary to raise an additional crop on the same land wherever possible. Secondly, yields of existing crops must be increased. In order to do this, the Programme report says full use of all agricultural inputs and services will have to be made. These include: (1) irrigation water, drainage, and flood control; (2) low lift pumps; (3) fertilizer; (4) better seeds; (5) plant protection; (6) better cultivation practices; (7) development of supporting services, including extension; and (8) credit.

GOEP has promised high priority on food production and is allocating large amounts of resources toward the further development of food production. Table 7 shows the original Third Plan allocation for specified inputs and services and the additional allocation required for the last three years of the Third Plan period.

Table 7 shows that more than $400 million (Rs. 1,957.795 million) were originally allocated to inputs designed to increase food production. Of this amount some $200 million were set up for agricultural credit and $100 million to fertilizers, both of which are extremely essential to increased use of improved seeds. Another input expected to increase demand for improved seeds is the educational services provided by the Agricultural Extension. This was recognized in the Self-Sufficiency Program by setting up additional allocation three times that was set up in the original Third Plan allocation.

The original allocation plus the additional allocation planned for the last three years of the Third Plan totals almost $550 million or Rs. 2,604 million. In addition, some $66 million in foreign exchange is estimated necessary to reach the "self-sufficiency" goal. If finances of this magnitude can be obtained by the East Pakistan Government and used wisely in securing the above inputs for agriculture, the goal of "self-sufficiency" in food grain production may well be a realistic attainable goal.

Table 7. Allocation Required to Finance Specified Inputs for Self-Sufficiency Programme in Food Grain Production.

Inputs and Services	Third Plan Allocation	Additional Allocation Required			
		1967-68	1968-69	1969-70	Total
			$ Million		
Fertilizer	101.198	--	5.959	11.370	17.329
FEC			(8.360)	(16.198)	(24.558)
Improved seeds	2.011	.549	.234	.528	1.311
FEC		(.732)	(.335)	(.671)	(1.738)
Plant protection	53.965	1.641	3.616	7.353	12.610
FEC		(1.101)	(2.687)	(5.387)	(9.175)
Irrigation	51.052	5.928	10.344	16.032	32.304
FEC		(2.647)	(5.182)	(8.224)	(16.053)
Agricultural Extension	2.404	.439	3.110	3.574	7.123
FEC		(.056)			(.056)
Agricultural credit	198.550	10.107	19.721	34.546	64.374
FEC		(1.045)	(6.270)	(7.315)	(14.630)
Total	409.180	18.664	42.984	73.403	135.051
Foreign Exchange Component		(5.581)	(22.834)	(37.795)	(66.210)

Source: Computed from page 74 in *Programme for Attainment of Self-Sufficiency in Food Production in East Pakistan by 1969-70.*

C. **Research and introduction programs** to make available new and superior varieties of agricultural crops in East Pakistan lies with the Agricultural Research Institute of the Directorate of Agriculture which has had a rice research program since 1911. In the beginning, breeding work was confined to Aus and Aman crops, while in 1934, improvement work was started on Deep Water rice and Boro crops. In 1965, this Institute in cooperation with the International Rice Research Institute (IRRI) launched an Accelerated Rice Research Program. Aims of this program include (1) introducing and rapidly testing varieties developed under the IRRI breeding program, (2) conducting research on cultural practices to gain maximum yield of the new varieties, (3) thoroughly using germ plasm introduced by IRRI, to develop varieties adapted to environmental conditions of East Pakistan and (4) making available seed stocks of new adapted varieties for multiplication to quantities ample for general use. In 1966-67, 70 agricultural scientists, administrators and planners were working on this accelerated program.

The introduced varieties of IRRI have not to date been completely satisfactory. For example, IR-8 grown in the Boro season matures 30 to 45 days later than expected. General local varieties developed earlier by province breeding programs have yielded almost three tons per acre under a large number of test conditions. These good local varieties combined with the research program should produce, in the relatively near future, superior adapted varieties for each of the rice growing seasons.

The development of a new variety, either by breeding, introduction, or both, is of little practical value unless accompanied by a program which moves seed stocks of the new variety into a supervised multiplication program. Such a program will be discussed in a later section. It is sufficient to say here that specific responsibilities be assigned to a specific person(s) within the Directorate of Agriculture to plant increased blocks of new varieties (or hybrids, strains, etc.) under close attention in order to have pure seed stocks to pass on to the producer of foundation seed, in this instance EPADC. In a general way this is actually the procedure at the present. There is no reason why the Directorate of Agriculture cannot maintain breeder stocks of the improved varieties and make them available at timely intervals to EPADC for the production of foundation stocks. It matters little whether 10 pounds or 10 tons of each variety is transferred from the Directorate to EPADC. It is important, however, that an agreement be in effect between the agencies which details the responsibilities of each, including amounts of seed to be produced by the Directorate of Agriculture and standards and procedures set forth for the further multiplication of original (breeders) seed, whether by the Directorate or by EPADC.

EXISTING ARRANGEMENTS FOR SEED MULTIPLICATION PROCESSING AND DISTRIBUTION

A. **A successful seed program has several basic components,** primary of which is a reliable source of improved seed stocks. This implies that some person, company, or

agency must be responsible for acquiring, developing, and maintaining adequate supplies of such stocks. Sources usually originate from plant breeding programs and/or introductions from other areas of a state, nation, or the world. The responsible agency may be public or private, commonly the research department of the country or state. Seed of new varieties arising from this source is usually termed breeders seed, genetic seed, or original seed.

Once the source of new varieties is established and functioning, a specific person or agency must assume responsibility for planting and supervising the crop arising from the breeders seed during the one or more generations that the seed stocks are being multiplied to usable amounts. The multiplied seed stocks are further increased under a commercial seed program of some type. Accompanying the production stages are processes of research, quality control, extension, and distribution.

1. **In a well-developed seed industry**, research is usually done both by private and public institutions; quality control through state and federal legislation, supplemented in many cases by seed certification programs which further guarantee varietal purity; extension primarily by a public extension service, but assisted by promotional programs of private companies; and distrubution by a private commercial seed industry including jobbers, wholesalers, and retailers.

2. **In East Pakistan** some seed is produced by a number of government agencies, but the bulk of seed planted is from the farmer's own production or from seed acquired from his neighbor. The quality of such seed varies tremendously depending upon the original genetic stock, the degree to which genetic and physical purity has been maintained and the conditions under which the seed was dried and stored. It may not apply to East Pakistan, but in most countries where drill box surveys have been conducted, the lowest quality seed, in every respect, comes from a farmer's own production or from that of a neighbor. Any good seed program has to get high quality seed of superior varieties into the farmer's hands.

In the past, and to some extent now, extension workers in East Pakistan distributed seed to the farmer in an effort to induce him to use better seed. Unfortunately, too often the seed distributed was of no higher quality than the farmer already had. The extension service with workers down to the union level (grassroots) has been and is quite effective in disseminating technical knowledge in a useful form, and thus can claim much credit for the use of better seeds and other agricultural inputs. The East Pakistani farmer is a good farmer. He is hard working and keeps his fields in good order. He is receptive to new ideas and takes up new practices when they are proven profitable. The farmer has tremendous responsibility, especially in East Pakistan with its population pressure.

3. **The East Pakistan Agricultural Development Corporation (EPADC)**, a semi-autonomus provincial government organization, in 1962, was given the responsibility for multiplying and distributing seeds, preferably improved seeds, to farmers of the province. This action was taken to compensate for the lack of a private seed industry in the province.

a. **The nucleus of EPADC's seed multiplication program** is its operation of one 3000-acre farm, four 500-acre farms, and seventeen 100-acre farms distributed throughout the province. These farms are owned and operated by EPADC. Each farm is administered by a superintendent who is expected to show a profit on the farm under his management.

By plan the EPADC receives small quantities of breeding seed stocks of new or existing varieties of crops from the research arm of the Directorate of Agriculture or from other organizations having research or seed introduction responsibilities. On its own farms, EPADC plants this breeding stockseed, increasing the amount for one or more generations until the quantity is sufficient to distribute. Part of the increase from the seed is allocated to seed producers, termed "registered growers" by EPADC, who plant the seed, returning the increase to EPADC which pays the seed growers a premium over market price of rice grain. EPADC markets the seed grown by the registered growers along with other seed grown on EPADC farms through public agencies at the village level. Recently, EPADC established its own distribution outlets at the district and village level which it is using instead of the existing agencies. Under this plan seed is distributed from the district to the Thana (fairly comparable to our county) and thence to farmer distributors on the village level who sell the seed for a commission.

The Seed Multiplication Farms were transfered from the Directorate of Agriculture to EPADC in 1962. According to EPADC the total area of the farms was 6,589 acres, which included 5,189 acres of cultivatable land, 158 acres of fruit nursery, 286 acres requiring reclamation work and 956 acres under roads, buildings, tanks, and wasteland unfit for cultivation. The topography on most of the farms is slightly to moderately uneven, requiring topographic mapping and leveling in order to make the fields suitable for irrigation and for increasing crop intensity and yields.

Gradual development was undertaken by EPADC to introduce good management to improve the lands by use of cover crops, and alter the land topography by human labor. By 1966-67 the cropped acreage had reached 6,060 acres against that of 4,069 in 1962-63. The production of rice rose at a slightly greater rate than the increase in cropped acreage.

The Dattanagar seed farm (3,000 acres) is situated partly in Kushtia and Jessore districts on the western boundary of the province. It is located 11 miles from a rail head and accessibility is not easy during the rainy season. The acreage of Dattanagar is 2,805 acres and for operational purposes is divided into five sub-divisions. However, if equipment and facilities requested through this loan application are received, headquarters, shops, and seed processing will be at one location – not at five.

The four 500-acre farms are not entirely equal in natural capabilities. The Madaphur and Tabnia farms are more fertile and better rice land than are Domar and Meherpur farms which are sandier, but careful management can make them especially useful for vegetable crops and for winter crops where irrigation is possible.

The 100-acre farms are of various types in reference to soils, management, and development. Fortunately, there are few really poor soils on any of the farms.

While much progress has been made in increasing the productivity of the farms in the past six years, considerably more improvement must be made before they reach their full potential as producing units. In spite of the high rainfall in East Pakistan, roughly half of the year is dry. Irrigation during the dry period can be expected to increase productivity significantly. There are programs underway which supply tubewells for irrigation purposes. But full efficiency cannot be obtained on the seed multiplication farms unless the fields are properly leveled for effective water control. Fields also need leveling to better distribute and drain water from natural rainfall. Farm leveling equipment can do the job.

b. **In terms of equipment** the EPADC farms have a total of 25 usable tractors and 35 plows and disc harrows for breaking and preparing land for planting. Primarily though, land breaking and other farm work is performed by teams of oxen and laborers with ancient type plows, harrows, and drags. Each farm has a godown (warehouse) for storing agricultural supplies, seed, and grain. These godowns are of concrete, soft brick, and plaster construction. Although they satisfactorily keep out rain and sun, they offer little resistance to moisture, high temperature, insects, and rodents – all enemies of seed. Each farm also has a concrete drying floor where rice and other crops are sun-dried and threshed by oxen-trampling.

EPADC has had some small seed cleaners of a farm type and are using on a limited scale small Japanese-made threshers. At one location a combine was being used as a thresher. At the present time EPADC essentially has no seed cleaning, drying or storage facilities. Although seed produced by hand culture does not contain as many weed seeds as crops grown and harvested mechanically, there is much inert material and immature seeds in the harvested seed which should be removed prior to marketing and planting. The majority of seed lots produced by EPADC or its registered growers are cleaned only by winnowing, sun-dried on drying floors and stored in the godowns under conditions favoring the population build-up of stored grain insects and rodents, and under high temperature and humidity conditions which favor the deterioration of the seeds.

c. **The registered growers scheme** operates in the production of rice and wheat. Growers are able to obtain technical help in their agricultural activities and if their seed is purchased by EPADC they get a premium. In the case of rice, the amount of premium is not the same for all varieties and for all seasons but is roughly 3 Rs. per maund which is about 15% above the price of commercial rice. EPADC attempts to recruit producers in blocks of land relatively close to its farms to expedite inspection of the growing crop and transportation of the seed to the farm.

The program is administered in each of the seventeen districts by a district officer who is an employee of EPADC. Under the supervision of the district officer are several seed development officers and sub-divisional seed development officers. In theory EPADC plans to produce only foundation seed, selling all this to the registered growers, and in turn buying the increase back and processing, bagging, and marketing the seed. In practice, because of the small size farmer-operated farms, channeling all production through the many registered growers is very difficult. Actually, part of the production of EPADC goes to the registered growers to increase, and part directly to farmers. It has been estimated in the scheme for the EPADC Seed Multiplication farms that if the foundation seed produced by the farms were all further multiplied by registered growers and sold, the supply would be sufficient to meet the total requirement of improved seeds.

The scheme further estimates, "that if all seeds produced by the use of farm grown seeds were used again for seed purpose then it would be possible to cover in 1970-71, 16% of the acreage of Aus, all the acreage under Transplanted Aman Paddy and 2.5% of the acreage under Broadcasted Aman Paddy, more than 25% of the acreage under Boro Paddy and all the acreage under wheat with improved seeds. However, all the production minus 10% for seed, etc. will not be used for seeds. At least 50% will go for consumption by the farmer as food and of the remaining 40% a part will be sold for earning cash and rest will be sold for seeds".

"The quantity of foundation seeds available in the SM farms will be distributed to the registered growers and to the progressive farmers for multiplication. It is stressed that for the present the production of certified seeds by registered growers will be limited annually to the extent of estimated farmer demand. No benefit can be obtained by paying a premium on a large surplus of seeds likely to end up in the cooking pot ultimately. As the quality of foundation seeds improve and the advantages to be gained from the use of improved seed become known, farmer demand will increase. At present registered growers are lacking in the bare necessity for production of improved seeds, like threshing floor, seed godowns, seed cleaners, seed grader, seed drier and seed treater."

d. **Production of seeds on ADC's SM farms reflects** significant growth during recent years. Total production of major crops on ADC's Seed Multiplication farms has almost kept pace with goals set by the Schemes for the Third Plan.

Rice acreage, production, and yields for the past six years and estimates for 1968-69 are given in Table 8. Aus production has increased from 561 tons on 1,051 acres in 1961-62 to 975 tons from 1,377 acres in 1966-67. This presents a 74 percent increase in production, a 31 percent increase in acreage, and a 29 percent increase in

Table 8. Rice Acreage, Production, and Yields for SM Farms, 1960 through 1968 by Kind of Rice.

Item	Year	Aus	Aman	Boro	Total
				Acres	
Acreage	1961-62	1,051	1,391	60	2,502
	1962-63	1,145	1,549	109	2,803
	1963-64	1,269	1,193	161	2,623
	1964-65	1,078	1,688	172	2,938
	1965-66	1,292	1,570	90	2,952
	1966-67	1,377	1,747	115[1]	3,239
Est.	1968-69	1,742	2,933	582	5,397
	IRRI	(55)	(270[2])	(267[3])	(592)
				Long Tons	
Production	1961-62	561	842	27	1,430
	1962-63	527	931	70	1,528
	1963-64	610	829	61	1,500
	1964-65	704	1,110	92	1,906
	1965-66	973	1,180	48	2,201
	1966-67	975	1,248	71[1]	2,294
Est.	1968-69	1,379	2,251	691	4,321
	IRRI	(101)	(444[2])	(464[3])	(1,009)
				Pounds/Acre	
Yields	1961-62	1,196	1,356	1,520	1,293
	1962-63	1,030	1,347	1,432	1,221
	1963-64	1,100	1,556	844	1,292
	1964-65	1,464	1,470	1,197	1,452
	1965-66	1,686	1,684	1,192	1,670
	1966-67	1,544	1,592	1,397	1,568
Est.	1968-69	1,774	1,719	2,660	1,890

Source: Cropping Schemes and Reports of SM Farms.

[1]Includes five acres of IRRI and seven tons of IRRI rice not designated as to season produced.

[2]Includes 70 acres of IRRI and 117 tons of IRRI rice not designated as to season produced.

[3]Includes 70 acres of IRRI and 117 tons of IRRI rice not designated as to season produced.

Table 9. Production of Wheat and Winter Vegetable Seeds for SM Farms, 1963-64-1966-67.

Year	Wheat	Winter Vegetable Seeds
	Long Tons	Pounds
1963-64	46	112
1964-65	66	3,224
1965-66	120	5,471
1966-67	122	6,141

Source: ADC's Annual Report 1966-67.

yields from 1,196 pounds per acre in 1961-62 to 1,544 pounds per acre in 1966-67.

Aman rice production as shown in Table 8 reflects essentially the same growth in acreage, production, and yields. Aman acreage has consistently been slightly higher than Aus acreage. Boro acreage and production have remained at a very low level due to lack of irrigation equipment for production during the dry winter season.

Total rice acreage in production on SM farms has increased from 2,500 acres in 1961-62 to 3,239 acres in 1966-67. Estimated acreage of 5,397 in 1968-69 reflects original hopes and plans for having some land leveling for irrigation on SM farms completed by that time. This not only would allow for more acreage during any one season but also would permit more complete use of SM farm land during the dry winter months.

As shown by Table 9 wheat production has almost tripled as it increased from 46 tons in 1963-64 to 122 tons in 1966-67. This reflects the increasing demand for the new Mexi-Pak wheat seeds.

Winter vegetable seed production increased from almost nothing (112 pounds) in 1963-64 to 6,141 pounds in 1966-67. The 1966-67 level was 92 percent of the winter vegetable seed production target and virtually meets the needs of the province. Annual importation of some 4,000 pounds of winter vegetable seeds has been eliminated saving scarce foreign exchange.

Table 10 shows the physical targets and achievements in SM farms for the year 1966-67. Rice production achievements ranged from a high of 81 percent for Aus to a low of 71 percent for Aman. In spite of the fact that wheat seed production almost tripled form 1963-64 to 1966-67, the 1966-67 production was only 45 percent of the target for that date.

Problems limiting achievements by Seed Multiplication farms can be overcome with some outside assistance. The full achievement of targets of production set for SM farms has been limited by problems, some of which were within the control of ADC, others were beyond ADC's control. Shortage of technical personnel, equipment, irrigation, and capital represents major bottlenecks. ADC's latest report, reviewing achievements through June 30, 1967, stated that "additional capital requirements and technical personnel were provided this year to equip these farms with better facilities of cultivation. Supply of 12 tractors, six rotary tillers, 65 pairs of bullocks was made during this year. To insure proper water supply to the crops throughout the year, 15 turbine tubewell pumps were installed in addition to the existing eight pumps."

The Government of East Pakistan is recognizing the greater role of ADC's SM farms in increased food production. Included in the related production and distribution of seeds were schemes for (1) Seed Multiplication farms, (2) registered growers, (3) procurement and distribution of improved seeds, and (4) procurement of seeds from outside the Province. The total of the budgets for these four schemes was increased from Rs. 7,230,000 ($1.5 million) to Rs. 8,541,000 ($1.8 million) for the 1966-67 year. However, the budget for procurement and distribution of seed which was set at Rs. 930,000 turned out with Rs. 4,730,000 expenditure.

e. **Cost of producing rice and wheat shows significant variation in seasons of year involved.** According to data from Cropping Scheme for 1968-69 on Dattangar farm, Aus production represented the most expensive. Table 11 shows Aus cost of production at Rs. 301.43 ($62.80) per acre. This compares to Rs. 230.36 ($47.99) for broadcast Aman, and to Rs. 283.43 ($59.05) for transplanted Aman and Boro.

For more detailed information on cost of production rice see Table 12 from Tambulkhana SM farm. These data show that labor at some Rs. 144 represents just about half of all costs. The second largest cost item shown in Table 12 is manure and fertilizers. Costs for labor, bullocks, seed, and fertilizers and manure total Rs. 283 ($58.97). Returns expected from Aus paddy are Rs. 400 ($83.33) as 20 maunds of Aus rice are sold for Rs. 20 per maund. Net return above specified cost is Rs. 117 ($24.36).

Other cost of production data reflect similar variations to that of SM farms. Data on cost and returns for

Table 10. Statement Showing Physical Target and Achievement in SM Farms for theYear 1966-67.

	Target		Achievement		
Crops	Area	Production	Area	Production	Production Achievement
	Acres	L. Tons	Acres	L. Tons	Percent
Aus	1,507	1,199	1,246	975	81
Aman	2,276	1,768	1,787	1,248	71
Boro	111	86	110	64	74
IRRI	-----	-----	-----	7	-
Jute Seed	298	44	321	33	75
Wheat Seed	709	269	337	122	45
W. V. Seed	-----	6,545 lbs.	-----	6,141 lbs.	94

Source: EPADC Annual Report 1966-67.

Table 11. Cost of Producing Rice and Wheat for 1968-69 on Dattanagar Farm in Rupees and Dollars.

Item	Per Acre Cost of Production	
	Rupees	Dollars
Aus	301.43	62.80
Aus seed bed	359.43	74.88
B. C. Aman	230.36	47.99
Tr. Aman	283.43	59.05
Tr. Aman seed bed	359.43	74.88
Boro	283.43	59.05
Boro seed bed	359.43	74.88
Wheat	326.16	67.95

Source: Cropping Scheme for Dattanagar SM Farm for 1968-69

Table 12. Cost of Producing Aus Paddy for 1968-69 on Tambulkhana SM Farm.

Item	Per Acre	
	Rupees	Dollars
Cost:		
Labor, days 90 @ Rs. 1.60	144.0	30.00
Bullocks, pair days 16 @ Rs. 2.00	32.0	6.67
Seed cost, 1 maund @ Rs. 20.0	20.0	4.17
Manure and fertilizer	87.0	18.13
Total specified costs	283.0	58.97
Revenue:		
Aus Paddy, 20 maunds @ Rs. 20	400.00	83.33
Net above specified costs	117.0	24.36

Source: Cropping Scheme for 1968-69 for Tambulkhana SM Farm.

producing Taipei 177, Boro, Shaita rice will be presented. These data are taken from **Cost and Returns** by Mahmoodur Rahman, Comilla, East Pakistan, March 30, 1967. Table 13 is a summary of total cost per acre of all inputs for Taipei 177, Boro, and Shaita rice. These data show that Taipei rice with Rs. 370.95 ($77.27) cost of production per acre is considerably above local Boro at Rs. 307.94 ($64.19) and local Shaita at Rs. 250.85 ($52.25).

Fertilizer represents the most expensive input, costing from Rs. 70 to almost Rs. 90 per acre. More fertilizer was used with Taipei variety, since it is a new variety and one that can utilize more fertilizer than some local varieties. Planting represented the next highest cost item of input for both Taipei and Boro. Table 14 shows the cost of all major items used in the production of rice.

When all costs and returns are combined, the Taipei 177 showed the largest margin of profit at Rs. 433 ($90.25). Table 14 shows gross return on Taipei 177 at Rs. 804.09 ($167.52) compared to Rs. 443.51 ($92.40) for Boro and Rs. 402.84 ($83.93) for Shaita rice. Taipei rice yields were reported at 35.2 maunds per acre compared to 22.4 maunds for Boro and 16.8 maunds per acre for Shaita rice.

The best opportunity to reduce cost of production and increase production of seeds is to use tractor power, machines, and equipment so that timeliness, accuracy in amount, and placement of fertilizer and other inputs can be achieved. Table 15 shows a variation in labor cost on the Aus crop from a low of $25.00 on Itakhala farm to a high of $54.69 per acre on Tabnia farm. The average labor cost for all farms was $36.82. Two farms showed no cost for seed in their accounting system. Cost of seed on other farms averaged $4.60 and varied from $1.82 as a low on Tabnia farm to a high of $7.03 per acre on Meherpur farm. Manure and fertilizers, on the other hand, cost an average of $9.41 per acre. These costs varied from a low of $3.53 on Domar farm to a high of $18.33 on Sylet farm.

The target of receipts from sale of rice ranged from $62.91 on Kalyanpur farm to a high of $393.75 per acre where IRRI rice was grown on Tabnia farm. Average receipts for all farms totaled $128.97.

f. Inducements for producing seed are in the form of a price premium for seed produced for and sold to

Table 13. Total Cost Per Acre of All Inputs by Kind of Input and Kind of Rice.

Item	Taipei		Boro		Shaita	
	Rupees	Dollars	Rupees	Dollars	Rupees	Dollars
Plowing	55.55	11.57	44.53	9.28	39.57	8.24
Irrigation	48.70	10.14	50.67	10.56	51.83	10.80
Fertilizer use	87.77	18.28	74.07	15.43	69.81	14.54
Planting	83.05	17.30	66.62	13.88	27.31	5.65
Weeding	22.23	4.63	12.47	2.60	14.95	3.11
Spraying	3.41	.71	.95	.20	1.30	.27
Harvesting	35.42	7.38	33.53	6.99	27.76	5.78
Threshing	31.66	6.60	22.38	4.66	16.98	3.54
Credit (int.)	3.16	.66	2.82	.59	1.52	.32
Total	370.95	77.27	307.94	64.19	250.85	52.25

Source: *Cost and Returns* by Mahmoodur Rahman.

Table 14. Cost and Returns for Taipei 177, Boro, and Shaita Rice.

Item	Taipei 177		Boro Rice		Shaita Rice	
	Rupees	Dollars	Rupees	Dollars	Rupees	Dollars
Gross return	804.09	167.52	443.51	92.40	402.84	83.93
Cost of all inputs	370.95	77.27	307.94	64.19	250.85	52.25
Net return	433.14	90.25	135.57	28.21	151.99	31.68

Source: *Cost and Returns* by Mahmoodur Rahman.

EPADC, and in the availability of advice in production methods and technics from EPADC technicians. The 2 Rs. or 3 Rs. per maund premium over market price is not a great incentive, but will likely be sufficient as long as payment is for uncleaned rice and while the fields are not heavily rogued. If the incentive is enough of attract farmers into producing seed for EPADC and while doing so they see a chance for greater profit operating both as producers and distributors, then the premium (subsidy) has served a double purpose – that of supplying seed to the farmer and of encouraging a potential seedsman.

At the present time EPADC seed does not command a premium price on the market, due presumably to the fact that it is not really superior and also that the farmer is not accustomed to purchasing his seed for planting. Since the seed costs EPADC more to produce than the market will pay, the government must subsidize EPADC. In 1967-68 these amounts were for Aus Rs. 14.64 (40%), Aman and Boro Rs. 11.20 (30%) and wheat Rs. 11.66 (34%).

Incentives provided farmers are several, primary of which is below-cost seed, fertilizer, and water, all government subsided. These inducements to increased farm production will not likely be continued indefinitely and will not need to be when these materials are readily available at favorable prices. The contents of a production "package" – improved seed, fertilizer, insecticides, good cultural methods, credit, extension service assistance, etc., are all very important in increasing farm production of needed food and fiber. This is true the world over in both developed agriculture and traditional but developing agriculture.

One other ingredient, however, is often missing, namely marketing. When production is so very inadequate, problems associated with increasing production are emphasized, and rightly so. But in subsistence farming, only a moderate yield increase to above subsistence levels on thousands of farms becomes a sizeable marketing problem and unless provided for in advance results in a severe price depression of the product. It is not unusual for a production program to fail to gain acceptance among traditional farmers since an increase in yield, at a cost increase per acre, may result in lower net profit.

It is not too early for the government of East Pakistan to consider development of markets, construction of storage facilities and the working out of a way to stabilize prices as subsistence farming shifts to commercial farming, as it must if those in the cities are to be fed.

Table 15. Specified Aus Rice Production Costs, Price Per Maund, Target of Receipts, and Yields by SM Farm, 1968-69 Projections.

SM Farm	Specified Costs				Price Per Maund	Target of Receipt	Yield
	Labor	Seed	Manure	Total			
	Dollars						Lbs/Acre
Boalia	45.00	5.00	10.66	60.66	5.18	103.67	1,646
Dattanagar	NA	NA	NA	62.79	5.49	109.80	1,646
Domar	26.25	2.50	3.53	32.28	5.49	109.80	1,646
Itakhula	25.00	6.25	11.79	43.04	6.25	156.25	1,920
Jhilonja	39.58	6.25	10.08	55.91	6.87	151.25	1,810
Kalyanpur	31.87	5.24	10.15	47.26	4.17	62.91	1,242
Kashimpur	54.16	2.91	5.54	62.61	6.69	167.36	2,057
Madhupur	28.44	5.21	10.75	44.40	5.20	104.16	1,646
Meherpur	31.25	7.03	6.59	44.87	5.20	104.16	1,646
Mirpur	28.75	NC	6.10	34.85	6.25	187.50	2,469
Natrokona	37.67	6.25	9.83	53.75	5.90	147.53	2,055
Nilphamari	35.42	5.20	5.21	45.83	5.48	82.29	1,411
Noornagar	38.00	4.58	6.57	49.15	4.58	91.66	1,646
Panchgachia	41.66	6.25	6.83	54.74	5.49	137.25	2,057
Pangsa	39.38	5.41	11.32	56.11	6.29	125.83	1,646
Rangpur	37.50	NC	6.60	44.10	5.21	104.16	1,646
Sadhuhati	26.88	6.53	8.53	41.94	4.17	99.20	2,609
Sylet	47.50	5.21	18.33	71.04	5.21	104.16	1,646
Tambulkhana	30.00	4.17	18.19	52.29	4.17	83.33	1,646
Tabnia	54.69	1.82	15.93	72.44	6.56	393.75	2,469
Thaburgion	37.50	6.25	5.74	49.49	5.48	82.29	1,234
Average	36.82	4.60	9.41	50.83	5.49	128.97	1,773

* Source: Cropping Schemes for ADC's SM farms for 1968-69.

4. **Private sector participation** in either seed production or marketing is practically nil, except for the involvement of the registered growers of EPADC. Even here it is debatable whether farmers producing seed for a government agency are really private sector participation. Under certain conditions, which will be discussed later, such participation could develop into a true private sector. EPADC's long-term plan calls for the transfer of the commercial portion of the seed operation to private enterprise, leaving only the production of foundation seed to EPADC.

Small amounts of seed, primarily vegetable, are imported or locally produced. No estimate can be made on the quantity or percentage of seed sold, but it would appear to be quite small in reference to either measurement.

5. **Seed legislation is not in effect in East Pakistan,** nor is seed certification as we generally know it. EPADC has set field and laboratory standards for several kinds and classes of seed, but there is no enforcement other than that administered by this producing organization. Realistic standards which identify high quality seed are difficult to attain and maintain under tl ·rude drying, cleaning and storage methods which are necessarily used. In reality the standards are guides or goals and may not be descriptive of seed quality at the consumer level.

B. **Evaluation of this institutional set-up** for producing and marketing seed is not particularly easy or exacting. It would appear that with the assistance of international teams, the development and adaptation of suitable varieties of rice and wheat will proceed rather rapidly. As previously mentioned, some of the newer introductions of rice varieties have given something less than desirable results in some areas. Ideally, these varieties should have been more widely tested before distribution. On the other hand, the demonstrating that the varieties had yielding potential, and that the modern production technics are effective tools in increasing production may have overshadowed the failure of the varieties on many farms. The situation does illustrate the importance of an effective testing program to evaluate new genetic material quickly and accurately. The Accelerated Rice Program should accomplish this purpose.

The importance of a clear policy regarding responsibilities for maintaining original (breeders) stock seed and methods and responsibilities of increasing this stock seed to usable quantities cannot be over-emphasized. After establishment of such a policy between the Directorate of Agriculture and EPADC close liason must be maintained among individuals responsible. This is one of the common points of failure in many programs resulting in the breeder not

maintaining pure stocks, the foundation seed stocks manager not knowing variety characteristics, the variety developing organization not advising the foundation seed producer of the impending release of new varieties, and a myriad of details which not only cause friction but which delay supply of improved seed supplies to the farmers.

An effective extension service is an absolute necessity if information and guidance are to be of any help to the farmer. East Pakistan appears to have a good extension organization. If it is as productive as it seems, news of improved varieties of crops can be rapidly disseminated. The Team was impressed by the large amount of agricultural news and information carried in the newspapers.

EPADC has the mandate from the government to take such actions as appears necessary to develop a seed production, processing, and marketing system - in short, a seed industry. EPADC has chosen to do this by producing seed on its own farms supplemented by farmer-seed producer contracts. The question arises as to the effectiveness of the system and the suitability of the farms for accomplishing the goal.

Producing seed is not EPADC's only activity. Having responsibilities in development of the entire agricultural sector, the organization has shown leadership in supplying pumps for irrigation and fertilizer. It has encouraged private sector participation to the extent that a fair portion of fertilizer is distributed through private dealers. The private sector is also showing interest in supplying pumps. Since EPADC is a young organization and the demand for action is great, the organization has had difficulty in acquiring sufficient numbers of trained technical personnel, but training programs are now in progress, programs which should help correct this deficiency.

The Seed Multiplication farms of EPADC prior to 1962, were under the management of the Directorate of Agriculture. EPADC immediately started a program to increase agricultural production by growing green manure crops, leveling the land by headbasket method, and establishing tubewells to supply irrigation systems. The improvement has slowly but steadily progressed.

There are differences among the several farms in regard to soil texture, soil depth, and degree of levelness. During seasons when irrigation is necessary, the sandier soils are quite useful for vegetable production and field crops other than rice. As a whole, the EPADC farms do not look as well-farmed as the general run of farmer-operated farms. This is no doubt due to the history of the farms and to the size of the farming units. Like most farms, some of EPADC's farms have "trouble spots". These may not be permanently serious, but the origin and nature of the problems should be investigated. Leveling the land on the farms would be effective in increasing production through irrigation and in better controlling natural rainfall on the fields. Further, the use of mechanization, to a degree, would not only increase efficiency but would result in an improved seedbed for each crop. Additionally, land preparation equipment could be of immense value where one crop closely follows another, which will likely occur with the development of improved varieties and installation of additional irrigation systems.

EPADC's seed program to date has not been particularly successful in supplying high quality seed, primarily due to lack of some essentials, chief of which are facilities for properly drying, storing, and processing seed. Seed is harvested by hand, sun-dried on concrete floors, threshed by trampling oxen, cleaned by winnowing, bagged and stored in common shelters. There is nothing wrong with these procedures under many conditions. But under environmental conditions found in East Pakistan, marketing of high-quality seed by these methods is practically impossible.

The chief reason for failure of EPADC seed to meet acceptable standards is the lack of processing and storing facilities. Seeds are living organisms, and are affected by environmental conditions to a lesser or greater degree as are other living organisms. From the time a seed is mature on the plant until it is planted, it is undergoing a process of deterioration. Two factors which most affect the rate of seed deterioration are temperature and moisture content of the seed - both determined by air temperature and relative humidity of the surrounding atmosphere. Climatic conditions of high temperature and high humidity, as found in East Pakistan, are very detrimental to seed in storage. To insure that seeds maintain vigor and viability at maximum level, they must be harvested soon after maturity, dried to a moisture content for safe storage, and stored under conditions which maintain this safe moisture level in the seeds. It makes no appreciable difference whether these processes are accomplished naturally by weather conditions or artificially by other means. These requirements dictate that in general, high quality seed can best be produced in geographic areas that have a dry atmosphere during harvest and storage periods. Unfortunately, no season in East Pakistan is ideal for seed production, although the winter season is more satisfactory than the monsoon season. The Aman rice crop, which matures after the monsoon season, therefore, can be harvested and stored with less difficulty than can the rice of the Boro and Aus seasons, which is harvested prior to or during the monsoon and stored six months when air temperatures and humidity are both in the eighties and nineties - very poor conditions for seed storage. In the absence of any way to dry and store its seed crops, it is small wonder that EPADC has failed to market seed of acceptable vigor and viability. EPADC must obtain seed cleaning and drying equipment and seed storage facilities if it is to be effective in multiplying and distributing foundation or commercial seed. No organization, public or private, can do the job EPADC is asked to do without some basic physical facilities necessary to produce high quality seed.

Management of EPADC seems to be aggressive in action and responsive to needs. Plans are carefully projected and followed to the extent possible. Nonetheless, when province goals change, EPADC reevaluates its program and gears output to attempt to reach the new goals. Farm plans,

called schemes, are used as guides, goals, and budgets. Farm managers measure progress in reference to farm schemes, and central management expects scheme goals to be reached and a profit shown.

Farm managers have been carefully selected, and all interviewed seemed to be quite capable in managerial ability. They were well-acquainted with the farms, the cropping patterns, production, yields, and the financial aspects of the operation. The several operators among farms, naturally, were not equal in all respects, but each appeared capable of managing his particular farm and interested in improving the efficiency of the unit. Most do not have a very clear concept about the several practices of producing, processing, and marketing high quality seed. But without specialized training and access to working with seed equipment, there is no reason to expect them to be knowledgeable about the specifics of seed improvement. With some on-the -job training any of them should be able to manage the operations to be suggested herein.

In summary, it can be concluded that for a government business, EPADC is well-managed, has potentially good producing land, but needs certain types of equipment and facilities along with trained personnel in order to develop a superior program. It is suggested that the directing body of EPADC strive to help develop a seed industry, largely outside the organization - an industry which not only serves the farmer, but one which is no burden to the public treasury. While EPADC remains a producer of seed, the corporation must develop a true "seed mentality" - must always put the production and marketing of high quality seed of adapted varieties above all other considerations. In reference to the registered grower program, it appears impractical for EPADC to expect to channel the total production capacity of the farms through supervised registered growers. For instance, consider an annual 5,000 long ton production of seed rice (not unrealistic at all). At an average planting rate of one ton per 45 acres (considering broadcast and transplanted rates and acreages), the 5,000 tons will plant 225,000 acres - a rather sizeable amount for close inspection and supervision. At a ton per acre yield these 225,000 acres should produce enough seed to plant 10,000,000 acres or one-half the total rice acreage in the province. EPADC also recognizes this as unrealistic at the present but hopes to approach this goal at some future date.

The danger in a stereotyped plan such as this, is that it either costs too much to do the job, or the job does not get done right, with the result that seed so produced is no better than the general run of seed. It is a rare occasion when an organization can produce 5,000 acres of truly high quality foundation seed; equally rare to adequately supervise 225,000 acres of a second increase and have a product that is truly superior.

It appears that a plan such as being practiced at the moment by EPADC could well be continued where the SM farms and a relatively small number of registered growers constitute the nucleus of the seed program, distributing extra high quality seed. Then attention can be directed toward developing a second "layer" of commercial seed growers - private individuals, cooperatives, and/or private companies.

The proposal agreed upon between EPADC technical people and Team members while in Pakistan fits well in this plan. Here the seed processing-drying and storage centers are to be situated in accessable locations with growers clustered in the vicinity of the installations. In the case of rice, production on the SM farms should be restricted to the neighborhood of 5,000 tons production and likewise the registered growers production maintained at about 5,000 tons. Even so it will require good planning and knowledgeable technicians to grow and supervise the 10,000 acres necessary to produce this amount of seed. The 10,000 tons so produced will provide enough seed that when planted again the increase will supply the total seed needs of the province. This last increase will be beyond control of EPADC but will provide room for development of a certification system or some other type of marketing system.

Put in outline form the plan will look something like the following:

The Directorate of Agriculture:

(1st Year)
Plant breeders seed of new variety on ..... 5 acres
which produces breeders seed of .....5 tons

(2nd Year)
these 5 tons of seed given to EPADC, plants .... 225 acres
which produces foundation seed of .....225 tons

(3rd Year)
these 225 tons of foundation seed plants on
EPADC and registered growers farms .....10,000 acres
which produces registered seed of ..... 10,000 tons

(4th Year)
these 10,000 tons of registered seed sold by
EPADC and registered growers to other seed
growers and good farmers which plant ..... 450,000 acres
these 450,000 acres yield ..... 450,000 tons
which will plant practically the total acreage of
rice in the country (22,500,000) ..... 19,250,000 acres

The proposed plan is only a guide since the registered grower program will fluctuate from year to year. At the level illustrated, close supervision can be given to 2% of the total seed needs of the country. This does not appear to be much seed, but considering that one more generation increase will plant all the province it will be a real accomplishment and will serve the needs quite well. It should be noted that EPADC farms will be producing two classes of seed separately - the first increase and the second increase. The terms "foundation" and "registered" as used in certification systems are used, even though a true certification system may not be in effect.

Consider the 10,000 tons produced by the EPADC and its registered growers. The recommended equipment in

this paper will adequately clean, dry and store this amount - even more if the management is willing to work two or three shifts per day. But assuming that as planned the seed facilities only provide improved seed for 450,000 acres, or 2% of the total seed needs, will this have any effect on the seed generally available to the average farmer? In answer, in what way is the seed improved? If the seed is an improved variety the genetic improvement maintains itself (in rice and wheat for example) for as long as it does not become mechanically mixed. So if the 450,000 acres are planted on clean land and care is exercised during handling to avoid mixtures, the improvement may effectively be continued several years. On the other hand, if the improvement is only an improvement of physical purity and germinability of the seed lot, this improvement does not "carry on".

It is assumed in the whole seed multiplication scheme, that the improved seed will be improved genetically, physically, and physiologically. But even if the seed should not be genetically much better than the general run, clean high-germinating seed which produce strong seedlings planted annually on 450,000 acres will have a great impact on leading farmers, and when farmers demand seed as good as EPADC's, then some of them will take more care in drying, winnowing, and storage. Villages can purchase simple seed cleaners, and with direction and encouragement a fledgling seed industry can begin with an assurance of high quality seed stocks from EPADC. To encourage this trend EPADC should encourage its registered growers to sell their seed which has been prepared in EPADC facilities directly to other seed growers, paying EPADC for processing and storage services. These growers could be very effective in incorporating the private sector in the commercial operation of seed production and marketing. In fact the registered growers would provide an excellent nucleus for the organization of a seed certification agency.

SEED FARM IMPROVEMENT

A. Present yields and production on individual Seed Multiplication farms reflect wide variations. Table 16 shows the average and range of rice and wheat yields reported for SM farms in 1966-67. The average yield for Aus paddy was reported at 1,524 pounds per acre, while one farm reported Aus yield as low as 778 pounds, and another farm reported a yield of 2,469 pounds per acre. The highest yield is more than three times the lowest, representing a difference in value (Rs. 22/md.) from Rs. 210 ($44) to Rs. 660 ($138).

In 1966-67, the total Aus acreage for all SM farms was reported at 1,377 acres. An increase in yield from the average of 1,524 pounds to 2,469 pounds per acre would represent an increase in value of rice produced on SM farms from $60,600 to $190,000. Data in Table 16 reflect similar wide variations in yield of other types of rice and even wider variations for wheat.

The 1968-69 projections shown in Table 16 reflect average goals about equal to the highest individual yields for 1966-67. In fact, both Boro and IRRI projections were about 400 pounds above the 1966-67 high. Wheat yield projections at 1,355 pounds per acre are not quite up to the 1966-67 highest production level of 1,399 even though it was almost twice the average yield level for wheat in 1966-67.

Table 17 shows the size of farm, acres of rice by kind, acres of jute, mustard, and all other crops by SM farm in 1966-67. A total of 1,336 acres of rice was reported for the 3,000-acre farm representing 54 percent of the total acreage of crops on the farm and 41 percent of rice acreage on all SM farms. The four 500-acre farms reported a total of 939 acres of rice in 1966-67. This is equal to about half of the total cultivated land. Since two to three crops of rice can be grown on the same land area, there is a good chance these

Table 16. Average and Range of Rice and Wheat Yields, 1966-67 and Projected Yields for 1968-69, Reported for SM Farms.

Crop	1966-67 Average Yield	1966-67 Range of Yields Low	1966-67 Range of Yields High	1968-69 Projected Yields[1]
	Pounds per Acre			
Aus Paddy	1,524	778	2,469	1,773
Tr. Aman paddy	1,636	523	2,347	2,068
B. C. Aman paddy	1,534	989	2,529	-----
Boro paddy	1,308	701	2,222	2,663
IRRI paddy	2,913	2,684	3,374	3,720
Wheat	724	198	1,399	1,355

Source: *Production Report of SM Farm for the Year 1966-67*, September 24, 1967.

[1]Computed from Cropping Schemes for ADC's SM Farms for 1968-69.

Table 17. Size of Farm, Acres of Rice by Kind, Acres of Wheat, Jute, Mustard, All Other Crops, and Total Acres of Crops by SM Farm, 1966-67.

SM Farm[1]	Size of Farm	Rice						Other Crops				Total Crops
		Aus	Tr. Aman	B. C. Aman	Boro	IRRI	Total Rice	Wheat	Jute	Mustard	Other[2]	
							Acres					
Boalia	100	4	68	0	0	0	72	4	0	6	2	84
Dattanagar	3,000	556	200	570	10	0	1,336	32	205	162	530	2,265
Domar	500	102	75	68	2	0	247	34	26	0	68	375
Itakhola	100	38	45	0	1	0	84	7	2	4	50	147
Jhilonja	100	12	52	0	0	0	64	0	1	0	2	67
Kalyanpur	100	10	15	3	1	0	29	10	2	6	18	65
Kashimpur	100	45	40	0	5	0	90	6	0	15	11	122
Madhupur	500	120	162	0	15	0	297	15	1	50	35	428
Meherpur	500	110	30	36	6	0	182	49	26	42	129	398
Mirpur	100	0	0	0	47	2.6	50	0	0	0	1	51
Netrokona	100	31	45	12	0	0	88	2	1	7	11	109
Nilphamari	100	22	27	3	0	0	52	27	4	0	3	86
Noornagar	100	45	9	0	0	0	54	15	1	7	5	82
Panchgachia	100	13	45	0	5	0	63	0	3	0	6	72
Pangsa	100	20	15	4	0	0	39	12	4	2	5	62
Rangpur	100	20	22	0	0	0	42	24	4	3	6	79
Sadhuhati	100	40	4	0	0	0	44	20	5	12	13	94
Sylet	100	28	48	0	18	2.0	96	6	2	0	5	109
Tambulkhana	100	55	13	0	0	0	68	27	1	10	10	116
Tabnia	500	96	92	25	0	0.2	213	70	20	37	73	413
Thakurgaon	100	10	20	0	0	0	30	18	2	18	7	75
Total	6,600	1,377	1,027	721	110	4.8	3,240	378	310	381	990	5,299

Source: ADC's SM Farm Report.

[1]One of the 100-acre farms (Charnajib) did not report any production.

[2]Includes 36 acres of dhaincha (seed), 5 acres of maize seed, 17 acres of sunhemp seed, 5 acres of cowpea seed, 88 acres of fodder, 479 acres of gram, 141 acres of lentile, 25 acres of khesary, 73 acres of matikalai, 61 acres of rahar, 5 acres of groundnut (seed), 3 acres of joar seed, 21 acres of sugarcane, 3 acres of potatoes, 2 acres of cotton, and 1 acre of zinza.

Table 18. Actual Acreage for 1966-67 and Planned Acreage for 1966-67 and 1969-70 by Crop on ALL SM Farms.

Item	1966-67 Actual	1966-67 Planned	Actual % of Planned	1969-70 Planned	1966-67 Actual % of 1969-70 Planned
	Acres		Percent	Acres	Percent
Aus	1,377	1,400	98	2,500	55
Tr. Aman	1,027	1,350	76	2,000	51
B. C. Aman	721	350	206	900	80
Boro	110	150	73	600	18
Total Rice	3,240	3,250	100	6,000	54
Wheat	378	600	63	1,300	29
Jute	310	250	124	500	62
Mustard	381	500	76	800	48
Other	990	815	121	1,440	69
Total Crops[1]	5,299	5,415	98	10,040	53

Source: Computed from Cropping Scheme of SM Farms.

[1]Does not include green manure crops.

939 acres of rice were grown in two or more crops and on significantly less than 939 different acres of land.

The remaining 965 acres of rice on SM farms in 1966-67 were grown on the 100-acre farms.

Table 18 shows the actual acreage of rice, wheat and other crops grown on SM farms in 1966-67. In addition, the planned acreage for 1966-67 and 1969-70 actual rice acreage accomplishment measure. These dates show that total rice production was right on target with Aus, twice the amount planned for B. C. Aman, and about 25 percent short on transplanted Aman and Boro.

In 1966-67 actual rice acreage was only about one-half that planned for 1969-70. The 1966-67 Boro crop acreage was only about one-fifth of the planned 600 acres for 1969-70. The Aus and transplanted Aman crop acreage of 1966-67 was about half the planned acreage for 1969-70. Broadcast Aman acreage, on the other hand, had increased to 721 acres in 1966-67 and 80 percent of the 1969-70 goal.

Wheat acreage expansion has been projected at a rather fast rate from actual acreage of only 378 acres in 1966-67 to 1,300 acres planned for 1969-70. Total acres of crops at 5,299 in 1966-67 represented about half that planned for 1969-70.

B. Ultimate capacity for production on SM farms can be considerably above the present level. No doubt the 10,040 acres of crops projected for 1969-70 will be attainable. However, to do so will require land leveling and forming for irrigation and drainage as needed, mechanical power and equipment for better land preparations and more timely operations. The 10,040 acres represent about twice the 1966-67 level of plantings and the actual cultivated area of all SM farms. With good irrigation and drainage facilities and equipment, two to three crops can be grown on most of the cultivated area of SM farms.

Yields have been increasing on SM farms. Improved seeds, better use of fertilizer, insecticides, and other improved practices have all contributed to the increase in yields. The rate of increase in yields should go even higher as better trained personnel become available for managing and operating the farms, and power and equipment become available for timely production, harvesting, processing, and storing of crops.

Table 19 shows the total area and cultivated area for the Dattanagar Farm (3,000 acres), the four 500-acre farms, and the 17 100-acre farms. These data show that of the total area of some 6,568 acres, Dattanagar Farms include 2,805 acres and 43 percent of all. Some 2,130 acres or 76 percent of the 2,805 acres in Dattanagar Farms are cultivated area.

Table 19 shows further that of the 2,060 acres in the four 500-acre farms, some 1,724 acres or 84 percent can be cultivated. The 17 100-acre farms include an area of just over 1,700 (1,703) acres of which 82 percent or 1,401 are available for cultivation. Out of the total land area of 6,568 acres on all SM farms, about 80 percent representing 5,255 acres are available for cultivation.

C. The potentials for farm production on SM farms are far above the present level of production. Increases in quantity and improvement in quantity of agricultural products

Table 19. Total Area, Cultivated Area, Average Cultivated Area per Farm, and Percent of Total Area Cultivated of the SM Farms, 1967-68.

Item	Dattanagar (3,000 acres)	4 500-acre Farms (2,000 acres)	17 100-acre Farms (1,700 acres)	Grand Total (6,700 acres)
		Acres		
Total area	2,805	2,060	1,703	6,568
Cultivated Area	2,130	1,724	1,401	5,255
Cultivated Area, Av. per Farm	2,130	431	82	----
Percent of Total Area Cultivated	76%	84%	82%	80%

Source: Computed from ADC's SM farm data.

can be very substantial through use of improved seeds. Results from farmer plot demonstrations and from research plots have shown that yields of rice can be increased from 500 pounds to as much as a ton per acre from the use of improved seeds. An increase of 500 pounds per acre on the 6,000 acres of rice projected for 1969-70 SM farm production results in 1,339 tons of additional rice valued (Rs. 22/md.) at Rs. 803,400 ($167,375).

Good drainage and irrigation coupled with more timely operations and better land preparation will result in pushing the potential for production on SM farms even higher. According to data in **Programme for Attainment of Self-Sufficiency in Food Production in East Pakistan by 1969-70** the irrigation factor of increase on yields is 0.6 ton of rice per acre. This factor was estimated for IRRI rice but is known to have significant influence on production of any good local variety. A large part of the SM farms need some land forming and leveling for more efficient irrigation and drainage. If the improvement of some 3,000 acres (half of 1969-70 rice acreage projections) resulted in just half of expected response of 0.6 ton per acre, there would be additional rice production of some 900 tons valued at Rs. 540,000 ($112,500).

Better seedbed preparation coupled with timeliness of planting have resulted in more than 350 pounds additional yield per acre. Mechanization of seed farms will result in better land preparation and timing of operations. If only 3,000 of the 6,000 total acres of rice were treated in this manner resulting in increased yield of some 225 pounds per acre, the total production increase would be about 300 tons valued at Rs. 180,000 ($37,500).

The ultimate capability, in terms of rice production, for each farm will be determined by its acreage of well-formed and leveled land suitable for rice production and the extent to which all known improved production practices are followed. The MSU team, after careful study, has come to the conclusion that rice yield improvement potential may well result in an average of 3,000 pound yields by 1975 compared to some 2,000 pounds today. The MSU team recommends that improved seed multiplication be limited to 5,000 acres on the SM farms and other areas of SM farms be used for producing food grains for government use in times of disaster of one kind or another. Double-cropping, increased by more and better irrigation, may result in the projected 10,000 acres of crops for SM farms by 1975.

D. **In discussing the evaluation of the farm production and leveling equipment,** reference will be made to that presented in the Propst – Thivierge report, especially where the selections differ. Mr. Propst has presented a very thorough report in justifying equipment selection-a report that should be made available to those who implement equipment purchase. It appears that to present all of the background material from his report again would be excessively repetitive.

The equipment (Tables 20 and 21) suggested by the MSU team was based upon examination of the SM farms, on Propst's evaluations, and upon present practices presently used in the rice farms (new and old) of Mississippi and Louisiana. When selections differ from those of Propst it is primarily a matter of judgment of which piece of equipment will be most satisfactory, all factors considered – not that one selection will do the job, and the other will not.

The 85 h.p. tractor is selected over the 65-75 h.p. suggested by Propst only because the trend in tractor models is in this direction. The extra 10-15 h.p. in this size tractor seems to warrant the trend. These large tractors for EPADC will have dual use, to furnish power for the land leveling operations, primarily to pull scrapers, and in heavy land preparation. Fifteen units, together with leveling equipment, will constitute the original land leveling and be free to move among farms until the land leveling operation is virtually complete. In addition, five will remain on the 3000-acre farm and one on each of the 500-acre farms to maintain the leveled conditions and to be used in land preparation. All the tractors will be equipped with 24-inch rice tires.

Major grading will be accomplished by two 4-cubic yard scrapers pulled in tandem by the 85 h.p. tractor. Used in this fashion the scrapers will be self-loading. The front

Table 20. List of Recommended Equipment for Crop Production on One 3,000-Acre, Four 500-Acre, and Seventeen 100-Acre EPADC Farms.

Equipment Item		3000 Acre Farms	500 Acre Farms	100 Acre Farms	Total Required	On Hand	Total to Purchase
1.	Tractor, 35-45 DB h.p., wheel type	10	8	17	35	25	10
2.	Grader	1	0	0	1	0	1
3.	Plow, Disc 2-3, 14" Cut	10	8	17	35	35	0
4.	Plow, Moldboard 4-5, 16" Bottom	5	4	0	9	0	9
5.	Plow, Moldboard 2-3, 16" Bottom	5	4	0	9	0	9
6.	Levee Plow	5	4	0	9	0	9
7.	Harrow, Disc Offset wheel type, 9' width	10	8	17	35	0	35
8.	Harrow, Disc Offset wheel type, 13' width	5	4	0	9	0	9
9.	Harrow, Drag, 8'	10	8	17	35	35	0
10.	Harrow, Drag, 12'	5	4	0	9	9	0
11.	Rotary Tiller, PTO Drive, 6' with Smoothing Board	10	8	17	35	0	35
12.	Fertilizer Spin Spreader	5	4	0	9	0	9
13.	Grain Drill, with Shoe-type Openers	5	4	0	9	0	9
14.	Spraying, Equipment, Power Driven, Hand	16	16	17	49	49	0
15.	Cultivator, 2 row Tractor Mounted	5	4	0	9	0	9
16.	Combine, Self-Propelled, Rice Tires, 7' Cut, Diesel	2	0	0	2	0	2
17.	Combine, Pull-type Rice Tires, 7' Cut	0	4	0	4	0	4
18.	Turner Trailer-Thresher or Equivalent with rice Cylinder and 12 h.p. Gas Engine	2	4	0	6	0	6

19.	Blade, 12' Rear Mount	2	4	0	6	0	6
20.	Trailer, 3 Ton, 4 Wheels	5	4	0	9	0	9
21.	Truck, 5 Ton, Cargo	3	4	0	7	0	7
22.	Shop Equipment, Full Set	1	0	0	1	0	1
23.	Shop Equipment, Limited Set	0	4	0	4	0	4
24.	Mechanic Tool Set	9	16	0	25	0	25
25.	Driver Tool Set	24	20	17	61	0	61
26.	Electric Generator 3 ph AC 230/440V, 50 cy - 50KW	1	4	0	5	0	5

Table 21. List of Recommended Land Leveling Equipment for SM Farms.

Item		One 3000-Acre Farm		Total of 500-Acre Farms	
		Temporary	Permanent	Temporary	Permanent
1.	Tractor, 85-95, DB h.p. Wheel type, 24" Rice Tire	7	5*	8	4*
2.	Scrapers, Two 4-yd Wheel type pulled in Tandem	5 Pair	2	4 Pair	4
3.	Float Plane, 21 x 40 Leveler	2	2	4	4
4.	Rayne Plane for Water Leveling		2		4
5.	Chisel Plow, 12'	11	5*	4	4*

*Also used in Crop Production

4-yard scraper is filled first, followed by the filling of the rear scraper. This eliminates the need for a pusher and still permits the moving of 8-cubic yards of soil. This selection differs from that of Propst, who recommended an 8-yard elevating scraper. Experience in Mississippi and Louisiana has shown that the elevating scraper is difficult to maintain and is generally unsatisfactory. On the other hand, the tandem arrangement of smaller scrapers is giving very satisfactory results, even on the extremely heavy soils of the region.

Other land leveling equipment selected include a float plane, a water leveling plane, and a chisel plow. The float plane used on dry land leveling is a precision leveler. The water leveling plane can only be used where water level can be regulated and drained, but under such conditions it is quite efficient. The chisel plow pulled by the 85 h.p. tractor is used primarily to break up hard soil prior to leveling operations. There is also a good possibility that this type plow may find a use as a farm tool. It should be tried. These selections differ slightly from those suggested by Propst.

For farm production, 35-45 h.p. tractors are recommended, as did Propst. Recognizing that a 2-way reversible plow leaves only a small "dead furrow" and thus helps

maintain the level condition of the field, the Team hesitates to recommend this type plow. It is more difficult to maintain than the ordinary plow, more difficult to use, and more expensive. By plowing in the dead furrow and rotating the direction of plowing each time, the land can be kept reasonably free of the disadvantages of the non-reversible plow. On the other hand, should EPADC strongly prefer the reversible plow the team will yield to their wishes on this selection. Moldboard plows are suggested over disc plows, because conditions do not dictate the need for disc plows, although admittedly disc plows are more durable and easier to maintain than are moldboard plows.

The levee plow is needed to build and rebuild borders or levees within the rice fields. Discs and harrows follow plowing in land preparation; rotary tillers assist in puddling the soil to increase its water retention properties. A cultivator is needed for cultivating row crops, primarily certain horticultural crops.

In selecting seeding and fertilizer distributing equipment, the team is hesitant to recommend, as did Propst, a combination seed and fertilizer drill, not because this is not a fine piece of equipment, but because of doubts about maintenance. Unless extreme care is exercised in cleaning fertilizer drills after each usage, the drill can be easily damaged beyond use. Even a grain drill requires careful attention. Should there be no advantage in seeding the rice in rows, then the recommendation would be to use a tractor mounted spin ("cyclone") spreader for both seed and fertilizer. This type of equipment is practically indestructable. But since non-chemical weeding is easier in fields which are row-planted, the selections are for grain drills with adjustable shoe type openers, and spinner-type fertilizer distributors.

The selection of threshing equipment is particularly difficult. What is really needed is the conventional thresher widely used in the United States prior to the advent of the combine harvester. Such equipment is not available. There is, however, a small thresher designed by TVA which is giving satisfactory results in the United States on small farms for all grains and for rice on agricultural experiment station farms where plots are relatively small. The manufacturer states that the thresher is being used to thresh rice in several developing countries. Based on this evidence and a study of the thresher, the team recommends the purchase of six units, two on the 3000-acre farm and one on each of the 500-acre farms. While these threshers will not have the capacity to thresh the entire crop, purchase is recommended to use the units in an exploratory way, since they cannot be absolutely guaranteed to operate efficiently in East Pakistan where such large quantities of straw must be handled.

Additionally, one pull type combine, also recommended by Propst, is suggested for each 500-acre farm and two small self-propelled combines for the 3000-acre farm. The use of combines for field harvest will not be satisfactory except on those areas where water is controlled, and the rice does not lodge excessively. When not used in the fields the combines may be used as stationary threshers.

Although not suggested by Propst, the two self-propelled combines are selected for semi-experimental use. This type unit is a better combine and thresher than the pull type but admittedly more complicated. In the event that East Pakistan goes to mechanized harvest, it will probably be by way of the self-propelled unit. The presence of both types on EPADC farms will provide opportunity for making comparisons.

One generator is suggested for each of the 3000-acre and 500-acre farms. Each generator will provide adequate power to operate the repair shops and light essential buildings. According to the most recent plans of EPADC, the seed processing plant, drying and storage facilities would be established where electricity is already available. There is a chance that this decision would be reversed, and the processing facilities would in fact be located on a farm without electricity, then additional generating capacity would have to be included. This point must not be overlooked when finally the equipment orders are placed.

Shop equipment, mechanic tool sets and driver tool sets are itemized in Tables 16, 17, and 18 in Propst's report. The Team cannot improve upon the selection and hereby refers those interested in these tables.

Two types of equipment in Propst's report are not listed here. He lists 27 pickup trucks – 6 for the 3000-acre farms, 1 each for the 500 and 100-acre farms. Some form of transportation is needed, especially on the larger farms, but there is some doubt about the advisability of purchasing such type equipment with this type loan. Also there appeared to be a reasonable number of pickups and jeeps around the farms. It may be more reasonable for this type equipment to be purchased as a product of export trade, rather than from a long-term dollar loan.

The other type equipment which does not appear to be needed specifically for leveling and production uses on the farms are the crawler tractors and road graders. Propst recommended 6 tractors and 5 motor graders with scarifiers. The team recommends one grader for the 3000-acre farm to assist in maintaining the many farm roads and the road to the railhead. The chisel plows recommended will be more satistactory in preparing land for leveling than the scarifiers on the graders.

The crawler tractors equipped with dozer blades are highly useful implements in doing so-called pioneer work – making fills and deep cuts, clearing land, and the like. Little of these kinds of conditions exist on the EPADC farms, certainly not on the ones visited by the team, and to the extent that the areas affect the availability of improved seed. Nonetheless, there are a number of projects on which only crawler tractors can be effectively used. Building new ponds (tanks) or rebuilding old ones and building farm-to-market roads are two jobs which can be performed with this equipment and which will help the farms. The question arises as to whether these are EPADC functions, and while good roads would help market seed, it would be difficult to

Table 22. Manning Table for Seed Farms by Size of Farm Operation and Specific Job Requirement.

Item	3,000-acre Farm	Four 500-acre Farms	Seventeen 100-acre Farms	Total
		Numbers of workers[1]		
Chief Superintendent	1	0	0	1
Deputy Manager Farms	0	1	0	1
Farm Superintendent	5	4	17	26
Farm Overseers	20	16	17	53
Tractor Drivers	15	12	17	44
Asst. Tractor Drivers	12	8	17	37
Grader Operators	1	0	0	1
Pump Operators	16	16	0	32
Truck Drivers	3	4	0	7
Pickup or Utility Vehicles	6	4	17	27
Mechanics	6	4	17	27
Asst. Mechanics	6	4	0	10
Total Listed	91	73	102	266

Source: *Compiled from information in East Pakistan Agricultural Development Corporation Charts*, November 1967 and Third Plan Scheme for SM Farms.

[1]In addition to workers listed for each farm, there are numerous unskilled laborers who are available and used especially during the harvesting and planting seasons. Also, the office staff for each headquarters is not included in this manning table.

show how much profit accrued to EPADC was due to this improvement. EPADC has several non-seed production projects on which the equipment could be efficiently and effectively used. The question is, can the purchase be justifiably charged to the Seed Multiplication project, even though the farms can provide the revenue to pay for the equipment? This question must be answered by appropriate AID personnel. The amount of funds needed to purchase these 6 crawler tractors and 5 motor graders is estimated by Propst at $250,000.

E. Manning table reveals need for large number of skilled and semi-skilled workers on SM farms. According to Table 22, the Dattanagar Farm manning table shows requirements of 91 workers not counting office staff, seed processing staff, or unskilled laborers. The four 500-acre farms are estimated to need 73 skilled and semi-skilled workers. Workers of this same type for the seventeen 100-acre farms total 102. The grand total of all workers listed for the specific tasks and farms is 266 – all of whom need some training for effective performance of their tasks. However, ADC has been developing this staff overtime and could satisfactorily fill most of the worker slots within a year or so.

Table 22 data varies some from that given in Appendix Table 3. For one thing no office staff, storekeepers, medical officers, or unskilled laborers are included in Table 22. In addition, Table 22 shows a need for tractor drivers and assistant tractor drivers with the thought of reducing idle time of tractors due to shortage of drivers. The number of mechanics and assistant mechanics was also increased in Table 22 with the thought of keeping the tractors and other equipment in a good state of repair and maintenance.

Manning table for seed processing units reflects high state of automation. Table 23 shows that the Type I installation with a capability of processing up to 2,000 tons per year can be operated by seven laborers and one supervisor. When processing capacity is cut in half the number of laborers can be reduced by two, reflecting the labor efficiencies lost as volume of processing goes down. The smallest unit with a processing capacity of 100 tons requires two laborers and one supervisor. The supervisor should be an agronomist who is also in charge of quality control in seed fields.

Manning table for land leveling operation will vary with extent of work required including acres involved and depth of cut. The land leveling operation will require skilled equipment operators including:

Position	Number
1. Wheel tractor and scraper operators	15
Assistant operators	15
2. Float plane and chisel plow operators	9
Assistant operators	9
3. Mechanics	3
4. Grade foreman and equipment supervisors	8

After SM farm leveling and forming are completed, 15 of the 85 h.p. wheel tractors accompanied by nine scrapers, six float planes, and six chisel plows will be released for

Table 23. Processing Capacity, Supervisory Personnel, and Laborers Required by Type of Installation.

Item	Unit	Type of Installation I	II	III	IV
Processing Capacity	tons	2,000	1,000	600	100
Supervisory Personnel	no.	1	1	1	1
Laborers	no.	7	5	4	2
Installations	no.	1	3	9	8
Personnel:					
Supervisory	no.	1	3	9	8
Laborers	no.	7	15	36	16

Table 24. Staffing Pattern and Cost for Operating Registered Grower Scheme for Production of Improved Seeds.

Item	No. of Post	1965-1966	1966-67	1967-68	1968-69	1969-70	5-Yr. Total
				Rs. 1,000			
Dist. Seed Development Officer	17	56(10)	100	107	112	117	492
U. D. Assistant	17	0	0	0	41	43	84
Accountant	17	3(1)	3(1)	45	51	55	157
L. D. Assistant	17	0	0	0	31	33	64
Typist	17	0	21	23	29	31	104
Peon	17	14	14	15	16	16	75
Seed Development Inspector	85	88(33)	101(38)	225	255	275	944
Store Keeper	17	0	0	0	31	33	64
Darwan	17	0	0	0	16	17	33
Total	221	161	239	415	582	620	2,017

Source: Page 15, *Third Plan Scheme for Production of Improved Seeds (Paddy and Wheat) by Registered Growers in East Pakistan.*

similar work on registered grower farms or other such farms.

The SM farms now have a number of tractor drivers and mechanics and have access to a pool of such men in the Engineering Division. EPADC has promised every effort toward obtaining and keeping good operators for this equipment.

Manning table for the staff required to operate registered grower Third Plan Scheme involves 221 workers most of which must be skilled and require some training. Table 24 shows the number of workers by kind of position and cost over the five-year period covered by the scheme. Some assistant positions are not expected to be filled until the need arises–some three or more years after initiation of the program. The total cost of the staffing of this program as listed is Rs. 2,017,000 ($420,208).

F. Incremental annual costs of Seed Multiplication farm operations reflect an increasing trend in cropped acreage as well as higher costs for inputs.

According to Table 25 the cropped acreage for SM farms for 1965-66 was 5,464 acres with input requirements in the amount of $376,900 and reflecting an operating cost per acre of $69.00. As crop acreage goes up, cost per acre goes down somewhat. In 1966-67 the total cost of production was reported at $388,600 - 3 percent above the 1965-66 level. The average per-acre cost of $66.00 prevailed in 1966-67 in spite of increasing total costs.

Table 25 shows that cropped acreage on all SM farms is expected to increase by 84 percent from 5,464 acres in 1965-66 to 10,040 acres in 1969-70. During this same time total cost of farm operation increased 67 percent from $376,900 in 1965-66 to an expected $630,200 in 1969-70. Cost per acre of production declined from $69.00 in 1965-66 to $63.00 per acre in 1969-70.

Table 25. Incremental Annual Costs of SM Farm Operations.

Item	1965-66	1966-67	1967-68	1968-69	1969-70
Cropped acreage, acres	5,464	5,871	6,495	7,675	10,040
			$1,000		
Labor	213.8	221.6	245.2	289.7	379.0
Seed	25.1	26.1	28.8	34.1	44.6
Manure	75.1	77.8	86.1	101.7	133.1
Implement (1 1/2%)	1.5	1.6	1.7	2.0	2.7
Oil, Fuel, and Spare Parts	3.2	3.3	3.7	4.3	5.7
Cattle Feed	35.6	35.6	42.5	42.5	42.5
Office Expenses and Miscellaneous	12.9	12.9	12.9	12.9	12.9
Petty Construction and Repair	6.5	6.5	6.5	6.5	6.5
Drugs, Medicine, Pesticide	3.2	3.2	3.2	3.2	3.2
Total Cost	376.9	388.6	430.6	496.9	630.2
			Dollars		
Cost per Crop Acre	69	66	66	65	63

Source: Pages 44-48, *Third Plan Scheme for Seed Multiplication Farms in East Pakistan.*

SEED PRODUCTION, PROCESSING, DRYING AND STORAGE REQUIREMENTS

In order to adequately serve the province of East Pakistan, EPADC has proposed the establishment of seed processing, drying, and storage facilities in 12 areas, roughly corresponding to districts or combinations of districts. In most instances, the installations would be located on one of the EPADC seed farms. The proposal calls for a seed processing, drying, and storage installation at 13 locations, and eight small drying units on specific 100-acre farms for a total of 21 separate installations. These installations would handle all of the seed considered necessary for production by EPADC and its registered growers. Although, the majority of the 13 processing-drying-storage facilities would be constructed on EPADC seed multiplication farms, some would not be. Exact sites of the installations would be selected where electricity is available and where transportation facilities will aid in the development of blocks of associated seed growers. A site meeting these requirements in some instances is an EPADC farm. In other instances it is on other land owned by EPADC or on land which is accessable to EPADC.

The first impression of the proposal is that the number of installations is excessive. Normally, this would be true. Where roads and transportation vehicles are adequate, two or three well-designated main installations and a dozen dryers strategically placed would be ample. But East Pakistan has neither good roads nor adequate transportation vehicles. Furthermore, some production areas are isolated during the monsoon season. Additionally, weather conditions during harvest of a large part of the season necessitate immediate drying of the crop. Consequently, a greater amount of equipment is needed to handle a given tonnage of seed in East Pakistan than in many other areas. Likewise, more storage facilities are needed than for a comparable crop in certain other tropical areas. For instance, in countries where two crops of rice are grown per year, the seed from one crop needs only to be stored a few weeks or a month or so before it is used to plant the second crop. In East Pakistan, rice is grown in three separate seasons (Boro, winter; Aus, spring; and Aman, summer), and generally, the same variety of rice is grown in only one of the seasons. Therefore, seed must be kept over from the harvest period until the planting period of the same season, roughly six to nine months. Add these "differences" to the requirement for maintaining the genetic identity of several varieties of rice within the same season, and it is easy to recognize the need for space and flexibility in storage and processing facilities.

A. **Location of processing, drying, and storage facilities in the 12 selected areas,** along with small auxiliary drying installations, and the use of selected seed producers in each area to supplement EPADC farm production appears to be satisfactory answer to the transportation problem. Much of the seed produced on the 3000-acre farm will be shipped by rail to other parts of the province. Aside from this, the majority of seed produced within a district will be used in that district.

B. In reference to the layout of each installation and the selection of equipment and facilities, attention is called to the fact that seed processing plants and associated drying and storage facilities may be designed in one of many ways, depending upon the types and quantities of seed to be handled, the number of varieties, the degree of mechanical handling desired, the type and amount of labor available, the cost of construction, ease of construction and so forth.

In planning the installations for EPADC some of the more specific considerations included:

1. Selecting the minimum amount of equipment consistent with the requirements.
2. Keeping the number of kinds of equipment at a minimum to facilitate the stocking of spare parts.
3. Selecting equipment for its expected long life, simplicity and ease of maintenance.
4. Keeping the construction simple to allow ease of equipment installation and plant maintenance. Example - no elevator pits to limit equipment placement or to fill with water during rainy weather.
5. Using prefabricated construction where possible to speed construction and obtain the type of construction needed. Example - the selection of steel bins will enable the supplier to advise EPADC of the type construction of the concrete floor on which the bins can be quickly assembled, resulting in a known type of construction.

In the selection of the specific seed processing equipment items there are few alternatives. Although more detailed specifications can be presented by the Team upon demand, those items listed and described, along with the suggested suppliers are standard in the seed processing equipment field. All have been proven both for domestic use and for international application. Many more items of equipment could have been added, and would have been if a greater diversity of seed kinds were to be handled. For instance, corn and beans would have required additional equipment; forage crops seeds still more. In nearly all installations small amounts of vegetable seeds, wheat, pulses, and other crops will need to be dried, cleaned, and stored. The equipment selected will accomplish these demands, in addition to meeting the requirements of the rice crops. Should these minor crops become major commercial crops, the proposed processing plants are designed with enough height and floor space to accommodate additional equipment with little adaptation of installation.

C. The selection of drying-storage facilities is more difficult, because the problems are complex and the solutions costly. The unsatisfactory environmental conditions have been mentioned. High temperatures and humidity prevail during much of the year causing serious deterioration in seed viability. Additionally, large populations of stored-grain insects and rodents make storage of bagged seed in common warehouses or buildings very hazardous.

Construction and use of special storage warehouses in which both temperature and humidity are maintained is an excellent way to maintain seed at high vigor and viability levels; however, this method is expensive and is unnecessary for commercial seed which will be stored for less than a year or two at the most. It is possible to construct and equip warehouses with dehumidifiers which control only relative humidity. This, too, is satisfactory for one, two, or even three-year seed storage but is also expensive for use with large quantities of seed. (One dehumidified unit is recommended for Type I installation). Alternatively, seed can be artifically dried to a safe moisture level and bagged in moisture-proof or moisture-resistant bags in which the seed is later marketed. This method is quite satisfactory and also practical where such bags can be economically manufactured or imported.

1. To best accomodate the problems set forth above, an in-bin combination drying-storing type was selected as the basic unit. The essential parts of the installation consists of a fan and heater with appropriate controls, together with steel storage bin(s), constructed with a perforated floor above a plenum chamber into which the fan blows heated air which in turn is forced up through seed previously placed at a specified depth in the bin above the perforated floor. When a quantity of seed has been dried to a predetermined moisture content for safe storage, it is mechancally conveyed to another storage bin of the same type where dried seed of the same variety is stored. A few weeks before planting time, the seed is removed from the drying-storage bins and cleaned, treated, bagged, and transported to distributing areas.

2. **Several advantages are ascribed to this method of storage as opposed to the drying-bagging-storage sequence.** The bin construction precludes the entry of rodents; fumigation for the control of insects is easy and effective; and the small amount of seed bulk in contact with the atmosphere precludes a high buildup of moisture in the seed. Should additional drying or aeration be necessary, a fan, with or without the heater in operation, is immediately available for use. All conditions are controlled except temperature, and if seed moisture is kept at a low level, temperature has a lessened effect upon seed vigor and viability. The seed will only be exposed to ambient temperature and humidity during processing and distributing–an estimated period of one to two months out of a total period of six to nine months between harvesting and planting. This alone should double or triple the planting value of the seed.

It is with reluctance that an ordinary warehouse (godown) be included at each installation; for at best these are poor seed storage structures which in practice are usually contaminated with insects and rodents. Practically speaking though, storage is needed for bagged seed during processing, while seed tests are being performed, and before transporting. In some instances certain kinds and lots of seed may have to be stored for a season in these warehouses. With careful management, buildings can be kept clean, although they do little to control seed moisture. (More about this later in this section).

D. One of four different types of installations is suggested on each of the 21 proposed locations for seed handling

facilities. The principle difference among Types I, II, and III is size, while IV is only a dryer. The capacities assigned to each unit is based on projected acreages and production. Considered in the projection were the past production history of the seed multiplication farms, the anticipated production of the SM farms and registered seed growers and the yields expected from increased use of good seed, fertilizers, insecticides, fungicides and other improved cultural practices. (Table 26).

Table 27 describes the installations in reference to capacity, while Tables 28 and 29 relate the installations to the location site. General specifications of equipment items are given in Table 30. In Tables 31, 32, 33, 34, the equipment and facilities are itemized and costs given as per each type of installation with a summary in Table 35. A consolidated list of dollar-funded equipment listed and priced by item is presented later.

Equipment selection and cost of operation are based on the reasonable assumption that all rice and other seeds produced by the EPADC farms and the registered growers will be cleaned and stored until distributed, but only approximately one-half the Boro and Aus rice production, will need to be artificially dried. An examination of Table 36 shows that only about one-half of the total seed produced will be in the combined processing-drying-storage facilities at one time - the Aus and Boro crops during the wet season and the Aman during the dry.

No additional houses for supervisors and workers will be needed beyond that cited for farm improvement. Likewise, no additional shop equipment and buildings will be required for the processing, drying and storage operations.

E. **The basic sequence of operation** is harvesting, threshing, scalping, elevating to the bins, drying, storing, cleaning, treating, bagging, labeling and storing bagged seed in warehouses while awaiting transportation, and finally transporting to distributing points. Seed lots may be sampled and tested from the bins shortly before processing or from the bags after processing. If the latter is done, seed lots must remain in the warehouse until test results are obtained, after which the labeling tags are attached to the bags and the seed transported to distribution points.

F. **Management will be of utmost importance** in utilizing the equipment and facilities to the fullest extent toward the goal of distributing high quality seed. Consider the drying, storage, processing, and transportation sequence in a Type II installation.

1. Assume ¼ of crops Boro (including IRRI), ¼ Aus, and ½ Aman.
2. Assume two varieties of each type.
3. Start with Boro crop.
4. As Boro crop is harvested, seeds are dried at a maximum depth of 6 feet in each of two or more bins.
5. After drying, seeds are consolidated in two bins which will hold all Boro crops except IRRI varieties.
6. Store in two bins from March to September or October.
7. Assume two IRRI varieties of same maturity as IRI-8 (this may change within a few years).
8. Dry in two bins and consolidate in two other bins. This ties up six bins during drying but only four during storage.
9. Store in two bins from May to September or October.
10. Start drying and storage of Aus in June or July. Dry and store in two or more bins and consolidate in four bins for storage until October or November.
11. At this point, eight of the ten bins are full.
12. Process and ship out Boro and IRRI varieties during September, October, and November.
13. Begin harvest of Aman crop in November and store in two empty bins and proceed to other bins as Boro and IRRI are shipped out. Aman may not need drying, but dryers are available if needed.
14. Aus is processed and shipped out during January and February.
15. At this point the Aman crop will occupy four to six bins and Aus portions of one or two bins.
16. At this point harvesting of the Boro crop will begin and the cycle is completed with always one or two bins empty for drying wheat, pulses, and vegetable seeds.
17. Where varieties must be separated into lots, the small lots can be processed and bagged and either placed back in the bins on top of bulk seed, or placed in the ordinary warehouse.
18. Seed is sampled periodically at different bin locations and seed moisture and temperature determined to ascertain that good storage conditions are being maintained. If necessary, seed can be aerated with drying fan. Fumigation may be accomplished as needed to control stored-grain insects.

Type I installation has equal flexibility—more if a maximum of two varieties of each type rice is grown. Also, a dehumidified storage warehouse is assigned to this type installation. Since much of the seed produced here (the 3,000-acre farm) will be transported by rail, and inasmuch as the farm is located some distance from the rail head on a road not accessible in all types of weather, the dehumidified storage warehouse would be placed at the rail head. This warehouse would hold about one-fourth of the expected farm production and would provide excellent storage for much of the Boro and Aus seed lots during the monsoon season. The use of this storage would change the seed processing schedule of Boro and Aus but would still not interfere with the processing of the Aman crop.

Type III installations would have equal flexibility to Type II, providing only one variety of each type seed was grown as planned. But if two varieties of each are produced

Table 26. Size of Farm, Rice and Wheat Acreage Planned, Rice Production by Seasons, Wheat Production by Districts, Seed Multiplication Farms, and Registered Growers, 1968-69.

District	Size of farm	1968-69 rice acreage	1968-69 rice production planned					1968-69	Wheat Pro-
			Aus	Aman	Boro	IRRI	Total	Acreage	duction
		Acres	Long Tons					Acres	L. Tons
Dattanagar	3000	2136.0	559.9	904.3	229.6	-0-	1693.8	268.0	196.9
Dacca District									
Mirpur	100	78.0	4.4	1.8	38.2	33.1	77.5	3.0	1.7
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Faridpur District									
Pangsa	100	55.0	18.3	20.6	-0-	-0-	38.9	20.0	6.6
Tambulkhana	100	81.5	47.8	13.8	1.6	-0-	63.2	40.0	20.6
Reg. Growers	100	100.0	-	-	-	-	75.0	-	-
Comilla District									
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Panchgachia	100	110.0	27.5	124.9	29.4	-0-	181.8	-0-	-0-
Khulna District									
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Barisal District									
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Chittagong District									
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Jhilanda	100	82.0	9.7	46.5	-0-	44.1	100.3	-0-	-0-
Dinajpur District									
Domar	500	360.0	58.8	183.7	58.8	58.8	360.0	100.0	73.5
Nilphari	100	85.0	22.0	32.7	5.5	-	60.2	20.0	7.3
Thakurgeon	100	44.0	5.5	22.0	6.6	2.2	36.3	10.0	4.4
Rangpur District									
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Rangpur	100	60.0	22.0	18.4	-0-	9.2	49.6	20.0	7.3
Rajshahi District									
Tabnia	500	440.0	198.3	213.1	93.7	-0-	505.1	70.0	33.1
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Kalyanpur	100	43.4	5.8	28.8	3.7	-0-	38.3	15.0	8.8
Mymensingh District									
Madhupur	500	390.0	88.2	220.4	115.7	-0-	424.3	8.0	3.5
Reg. Growers	100	100.0	-	-	-	-	75.0	-	-
Kashimpur	100	85.0	27.6	49.6	36.7	-0-	113.9	6.0	4.0
Natrokona	100	76.3	19.7	45.0	-0-	-0-	64.7	8.1	7.3
Sylet District									
Sylet	100	140.0	29.4	55.1	29.4	-	113.9	-0-	-0-
Reg. Growers	200	200.0	-	-	-	-	150.0	-	-
Itakhula	100	130.0	38.6	62.4	22.0	29.4	152.4	30.0	11.0

Jessore & Kushtia Dist.									
Noor Nagar	100	57.0	30.8	8.1	-0-	4.5	43.4	18.0	9.9
Sadhuhati	100	132.0	47.8	88.1	20.2	-0-	156.1	6.0	4.4
Reg. Growers	500	500.0	-	-	-	-	375.0	-	-
Meherpur	500	239.0	110.9	52.5	-0-	44.1	207.5	50.0	18.4

Table 27. Description of Types of Seed Processing, Drying and Storage Installations

Type I	Equipment and facilities to dry 700-1,000 tons of seed; to process 1,400-2,000 tons per year.
Type II	Equipment and facilities to dry 350-500 tons of seed; to process 700-1,000 tons per year.
Type III	Equipment and facilities to dry 200-300 tons of seed; to process 400-600 tons per year.
Type IV	Equipment and facilities to dry 50-100 tons per year.

The drying rates are calculated on the premise that only the Aus and Boro crops will need to be dried. Actually, the Aman crop could also be dried since this crop is harvested while the other two crops are either already planted or are being planted. Drying-storage bin space is sufficient to hold nearly, if not all, the Aman crop, space which is not otherwise being used during the Aman storage season.

Table 28. Location and Approximate Acreage of Production Served by the Type of Seed Processing or Drying and Storage Installation.

Location	Type Installation
Dinajpur District	
Domar 500-acre farm	III
Nilphamari 100-acre farm	
Thakurgeon 100-acre farm	IV
Rangpur District	
Registered Growers around Bogra (200 acres)	III
Rangpur 100-acre farm	IV
Rajshahi and Pabna Districts	
Tabnia 500-acre farm	II
Registered Growers (200 acres)	
Kalyanpur 100-acre farm	IV
Mymensingh District	
Madaphur 500-acre farm	
Registered Growers (100 acres)	II
Kashimpur 100-acre farm	
Natrokona 100-acre farm	IV
Sylet District	
Sylet 100-acre farm	
Registered Growers (200 acres)	III
Itakhula 100-acre farm	IV

Jessore and Kushtia Districts	
Noor Nagar 100-acre farm	
Sadhuhati 100-acre farm	II
Registered Growers (500 acres)	
Meherpur 100-acre farm	IV
Dattanagar 3000-acre farm	I
Dacca District	
Mirpur 100-acre farm	III
Registered Growers (200 acres)	
Faridpur District	
Pangsba 100-acre farm	
Tambulkhana 100-acre farm	III
Registered Growers (100 acres)	
Comilla District	
Registered Growers (200 acres)	III
Panchgachia 100-acre farm	IV
Khulna District	
Registered Growers (200 acres)	III
Barisal District	
Registered Growers (200 acres)	III
Chittagong District	
Registered Growers (200 acres)	III
Jhilanda 100-acre farm	IV

Table 29. Consolidation of Locations According to Type of Seed Processing, Drying and Storage Installation

Type	No. of Installations	Location
I	1	Dattanagar 3000-acre farm
II	3	Mymensingh District Rajshahi and Pabna Districts Jessore and Kushtia Districts
III	9	Dinajpur District Rangpur District Sylet District Dacca District Faridpur District Comilla District Khulna District Barisal District Chittagong District
IV	8	Thakurgeon 100-acre farm Rangpur 100-acre farm Netrokona 100-acre farm Kalyanpur 100-acre farm Itakhula 100-acre farm Meherpur 100-acre farm Panchgachia 100-acre farm Jhilanda 100-acre farm

Table 30. General Specifications for Seed Processing, Drying and Storage Equipment

Item No.	Item
1.	Seed cleaner, four (4) screens air and screen type, with top and bottom air variable speed feed roll, screen width of 54 inches, seed delivery to right and waste products to the left of cleaner. To be furnished with complete drive assembly including v-belts, adjustable motor mount and TEFC motor of required HP for 220/440 volts, 3 phase, 50 cycles electrical current. Also to be supplied with recommended dust collector(s) (including ducting and necessary transitions - amounts to be specified at time of ordering). Twenty-two (22) extra screens to be furnished. Suggest Crippen Model H454 or A.T. Ferrell Clipper Model X2980 or equal.
2.	Seed Cleaner, four (4) screens air and screen type, with top and bottom air variable speed feed roll, screen width of 34 inches, seed delivery to right and waste products to the left of cleaner. To be furnished with complete drive assembly including v-belts, adjustable motor mount and TEFC motor of required HP for 220/440 volts, 3 phase, 50 cycles electrical current. Also to be supplied with recommended dust collector(s) (including ducting and necessary transitions - amounts to be specified at time of ordering). Twenty-two (22) extra screens to be furnished. Suggest Crippen Model H434 or A.T. Ferrell Clipper Model X297D.
3.	Seed treater for application of fungicides and/or insecticides in slurry or liquid form. Suggest Gustafson Model M-100 or equal. To be supplied with one metering reservoir, no film coater. Complete with pulleys, drives and motor for 220 volts, 50 cycle electrical current.
4.	Bagger-weigher, automatic. Suggest Waymatic Model with "R" bracket for direct mounting to scales.
5.	Scales, platform. To supplement bagger. Suggest Howe Model 54DB-1 (double beam) or equal.
6.	Holding (surge) bin, hoppered, with cut-off gate and supporting framework, metal construction. Size 6' x 6' x 6'.
7.	Holding (surge) bin, hoppered, with cut-off gate and supporting framework, metal construction. Size 3' x 3' x 3'.
8.	Holding (surge) bin, hoppered, with cut-off gate and supporting framework, metal construction. Size 2' x 2' x 2'.
9.	Steel support for seed cleaner.
10.	Steel support for seed treater.
11.	Elevator, belt and bucket centrifugal discharge type and assembly. Suggest Universal Model C2-175 "Easy Dump", 48 foot discharge height with standard drive and motor required for 220 volts, 50 cycles electrical current. To be furnished complete with distributor head, pipes, and flanges; numbers and lengths to be indicated by purchaser at time of ordering.
12.	Elevator, belt and bucket centrifugal discharge type and assembly. Suggest Universal Model C2-175 "Easy Dump", 26 foot discharge height with standard drive and motor required for 220 volts, 50 cycles electrical current. To be furnished complete with distributor head, pipes, and flanges; numbers and lengths to be indicated by purchaser at time of ordering.
13.	Elevator, belt and bucket centrifugal discharge type and assembly. Suggest Universal Model C2-175 "Easy Dump", 22 foot discharge height with standard drive and motor required for 220 volts, 50 cycles electrical current. To be furnished complete with distributor head, pipes, and flanges; numbers and lengths to be indicated by purchaser at time of ordering.
14.	Conveyor, portable aluminum belt conveyor with overhead motor mount. 16-foot length. Suggest Burrows No. 2500 with No. 2503 1/2 HP heavy duty open electric motor; complete with sheaves and drive belts. Motor to operate on 220 volts, 50 cycles electrical current.
15.	Grain storage bin, corrugated metal construction, 18 feet in diameter and 16 foot shell height (normal 3,300 bushel capacity), each equipped with perforated floor to accomodate drying of seed rice, two base rings, tube and well kit, sweep auger with motor.

16. Auger, horizontal. To deliver seed from bins through tube to outer edge of storage bin.

17. Fan-heater unit for drying seed rice in storage. To be equipped with humidistat to function on 5% differential of relative humidity and a thermostat to operate at + or - 2°F. Heater to be oil-fired and to deliver up to 250,000 BTU's/hr with provision for low heat turn down. Fan to be 5 HP centrifugal backward curved or propellor-type capable of delivering 6,000 CFM at a static pressure of 2.5 inches. Motors to be operable on 220 volt, 3 phase, 50 cycle electrical current. Units to be furnished with transitions as per specifications presented at time of ordering.

18. Fan-heater unit for use in sack drying rice seed. To be equipped with humidistat to function on a 5% differential of relative humidity and a thermostat to operate at + or -2°F. Heater is to be oil-fired and to deliver up to 80,000 BTU's/hr with provision for low heat turn down. Fan to be 1 1/2 HP capable of delivering 4,000 CFM at 0.5 inches of static pressure. Motor to be operable on 220 volt, 3 phase, 50 cycle electrical current.

19. Fan-heater unit. To be oil-fired heater and engine driven fan with generator for operating controls. Humidistat operating on 5% differential and thermostat with a differential of + or - 2°F. to be supplied as a part of the unit. Fan to be a 1 1/2 HP type to deliver 4,000 CFM at a static pressure of 0.5 inches. Heater to deliver up to 80,000 BTU's/hr.

20. Scalper, field grain screen type complete with motor drive assembly and motor of required HP to operate on 220 volts, 50 cycles electrical current. Suggest A. T. Ferrell Model 33S-1 or equal.

21. Dehumidifer, desiccant type with cooler to reduce temperature of air exhausted from unit. Suggest Una-Dyn Model 30LT with water cooler. To operate on 220 volts, 3 phase, 50 cycles electrical current.

22. Cooling tower with motor and pump for cooling water used by dehumidifier. Specifications to be detailed at time of ordering.

23. Scales, laboratory. Complete with gram weight set. Suggest Burrows Model 1301 scales with 1301-W weights.

24. Moisture tester. With its own source of electrical current. Suggest Universal Moisture Tester Model EH with all accessories (range 8 1/2 - 40% moisture).

25. Sample cans, pint size with screw on caps. Suggest Burrows No. 305 or equal.

26. Sample pans, triangular, heavy tin (10" x 10" x 2 1/2"). Suggest Burrows No. 304 or equal.

27. Trier, 10 foot long, double tube, brass, 1 3/8" outside diameter, 20 openings, partitions between openings. Suggest Burrows No. 555 or equal.

28. Trier, 63" long, double tube, brass, 1 3/8" outside diameter with partitions between openings. Suggest Burrows No. 521 or equal.

29. Bin thermometer (with shield) and five (5) 3-foot extensions. Suggest Burrows No. 330 unit with No. 330E extensions.

30. Electrical installation - estimate and listing of required materials to be supplied after final selection of plans and equipment are determined.

Screens for air-screen cleaner (items 1 and 2) as follows (one (1) of each listed):

Round Hole Screens:
6, 7, 8, 10, 11, 12, 14, 16, 18, 19, 20, 22, 24, 26, 30

Wire Mesh Screens:
6 x 19, 6 x 20, 6 x 21, 6 x 22, 6 x 24

Slotted Screens:
5 x 3/4, 6 x 3/4, 7 x 3/4, 8 x 3/4, 9 x 3/4, 10 x 3/4, 11 x 3/4, 12 x 3/4, 1/13 x 1/2, 1/14 x 1/2

Table 31. List of Seed Processing, Drying and Storage Equipment and Facilities for Type I Installation

Equipment Costs - Dollar Funding

Item No.	No. Required	Item	Unit Cost	Total Cost
1	1	Seed cleaner, 54" screen	5,200	5,200
3	1	Seed treater	1,100	1,100
4	1	Bagger-weigher	340	340
5	1	Scales, platform	205	205
6	1	Holding bin (6' x 6' x 6')	400	400
7	2	Holding bin (3' x 3' x 3')	300	600
8	1	Holding bin (2' x 2' x 2')	200	200
9	1	Steel supports for cleaner	100	100
10	1	Steel supports for treater	100	100
11	6	Elevator, 48-foot	2,240	13,440
12	1	Elevator, 26-foot	750	750
13	1	Elevator, 22-foot	720	720
14	2	Conveyor	340	680
15	18	Grain storage bin	1,600	28,800
16	4	Auger	100	400
17	10	Fan-heater for main dryer	1,000	10,000
18	1	Fan-heater for pre-threshing	1,000	1,000
20	2	Scalper	1,380	2,760
21	4	Dehumidifier	1,800	7,200
22	4	Cooling tower	300	1,200
23	1	Scales, laboratory	40	40
24	1	Moisture tester	495	495
25	3 dz.	Sample cans	8/dz.	24
26	1/2 dz.	Sample pans	32/dz.	16
27	1	Trier, 10-foot	80	80
28	1	Trier, 63 inches	44	44
29	1	Bin thermometer	38	38
30		Electrical Installation Supplies		10,000

Sub-total (equipment)	85,932
Spare parts (10% of sub-total)	8,593
Crating and Shipping (30% of sub-total)	25,780
Total	$120,305
Total Dollar Funding (one installation required)	$120,305

Construction Costs - Local Funding (U.S. Dollars equivalent)

Warehouse storage (40 x 110 x 15) @ $4/ft^2	$17,600
Processing building (27 x 50 x 25) @ $4/ft^2	5,400
Dehumidified storage (2 - 40 x 50 x 10) @ $6/ft^2	24,000
Floors (concrete) for threshing and general work area (150 x 150) @ $0.50/ft^2	11,250
Pre-threshing dryer shelter (20 x 50) @ $2/ft^2	2,000
Total per installation	$60,250
Total Local Funding (one installation)	$60,250

Table 32. List of Seed Processing, Drying and Storage Equipment and Facilities for Type II Installation

Equipment Costs - Dollar Funding

Item No.	No. Required	Item	Unit Cost	Total Cost
1	1	Seed Cleaner, 54" screen	$5,200	$5,200
3	1	Seed treater	1,100	1,100
4	1	Bagger-weigher	340	340
5	1	Scales, platform	205	205
6	1	Holding bin (6' x 6' x 6')	400	400
7	2	Holding bin (3' x 3' x 3')	300	600
8	1	Holding bin (2' x 2' x 2')	200	200
9	1	Steel support for cleaner	100	100
10	1	Steel support for treater	100	100
11	4	Elevator, 48-foot	2,240	8,960
12	1	Elevator, 26-foot	750	750
13	1	Elevator, 22-foot	720	720
14	2	Conveyor	340	680
15	10	Grain storage bins	1,600	16,000
16	2	Augers	100	200
17	6	Fan-heater for main dryer	1,000	6,000
18	1	Fan-heater for pre-threshing	1,000	1,000
20	2	Scalper	1,380	2,760
23	1	Scales, laboratory	40	40
24	1	Moisture tester	495	495
25	3 dz.	Sample cans	8/dz.	24
26	1/2 dz.	Sample pans	32/dz.	16
27	1	Trier - 10-foot	80	80
28	1	Trier - 63-inches	44	44
29	1	Bin thermometer	38	38
		Electrical Installation Supplies		6,500
		Sub-total (equipment)		52,552
		Spare parts (10% of sub-total)		5,255
		Crating & Shipping (30% of sub-total)		15,765
		Total per installation		$73,572
		Total Dollar Funding (three installations required)		$220,716

Construction Costs - Local Funding (U. S. Dollars equivalent)

Warehouse storage (40 x 110 x 15) @ $4/ft^2	$17,600
Processing building (27 x 50 x 25) @ $4/ft^2	5,400
Floors (concrete) @ $0.50/ft^2 (150 x 100)	7,500
Pre-threshing dryer shelter (20 x 50) @ $2/ft^2	2,000
Total per installations	$32,500
Total Local Funding (three installations required)	$97,500

Table 33. List of Seed Processing, Drying and Storage Equipment and Facilities for Type III Installation

Equipment Costs - Dollar Funding

Item No.	No. Required	Item	Unit Cost	Total Cost
2	1	Seed cleaner, 34" screen	$4,000	$4,000
3	1	Seed treater	1,100	1,100
4	1	Bagger-weigher	340	340
5	1	Scales, platform	205	205
6	1	Holding bins (6' x 6' x 6')	400	400
7	2	Holding bins (3' x 3' x 3')	300	600
8	1	Holding bins (2' x 2' x 2')	200	200
9	1	Steel support for cleaner	100	100
10	1	Steel support for treater	100	100
11	2	Elevator, 48-foot	2,240	4,480
12	1	Elevator, 26-foot	750	750
13	1	Elevator, 22-foot	720	720
14	1	Conveyor	340	340
15	5	Grain storage bins	1,600	8,000
16	1	Auger	100	100
17	3	Fan-heater for main dryer	1,000	3,000
20	1	Scalper	1,380	1,380
23	1	Scales, laboratory	40	40
24	1	Moisture tester	495	495
25	3dz.	Sample cans	8/dz.	24
26	1/2 dz.	Sample pans	32/dz.	16
27	1	Trier, 10-foot	80	80
28	1	Trier, 63-inches	44	44
29	1	Bin thermometer	38	38
		Electrical Installation Supplies		3,500
		Sub-total (equipment)		$30,052
		Spare parts (10% of sub-total)		3,005
		Crating & Shipping (30% of sub-total)		9,016
		Total per installation		$42,073
		Total Dollar Funding (nine installations required)		$378,657

Construction Costs - Local Funding (U. S. Dollars equivalent)

Warehouse storage (40 x 50 x 15) @ $4/ft^2	$8,800
Processing building (27 x 50 x 25) @ $4/ft^2	5,400
Floor (concrete) (100 x 100) @ $0.50/ft^2	5,000
Total per installation	$19,200
Total Local Funding (nine installations required)	$172,800

Table 34. List of Seed Processing, Drying and Storage Equipment and Facilities for Type IV Installation

Equipment Costs - Dollar Funding

Item No.	No. Required	Item	Unit Cost	Total Cost
19	1	Fan-heater for sack dryer	$2,300	$2,300
		Sub-total (equipment)		$2,300
		Spare parts (10% of sub-total)		230
		Crating & Shipping (30% of sub-total)		690
		Total per installation		$3,220
		Total Dollar Funding (eight installations required)		$25,760

Construction Costs - Local Funding (U. S. Dollars)

Sack dryer (30 x 25 x 8) @ $5/ft^2 (including roof and wall)	$3,750
Loading shed (30 x 15) @ $2/ft^2	900
Total per installation	$4,650
Total Local Funding (eight installations required)	$37,200

Table 35. Summary Table Listing Total Costs of All Seed Processing, Drying, and Storage Equipment and Facilities.

Type Installation	Dollar Costs	Local Funding (U. S. $)
I	120,305	60,250
II	220,716	97,500
III	378,657	172,800
IV	25,760	37,200
Mfg. Service Contract	20,000	
Technical Services	15,000	
Contingencies	69,562 (9%)	18,388 (5%)
Totals	$850,000	$386,138

Table 36. Cropping Sequence of Rice Types in EPADC Farms and Movement of Seed Through the Processing, Drying, and Storage Facilities

	1/4 Total Crop		1/4 Total Crop	1/2 Total Crop
	Boro	IRRI	Aus.	Aman
Jan.	plant	plant	distribute	process
Feb.			plant	process
March	harvest, dry		plant	plant (b) process (tr)
April	harvest, dry		plant	

May	dry, store	harvest	plant	
June (wet)	store	dry, harvest	harvest, dry	
July (wet)	store	dry, store	harvest, dry, store	plant (tr)
Aug. (wet)	store	dry, store	harvest, dry, store	plant (tr)
Sept. (wet)	process	process	store	plant
Oct. (wet)	process	process	store	
Nov.	distribute	distribute	process	harvest
Dec.	plant	plant	process	harvest

b = broadcast Aman
tr = transplanted Aman

then some extra bagging and handling will be necessary. Even so, it is doubtful that the cost of additional units of drying-storage bins cannot be justified. The storage capacity of the installation is great enough to take care of the anticipated crops, but excessive varieties or lots will require bagging of some lots prior to storage, storing the bagged seed in the steel bins on top of bulk seed or in the ordinary warehouse.

An alternative to bagging and storing small lots unprotected in the ordinary warehouse would be to use moisture-proof or moisture-resistant package materials. For instance, a 6 mil polyethylene liner in a jute bag would provide a dry atmosphere around the bagged seed. (The use of moisture-proof containers can be very successful in preserving the viability and vigor of seed, or it can be a complete failure. Care in making sure that seed moisture is low enough to prevent excessive respiration and that seed is free of insects when placed in the bag are absolutely essential). With experience afforded by storing these small lots in moisture-proof bags, EPADC could eventually expand its capacity to handle a large variety of seed kinds.

Type IV installations are placed on EPADC 100-acre farms to serve these farms and surrounding registered growers as dryers only. These are sack-type dryers and will enable the farmers to dry the seed to safe-storage levels of moisture during the time between harvest and eventual transportation to a Type II or III installation for final processing. Type IV installations are on farms isolated by distances and/or water too far for transporting wet rice to the other drying installations.

G. The problem of threshing has not been wholly solved. The type of thresher needed is the kind used on U.S. farms prior to the advent of the combine harvester but now out of production. These threshers have been used quite satisfactorily in several rice-growing countries. A similar unit on an EPADC farm had given good service but was completely worn out.

One of the chief difficulties in threshing the Aus crop by any method is that it is harvested during the monsoon season from fields still covered with water. The Team suggests that EPADC experiment with a pre-threshing procedure on Type I and II installations. Equipment item number 18 is the fan-heater unit for this experimentation. Essentially, this equipment and facilities at the four farm locations is a type of hay-dryer, on which freshly-harvested, unthreshed rice will be dried sufficiently for threshing. The idea may not be practical, but it is worth a try, since the problem is so severe. The estimated cost of the equipment is for all four locations $4,000 and equivalent dollar value in local construction of $8,000.

In general, the foregoing describes the operating procedures. Training courses as suggested elsewhere will porvide the details of those with responsibilities for operating and managing the facilities.

A reexamination of Table 36 will show that the schedule for processing is well distributed, the Aus, Boro and Aman being handled at different times which in total could reach over a 6-month period.

H. Installation lay-out on Types I, II, and III, are shown on the attached blueprint. It may be noted that the units are somewhat modular, Type III with a processing plant, in-bin drying consisting of five storage bins with three fan-heater units being a base unit. Double the number of bins and fan-heaters and increase the size of the seed cleaner and Type II results. Add eight more bins and four more fan-heater units and Type I is created. No larger seed cleaner is added in moving from Type II to Type I, since the larger installation will be more efficient and also because the cleaner is slightly over-sized for the Type II installation.

The fact that the installations are so similar does not mean that seed production conditions are equal in each vicinity having a like type installation. The Team visited enough of the areas to recognize that this is not the case.

Nevertheless, where rice production will be lower, acreages of jute, vegetable seeds, wheat and other crops will compensate to a large extent. The same facilities can be used for all seed crops likely to be grown.

Size of seed processing equipment and facilities reflects volume of rice and wheat seed production expected in each area. Table 26 shows certain information about producers within each district. These data include size of farm, 1968-69 rice acreage projections, and 1968-69 rice production projections by season of production. In addition, wheat acreage and production data for 1968-69 are included.

The data show that the largest acreage and tonnage of production is found at the 3,000-acre Dattanagar Farm. A Type 1 system with a capability of some 1,400-2,000 tons per year is scheduled to meet this need. On the other hand, a Type IV system, with a capacity of 50-100 tons per year, will handle with all ease the expected production of about 60 tons from the Rangpur Farm.

1. **Annual cost of seed cleaning, processing, drying, and storage is about .7 cents per pound of seed and use of such enable seeds to have the quality necessary to sell as seed rather than grain.**

Table 37 shows the major items of added expenditures for owning and operating the seed cleaning, processing, drying, and storage equipment and facilities. The cost for operating the "dollar cost" equipment is estimated at almost $164,000 and represents 83 percent of the total added cost of $197,566.

Sacks, treating materials, closures, and tags combine to represent a major item of cost of producing seeds totaling more than $64,000 for the system designed for East Pakistan. Due to relatively heavy investment in equipment, the depreciation cost at almost $44,000 also represents a relatively high cost. Labor costs are detailed in Appendix Table 4.

The total investment in buildings and facilities through local currency is almost $34,000, involving a depreciation cost of some $18,000 and an interest cost of somewhat less than $12,000.

REQUIREMENTS FOR A SEED TESTING LABORATORY

The Extension Service has an equipped seed testing laboratory which is not functioning. EPADC is building a laboratory near Mymensingh. No equipment other than that listed for the individual installation is needed or requested. It could not be ascertained by the Team why the Extension

Table 37. Annual Costs of Owning and Operating Seed Cleaning, Processing and Drying Equipment, Buildings, and Facilities.

Item	Amount	
	Dollars	
Dollar Cost Equipment:		
Depreciation	43,918	
Interest (6%)	17,302	
Maintenance	12,348	
Electricity	8,180	
Fuel	1,717	
Labor	15,989	
Treating, sacks, closures, etc.	64,464	
Subtotal		$163,918
Local Currency Construction and Facilities:		
Depreciation	18,387	
Interest (6%)	11,584	
Maintenance (1%)	3,677	
Subtotal		$ 33,648
Grand Total Cost		$197,566
Drying and processing capacity, tons		11,200
Average cost per tons drying and processing capacity		$ 17.64
Average cost per pound of drying and processing capacity		$ .007

Service laboratory was not functioning, nor why if a new laboratory were to be constructed it should not be at the University at Mymensingh or in a division of the Directorate of Agriculture. The location or administration of the laboratory is of little concern in reference to this loan application. It does have reference to the future development of a seed industry. Not knowing the background of interagency relations in the province on this subject there is hesitation to comment extensively.

Basically, it is not a good idea for a producing agency to also be a testing agency except to obtain information for its own use. If seed lots are to be labeled for factors of seed quality, the laboratory should be administered by a different agency. The testing of EPADC-produced seed by another agency would remove any suspicion of possible bias which the public might associate with a producing organization doing official testing. It is emphasized that the Team members do no think that EPADC would market seed not meeting prescribed standards, but operation of the laboratory outside EPADC would not only allay any suspicion by purchasers, but the laboratory could also serve the whole province as a service laboratory and a regulatory laboratory as seed production and marketing develop outside EPADC.

With seed probes, balances, and moisture tester at each processing plant installation available for determining the quality of the processing operation, one good central laboratory should be sufficient to meet the needs in the foreseeable future.

GENERAL OBSERVATIONS AND SUGGESTED MODIFICATIONS CONCERNING EPADC AND RELATED PROGRAMS

When the seed farms and the production centers are completely organized and equipped, both the EPADC farms and those of the registered seed growers must be operated as **seed farms** not as general grain farms. While it is necessary that the farms show a profit, in the early years policies and procedures must be set forth and followed which place the production of high quality seed above profit-making. After the Corporation has gained a reputation for producing and marketing high quality seed, prices should be increased sufficiently to pay for costs, plus enough profit to maintain equipment and improve efficiency.

A. Production techniques for maintaining varietal purity in the field must be technically sound and faithfully followed. Incentives to EPADC farm managers and registered seed growers must be attractive enough to encourage more attention to seed production than to grain production. Although there is a production incentive at present, a farm manager or seed producer can show more profit by holding grain several months after harvest to wait on a price rise than he can by producing and marketing seed for planting purposes.

B. Seed production and marketing should not be speculative. EPADC must strive to produce genetically pure seed of a small number of recommended varieties. It should dry, store, clean, and bag the seed to maintain high quality in reference to physical purity and viability. The Corporation must further perfect a distribution system which makes seed available to farmers where and when they need it. When these are accomplished, then EPADC can charge a unit price for the seed which the farmer can afford to pay and which will return a fair profit to the Corporation. The notion fostered by many public seed production agencies that farmers will only buy low-priced seed is questionable. It has been shown in every part of the world that farmers will pay the production price plus profit for seed if he finds that the seed is worth it. Expenditures for seed is relatively low when compared with other inputs required in producing a crop. But farmers have a tendency to use for seed, grain left over from a former crop unless they can be shown that the purchase of seed will make them money. With the equipment herein recommended, a good training program, superior local crop varieties, the anticipated new varieties yet to be developed, and an effective promotional program there is no reason to believe that EPADC cannot produce high quality seed and sell it all at a reasonable price to receptive consumers.

C. Another suggested modification has reference to seed produced by the EPADC's registered growers. Presently, of the seed stocks furnished the seed growers by EPADC, the increase of only about 40 percent of the planting is returned to the Corporation; the remainder consumed by the seed grower as food. It is understandable why this is done, but if the foundation seed produced by EPADC is grown, as it should be, from breeders (or genetic) seed under close observation in the field and supervised with extreme care in cleaning and storing; and if the registered growers are properly supervised and counseled, then it is a great waste of effort and expense to lose 60 percent of the production from this seed. Since EPADC now produces more seed than it sells, this is of small consequence at the moment. Because of the small size of seed grower farms and the difficulty of keeping seed and grain separate, it may not be practical to modify this procedure, but when serious seed production is undertaken, consideration should be directed toward altering this practice.

D. In its relationship with related programs EPADC seems to be pursuing a course of doing the entire task of seed production, testing, certifying, processing, marketing and promotion. Not knowing all of the background, the Team hesitates to either criticize or praise this attitude. The Corporation appears to have the leadership necessary for this role; its personnel has enthusiasm for the job, and at the present time it may be necessary for EPADC to do the whole job; in order to get seed produced and distributed. Certainly this is its mandate. Still, it would appear advantageous if other established agencies could assume some important roles in the total seed program. Why not utilize

more effectively the research arm of the Ministry of Agriculture, the Extension Service, other provincial agencies, and ultimately a developing private sector? It appears that EPADC should play the role of a catalyst, at the same time doing what others cannot do, toward the ultimate aim of developing a seed industry, be it public, private, or both, which will consistently and effectively supply farmers with a source of high quality seed of superior adapted varieties and hybrids.

E. **The part of the Directorate of Agriculture** in providing stocks of new and improved varieties has been mentioned. This same department should be expected to maintain pure breeding stocks of all useful varieties as a source of replenishment of EPADC stocks and to undertake research to answer seed production problems. The matter of quality control must be considered. The seed given by breeders to EPADC should contain a label indicating variety. Seed stocks used by EPADC and produced by EPADC must always be labeled or identified so as to prevent mistakes in identity of seed. This is being done on the farms now. The practice should be continued and improved since personnel working with the seeds will not be familiar with new varieties. Care in the field must be exercised to insure that fields are identified as to variety or strain, that volunteer plants do not contaminate the seed field. Particular attention should be given to the practice of planting a variety of rice on the same land previously planted to a different variety. Only local research and observation can ascertain whether this is an acceptable practice for each variety since dormancy characteristics may vary among varieties.

F. **Before marketing, each bag of seed should be labeled** as to variety, physical purity, and viability. EPADC presently labels and seals bags of seeds, but these bags are opened at distribution areas prior to sale in order that farmers may purchase only the portion of the bag needed to seed his farm. It is recommended that EPADC package the seed in appropriately-sized bags so that the farmer receives a labeled and sealed bag. This practice will not only assure him that he is getting the variety and quality he wants but will help advertise EPADC seed.

G. **Additional care must be taken by the EPADC processing, drying, and storage installations** to make sure that machines, bins, and conveyors are thoroughly cleaned between the handling of different varieties. Rodents and insects must be controlled by sanitation and poisoning and seed protected against the absorption of excessive amounts of moisture. These are some of the normal considerations in seed production which are of less consequence in grain production. Detailed procedures can be provided through training courses and on-the-job training.

H. **Should there be laws and regulations** to insure minimum standards for marketable seeds? If not, why? If so, who should have the responsibility for this activity? There is probably no single answer to the questions posed, either in general or for East Pakistan in particular, however, some guidelines are suggested. The primary purpose of any control system is to assure the buyer that the product offered is as represented. Should a farmer wish to purchase Variety X, he should have adequate assurance that this is possible. If he wants seed with an expected percent germination of 90%, he should have reasonable assurance that a seed lot so represented has this capability. In a highly competitive system of marketing it is sometimes considered that competition will, in itself, maintain seed quality at high levels. This opinion contains an element of truth, but even here some outside control has usually been found necessary. Should a group of producers police themselves? Seed certification is a system, as practiced in the United States and Canada, by which seed growers through their certification organization set quality standards of production and marketing on themselves and guarantee genetic identity of seed offered for sale. The principal of seed certification has been used with modification in seed programs in some developing countries. Often it becomes synonymous to seed legislation and thus loses some important aspects of true seed certification, primarily in methods of organization, enforcement, and terminology. For instance, in spite of resolutions in seed seminars in all regions of the world that the certification terms Breeders Seed, Foundation Seed, Registered Seed, and Certified Seed be used as defined by the International Seed Testing Association (United States and Canada), many developing countries indicate all seed inspected by a state or federal agency as qualified to be labeled according to these certification terms.

I. **As long as EPADC is producing and marketing the bulk of the seed, there appears to be little need for either a seed law or seed certification.** However, elements of each must somehow be in effect and enforced. As mentioned above, the consumer must be protected to the extent that he knows what he is buying.

To act in the capacity of a combination advisory-control council, administrative and technical representatives of research, extension, the agricultural university, and registered growers could draw up rules and regulations for seed production and marketing and standards which seed must attain before being marketable. The committee would also designate a seed testing laboratory to run "official" tests. Seed not meeting the standards would not be sold as seed. Special cases would be presented to the council for decision. This system would have no enforcement powers.

Should this system fail or when a number of agencies, persons, or firms begin marketing seed, then official seed legislation along with enforcement powers would need to be effected. When this time approaches, USAID can supply consultants to provide assistance.

The route of seed certification could also be taken - with or without a seed law. The multiplication system as described in the proposal starting with a new variety developed by the Directorate of Agriculture and multiplied by EPADC contains the element of maintaining a genetic stock through generations - the prime requisite of seed certification. To complete the process, a certifying agency (public or private - or elements of both) must be designated, rules

and regulations adopted, standards developed, an unbiased inspection system setup, and a method of inspecting and finally "certifying" the commercial seed. The greatest single factor lacking in the EPADC system is the last inspection - the increase beyond EPADC seed. In the opinion of the Team certification is a few years away for East Pakistan. Here again when the need develops, USAID can supply the needed consultative assistance.

J. **In reference to a larger role for the private sector,** it must be noted that at present, private sector participation in seed production and marketing is extremely small. Probably less than a half dozen small firms supply vegetable seeds at the retail level. The seeds offered for sale are either imported or produced in the northern part of the country. Field seed sold outside government agencies is primarily on a farm to farm basis. Farmers growing seed for EPADC may be said to be involving the private sector. Although partially true, the growing of seed for a government agency which cleans, bags, and markets the seed can hardly be classified as a private seed industry, although admittedly it is a start.

These growers who are now producing seed for EPADC can, if encouraged, provide the nucleus of private sector participation. This is especially true in those districts in which EPADC does not have large farms. After the growers have obtained experience producing seed for the Corporation for two or three years, they can be encouraged to market the seed directly rather than sell the seed back to EPADC. To increase marketing efficiency they may wish to organize locally into an American-style marketing cooperative. In the beginning EPADC could continue drying and cleaning the seed, charging the producers for the services, until the group can put up its own facilities. There is also room for private production and marketing enterprise beyond the EPADC seed growers. It is hardly likely, however, that companies with their own breeding programs in field crops will develop very soon. Rice is not a particularly attractive crop on which to build a seed business. But there are possibilities in vegetable seed production which should be able to attract some interest in the private sector. Aside from the possibility of profits, the extent to which the private sector can develop either in field or vegetable crops will depend largely upon the program and action of EPADC and the government of East Pakistan. Seed sold below cost by public agencies, laws which create government seed monopolies, restriction on use of foundation seed stocks, excessive length of test periods to gain recommendation of varieties, restrictive laws of transport, excessive taxes and import duties are some of the factors which commonly discourage private sector participation in various countries. In most instances, these laws and regulations are not in effect for the purpose of delaying the entrance of private individuals and companies in the seed business, but they accomplish this result.

Positive action should be taken to remove such obstacles and to actively encourage the development of the private sector. Accessability to basic stocks of new varieties, fair price competition by EPADC and other public agencies, long-time low interest loans, waiver of import restriction on seed production, processing, drying and storage equipment are some measures which could be considered to improve the investment climate for firms interested in seed production and marketing in East Pakistan. These considerations plus a good breeding program to develop improved varieties and a vigorous and effective extension program to create a demand will go a long way toward encouraging individuals, corporations, and companies to participate in the seed program. Simply put, EPADC's mandate is to get a commercial seed multiplication and distribution set up, then to concentrate its efforts on foundation seed production to supply the system. Acceptance of some of the foregoing suggestions may help.

TECHNICAL ASSISTANCE

Technical assistance in this proposed project takes several forms. Maintenance of equipment looms large as a factor which can spell success or failure to the project. Funds are provided under the proposed loan for service contracts with the suppliers of the major items of equipment, especially tractors. Funds are also supplied under the loan to finance two man years of consultant services to assist in setting up and helping administer the equipment maintenance program. EPADC has agreed to appoint permanent government employees to supervise and work under the maintenance program.

AID, either through mission personnel or short-term consultants, should provide assistance during the training of land-leveling crews.

In reference to technical assistance requirements for the drying and storage units, AID, in requesting bids, should specify that the supplier of these units should train a construction crew in East Pakistan in the erection of one complete installation. An alternative would be to have a person or persons on EPADC staff work in the United States with the supplier actually erecting units during a training period. It is naturally assumed that personnel so trained would be responsible for erecting the installation in East Pakistan.

Concerning the seed processing equipment and installation, Mississippi State University through AID Global contract can prepare layout plans for the installation, detailed specificatons for equipment and suggest general building specifications for the processing plant and warehouses. When all equipment has been delivered on site at one location, personnel can be sent to help place the equipment, get it in operation and train EPADC personnel to install equipment at the other locations. By working in cooperation with the supplier of the drying-storage installation, Mississippi State University personnel could also assist in the operation and management of these installations. The two-year equipment maintenance consultant would also be available to help keep equipment operating. The University staff can offer training in East Pakistan in seed production, processing, drying, storage, seed analysis and associated subjects

needed in the operation of a complete seed program. The cost of this to the USAID Mission would be international transportation and subsistence. The cost to East Pakistan would be local transportation. In the event, however, that EPADC would be expected to pay all costs, an amount is set in the budget to cover all expenses of seed advisory personnel, including salaries. To supplement local training, personnel in a supervisory capacity could be sent to the AID/IADS Special Course in Seed Improvement conducted each year from June to August in the United States.

The above services plus an occasional consultant on special problems as they arise should assure the satisfactory operation of the program. Although an agronomist trained and experienced in seed improvement and technology on the USAID staff would be a valuable asset in assisting on technical problems and training, and in helping guide the project from a seed farm operation toward the development of a total program, such a position is not set in the budget.

Technical assistance in production techniques and promotional methods may be supplied by East Pakistan Agricultural University with which AID has contact through the Texas A & M contract. Training courses given by the Academy at Comilla can also be a great value in these areas.

Assistance will be required in preparation of detailed equipment specifications, procurement documents and evaluation of tenders. EPADC has an agreement with the Roads and Highways Directorate to provide asssitance in preparing the detailed specifications of farm production and leveling equipment. AID will need to provide the services of a knowledgeable engineer to check out these specifications and prepare necessary purchase documents.

Estimated Technical Assistance Requirements Outlined in East Pakistan

1. One long-term (2 years) consultant
   Farm shops, agricultural machinery, seed processing and drying equipment
2. Manufacturers Service Contracts
   a. Farm production and leveling equipment (1½ man years)
   b. Seed drying equipment (1/3 man year)
3. Technical Services
   a. Training of leveling crews by local AID staff
   b. Installation of processing equipment, training of equipment operators, seed production agronomists, seed laboratory technicians. To use Mississippi State University staff or equivalent. Total of 4 months, 2 trips to East Pakistan.
4. Local Training
   a. Seed production, distribution and extension. By personnel supplied by 1, 2, and 3 above.
   b. Training by local institutions such as, Academy at Comilla, East Pakistan Agricultural University at Mymensingh, Extension Service and EPADC.

In the United States

1. Responsible persons to prepare detailed equipment specifications and purchase documents.
2. Responsible persons or organizations to maintain contact to assist in technical matters.
   Example - Mississippi State University/AID Global Seed Contract.

Table 38. Summary of Capital Costs

Item	Dollars	Rupee Equivalent[1]
I. Dollar Costs (Foreign Exchange Component)		
A. Production, Harvesting & Land Leveling	$1,225,000	Rs. 5,880,000
B. Seed Processing, Drying & Storage	850,000	4,080,000
Total Dollar Costs (FEC)	$2,075,000	Rs. 9,960,000
	Dollar Equivalent	Rupee
II. Local Currency Costs		
A. 3,000-Acre Farm	$ 400,685	Rs. 1,923,285
B. Four 500-Acre Farms	255,316	1,225,518
C. Seventeen 100-Acre Farms	229,229	1,100,295
D. Seed Processing & Storage	386,138	1,853,462
Total Local Currency Costs	$1,271,368	Rs. 6,102,560
GRAND TOTAL (I + II)	$3,346,368	Rs. 16,062,560

Rs. 4.80 = $1.00

FINANCIAL ANALYSIS

A. The total capital cost of this project is estimated at the equivalent of $3.3 million (Rs 16.1 million). Of this amount, shown in Table 38, $2.1 million (Rs 10.0 million) is dollar-funds to be provided by an AID loan. The equivalent of $1.2 million (Rs 6.1 million) represents local currency to be provided by the borrower (Pakistan Government). A condition precedent to disbursement under the loan will be that the borrower provides assurance satisfactory to AID that the necessary rupees will be provided in a timely manner.

The major purposes for the $3.3 million expenditure is to (1) form cropland for irrigation, drainage and improved production; (2) mechanize production and harvesting for more timely and efficient operation; (3) mechanize seed harvesting, threshing, cleaning, drying, processing, and handling for better quality seeds, and (4) assure an adequate supply of "improved seeds" from the production on ADC's Seed Multiplication Farms and Registered Growers.

According to Table 38 land forming, production, and harvesting segment of the dollar loan involves $1.2 million (Rs 5.9 million) or almost 60 percent of the total dollar cost. Seed processing, drying, and storage equipment account for the other $850,000. This represents just over 40 percent of the area.

Appendix Table 5 presents a detailed list of items to be included in both the dollar fund purchases and in local currency funds. The items to be financed by dollar-loan funds are divided into one section showing those items which relate to production, harvesting, and land-leveling. As indicated earlier these items account for $1.2 million of the loan-fund request. The 24 large 85-95 h.p. tractors represent the largest single item of equipment included in this list - accounting for $180,000. Nine of these tractors will remain on the large (500-acre) farms and the 3,000-acre farm for use in land forming maintenance and land breaking operations. The other 15 will be moved to land leveling projects on other farms on lease from the East Pakistan Government. These and accompanying land forming equipment will be moved from SM farms as soon as the land forming job is completed on each of them.

B. **Land forming by machine costs less and is accomplished quicker and in more precision than "Head Basket" method.** Annual operating costs involves operation of land forming and leveling equipment, crop production and harvesting equipment, and seed processing, drying, and storage facilities and equipment.

Table 39 shows the purchase cost, use, and cost of land forming and leveling equipment to be used on ADC's SM farms. These data indicate the total cost for the land forming and leveling needed on SM farms to be just over

Table 39. Use of Machinery for Land Forming and Leveling.

Item	Purchase Cost	Life of Machine	Used on Project	Depreciation Repair Operation, POL cost/hr.	Total Cost
	Dollars	Years	1000 hrs.	------- Dollars -------	
A. Capital Equipment					
24-85 h.p. wheel tractors	180,000	10.0	30.0	3.18	95,400
15-Scrapers	52,500	5.0	15.0	1.30	23,790
12-Float plane (12x40)	27,600	5.0	8.4	.64	6,182
6-Plane, water leveling	3,600	5.0	1.8	.60	1,080
15-Plow, chisel 12 ft.	10,500	5.0	4.5	1.38	6,210
B. Freight, crate, and insurance (25% of cost over 6-year period)					11,425
C. Short term mfg's. service contracts (1 1/2 man years over 2 years $90,000					45,000
D. Supervision, peon labor and overhead (10%)					19,129
E. Total year one					208,216
F. Total year two					208,216
G. Grand Total					416,432

Table 40. "Head Basket" Method of Land Leveling

Year	Average Per Year	Cost/Acre	Total Cost
	Acres	Dollars	
1	825	240	198,000
	Supervision and Overhead 10%		19,800
	Total Year 1		217,800
2			217,800
3			217,800
4			217,800
	Grand Total Cost		$871,200

Source: East Pakistan Agricultural Development Corporation.

Table 41. Summary of Operating Costs by Years.

Year	Annual Costs		
	Crop Production	Seed Processing	Total
1	556,827	184,960	741,787
2	645,671	177,828	823,499
3	727,044	179,918	906,962
4	727,044	179,918	906,962
5	727,044	179,918	906,962
6	847,044	179,918	1,026,962
7	847,044	179,918	1,026,962
8	847,044	179,918	1,026,962
9	847,044	179,918	1,026,962
10	847,044	179,918	1,026,962

$400,000. It shows further that this work is expected to be completed within two years after equipment is on hand to begin work.

The major power source for this work is to be provided by 24-85 h.p. wheel tractors. The bulk of soil movement will be handled by the scrapers which are designed to be used in tandems. Land leveling experiences in the Delta area of the Mississippi River show that the 85 h.p. tractor can load these 2 scrapers, coupled in tandem arrangement, without the aid of a "pusher" tractor.

According to Table 39 the land forming and leveling can be done at a cost just over $400,000. This compares to more than $800,000 estimated by ADC for the same work to be done by the "Head Basket" method. In addition, the "Head Basket" method would require some four years or twice the time to get the job done. The delay of two years could result in significant financial loss as achieving production potentials would be delayed by the same amount of time.

Time and cost are both important in comparing machine leveling and land forming with the "Head Basket" method. The most important factor, however, is that the "Head Basket" method does not result in satisfactory land forming for the large fields required for efficient mechanized seed productions and harvesting. (Table 40).

Operating costs for ADC's "improved seed" program are three-fourths production and one-fourth processing. Table 41 shows annual operating costs for crop production and seed processing for 10 years following initiation of a mechanized program on SM farms. These data show that total costs for crop production increase from just over $550,000 in the first year to almost $850,000 in the 6th year after equipment and facilities are all in place and annual debt payment of some $120,000 has begun. According to Table 41 from the 6th through the 10th year the total annual production costs remain at the $850,000 level.

Appendix Table 6 shows detailed annual operating costs for crop production on SM farms. Cost data in the table includes both tractors and equipment to be purchased through loan funds as well as for tractors and equipment on hand and in operating condition. Total annual costs for equipment ownership and operation represents more than

$300,000 while other inputs such as fertilizer, seed, pesticides, labor and management account for most of the balance. Depreciation on capital equipment provided by local currency represents annual costs of over $40,000.

Seed processing costs at about $180,000 each year represent some one-fourth of total costs. Depreciation, interest (6%) and maintenance for seed processing equipment at just under $75,000 represent a major share of total cost of operating the seed processing program. Labor, fuel, and electricity costs are relatively small when compared to costs of sacks, closures, treating, etc.

Appendix Table 7 lists each major item of equipment used in seed processing and shows data for specific cost items. Both Appendix Table 6 and Appendix Table 7 show cost items for the manufacturer's service contract which is designed to get a service program for care of the machinery well underway as local people are taught how to carry such a program forward. In addition, funds are included for a long-term consultant and special technical assistance for proper initiation and development of and "improved seed" program.

Total operating costs according to Table 42 increase from just under $750,000 during the first year to just over a $1 million level by the end of the 10th year. Total costs include an amount for depreciation based on the life of machine or the facility, repair costs estimated from 60 to 100 percent of purchase price of item over its lifetime period, operator labor costs, fuel and interest (6%).

Total annual operating costs include special costs for technical aid, manufacturer's service contracts, and debt service after the fifth year. Table 42 shows information on these special costs by years in which they occur. Technical aid and manufacturer's service costs occur during the first two years as machinery and equipment is installed and workers are trained in its operation. On the other hand, debt service by agreement does not begin until after the fifth year following five years of grace on both interest and principal payments.

When technical service, manufacturer's service and debt service are subtracted the total operating costs are lowered $845,000 for the 10-year period. The first year net operating cost is just over $600,000. Then there is an increase to over $700,000 the second year and to just over $900,000 the third and each year thereafter.

Table 43 shows net operating costs, value of production, profit or loss, and accumulations for the first ten years of operation. These data show that after the first two years, value of farm production exceeds annual net operating costs, and by the end of the fourth year the accumulated losses have been recovered and a profit of just over $160,000 has accumulated. After the third year when full production has been reached, there is an annual profit of about $260,000. The accumulation of this profit would be sufficient to repay the dollar cost of the loan request ($2,075,000) by the end of the 12th year.

When cost escalation is considered as a possibility over the next ten years, there is a significant increase in net operating cost over that time. Table 44 shows net operating cost, cost escalation factors and escalated cost for the 10 years. Cost escalation factors are based on the past ten years index of general wholesale prices in East Pakistan. These data show that the total escalation in cost is just over $900,000 for the 10 years.

There is good reason to believe that prices received will also show some escalation if cost rise over the next ten years results in only slight changes in price relationships. In addition, there is some room for belief that efficiencies of producing seed will also help to offset rise in cost of inputs.

ECONOMICAL ANALYSIS

The chief national economic benefit of this project will be through increased production of food as a result of improved seeds. Both quality and quantity of seeds, available

Table 42. Total Annual Operating Costs, Technical Aid and Manufacturer's Service, Debt Service, and Net Operating Costs.

Year	Total Costs	Less Technical Aid And Services	Less Debt Service	Net Operating Costs
	Dollars			
1	741,787	140,000	-------	601,787
2	823,499	105,000	-------	718,499
3	906,962	-------	-------	906,962
4	906,962	-------	-------	906,962
5	906,962	-------	-------	906,962
6	1,026,962	-------	120,000	906,962
7	1,026,962	-------	120,000	906,962
8	1,026,962	-------	120,000	906,962
9	1,026,962	-------	120,000	906,962
10	1,026,962	-------	120,000	906,962

Table 43. Net Annual Operating Costs, Value of Production, Annual Profit or Loss with Accumulations.

Year	Net Operating Cost	Value of Production[1]	Profit or (Loss)	Accumulations
	Dollars			
1	601,787	380,000	(221,687)	(221,687)
2	718,499	583,500	(134,999)	(356,686)
3	906,962	1,167,000	260,038	(96,648)
4	906,962	1,167,000	260,038	163,390
5	906,962	1,167,000	260,038	423,428
6	906,962	1,167,000	260,038	683,466
7	906,962	1,167,000	260,038	943,504
8	906,962	1,167,000	260,038	1,203,542
9	906,962	1,167,000	260,038	1,463,580
10	906,962	1,167,000	260,038	1,723,618

[1]See Appendix Table 9 for acutal and predicted values of each crop grown.

Table 44. Net Operating Cost, Cost Escalation[1], and Escalated Cost for 10-Year Period.

Year	Net Operating Cost	Cost Escalation Factor	Escalated Cost
	Dollars		Dollars
1	601,787	.....	601,787
2	718,499	1.021	733,587
3	906,962	1.0424	945,417
4	906,962	1.0643	965,280
5	906,962	1.0867	985,596
6	906,962	1.1095	1,006,274
7	906,962	1.1328	1,027,407
8	906,962	1.1567	1,049,083
9	906,962	1.1810	1,071,122
10	906,962	1.2058	1,093,615
10-Year Total	8,575,982	xxxxxx	9,479,168
Cost escalation total			903,186

[1]Cost escalation factor is based on Index Numbers for General Wholesale Prices for 1956-57 through 1965-66 in East Pakistan.

to farmers in East Pakistan, will be improved. The largest share of these seeds will be rice, however; wheat, vegetable, and other seeds will also be more abundant and better quality than formerly.

The area to be planted in improved seeds is projected at 1,350,000 acres in 1974 when the seed improvement project has reached its planned level of production and distribution. Table 45 shows that the improved seeds made available to East Pakistan farmers from ADC's SM farms and the Registered Growers is expected to plant 225,000 acres each for a total of 450,000 acres. Seeds, from other farmers which are only one year or so from Registered Growers or SM farm seeds, account for a major share of the total to be made available. Some 20,000 tons of these are expected to be used on about 900,000 acres.

Appendix Table 10 shows how much the value of crops can be increased as a result of using improved seeds from ADC's SM farms at three different response levels. These data show that the increased value of crop production on SM farms from the planting of these seeds by East Pakistan farmers may well mean from just under $10 million to almost $40 million for the first 10 years. Appendix Table 11 shows that the 10-year economic influence of Registered Grower seeds may well be from about $7 million to almost $30 million. Appendix Table 12 indicates that improved seeds from other sources may have economic impact from

Table 45. Amount of Improved Seeds and Acres Planted by Source of Seed 1974.

Seed Source	Improved Seeds	Area Planted
	1,000 L. Tons	1,000 Acres
ADC's SM Farms	5.0	225
Registered Growers	5.0	225
Other Seed Producers	20.0	900
Total	30.0	1,350

Table 46. Total Additional Value of Crop Production from Improved Seeds at Medium Response Level for ADC's SM Farms, Registered Growers and Other Sources.

Year	Total Additional Value of Crop Production from Improved Seeds at Medium Response Level			
	ADC's SM Farms	Registered Growers	Others	Total
	1,000 Rupees[1]			
1969	5,940	4,455	13,860	24,255
1970	7,920	5,940	13,860	27,720
1971	9,900	7,425	13,860	31,185
1972	9,900	7,425	15,840	33,165
1973	9,900	7,425	17,820	35,145
1974	9,900	7,425	19,800	37,125
1975	9,900	7,425	19,800	37,125
1976	9,900	7,425	19,800	37,125
1977	9,900	7,425	19,800	37,125
1978	9,900	7,425	19,800	37,125
Ten-Year Rs.	93,060	69,795	174,240	337,095
(1,000)	$19,387	14,540	36,300	70,227

[1]$1.00 = 4.80 Rupees.

about $18 million to almost $73 million for the first 10 years.

Table 46 summarizes the additional value of crop production from improved seeds at the medium response level for ADC's SM farms, Registered Growers, and other growers from 1969-1978. These data show that the total additional value of crop production is about $70 million for the ten-year period. This represents an annual average of some $7 million and more than twice the total capital costs, both dollar and local currency, of the proposed project.

The "medium response" referred to on the following page represents an increase in rice production of 2 maunds per acre from the use of SM farm seeds, 1.5 maunds per acre from the use of Registered Grower seeds, and 1 maund per acre from the use of seeds obtained from other growers. These calculations are, in fact, very conservative when compared with experiences reported by others. Dr. A. Alim in **Rice Improvement in East Pakistan** stated, "The cultivators may easily get 5-15 maunds of increased yield per acre by growing the improved varieties." In **Programme for Attainment of Self-Sufficiency in Food Production in East Pakistan by 1969-70**, the seed factor is 7.9 maunds of paddy per acre for IRRI and 3.0 maunds of paddy for local improved varieties.

Appendix Tables 13 and 14 show additional value of crop production from improved seeds at the lowest response level and highest response level, respectively.

Table 47 gives the value of production from ADC's SM farms, additional value of crop production from use of improved seeds (medium response) and gross value of production 1969-1978. The 1969 and 1970 values of production on SM farms are one-third and one-half respectively of the 1971 value shown. The 1971 value is the same as the 1969-70 value given in the Third Plan Scheme for SM farms. The reduced value for 1969 and 1970 represents the amount of delay SM farms will have in reaching their 1969-70 goal as interpreted by the MSU Team.

Table 47. Value of Production from ADC's SM Farms, Additional Crop Value from Use of Improved Seeds (Medium Response) and Gross Value of Production, 1969-1978.

Year	Value from Production on SM Farms[1]	Additional Crop Value on Improved Seeds (Medium Response)	Gross Value of Production
	----------	$1,000	----------
1969	380	5,053	5,433
1970	584	5,775	6,359
1971	1,167	6,497	7,664
1972	1,167	6,910	8,077
1973	1,167	7,322	8,489
1974	1,167	7,734	8,901
1975	1,167	7,734	8,901
1976	1,167	7,734	8,901
1977	1,167	7,734	8,901
1978	1,167	7,734	8,901
Total	10,300	70,227	80,527

[1]1969 and 1970 are one-third and one-half respectively of the 1971 value listed as 1969-70 value of production in the Third Plan Scheme for SM Farms.

Table 48. Net Operating Costs for ADC's SM Farms, Registered Growers, Procurement and Distribution, and Total 1969-1978.

Year	Net Operating Costs			
	SM Farms and Processing Plants	Registered Growers[1]	Procurement and Distribution[2]	Total
	----------	$1,000	----------	
1969	602	94	265	961
1970	718	290	328	1,336
1971	907	362	377	1,646
1972	907	390	413	1,710
1973	907	390	413	1,710
1974	907	390	413	1,710
1975	907	390	413	1,710
1976	907	390	413	1,710
1977	907	390	413	1,710
1978	907	390	413	1,710
Total	8,576	3,476	3,861	15,913

[1]Cost data from Third Plan Scheme for Registered Growers.
[2]Cost data from Third Plan Scheme for Procurement and Distribution.

Data in Table 47 shows that the gross value of production is expected to increase from about $5.4 million in 1969 to $8.9 million in 1974. There is not expected to be any significant change in gross value after 1974. Of the ten-year total of $80.5 million gross value, SM farm production represents about 13 percent, and additional crop value from use of improved seeds represent about 87 percent.

Net operating costs for ADC's SM farms, Registered Grower supervision, procurement and distribution, and total 1969-1978 are shown in Table 48. According to these data net operating costs increase from $961,000 in 1969 to $1.7 million in 1972. Costs are not expected to change much after the program is in full operation in 1972. The operation of SM farms and seed processing plants is expected to cost about $8.6 million over the 10-year period. This compares to $3.5 million for Registered Growers, and $3.9 million for procurement and distribution.

Table 49 presents summary data for gross value of production, total net operating costs, net benefits to economy, and net benefits discounted present value by 10 percent.

Table 49. Gross Value of Production, Total Net Operating Costs, Net Benefits to Economy, and Net Benefits Discounted Present Value by 10 Percent, 1969-1978.

Year	Gross Value Of Production	Total Net Operating Costs	Net Benefits To Economy	Net Benefits Discounted Present Value By 10 Percent
	$1,000			
1969	5,433	961	4,472	4,065
1970	6,359	1,336	5,023	4,151
1971	7,664	1,646	6,018	4,521
1972	8,077	1,710	6,367	4,349
1973	8,489	1,710	6,779	4,209
1974	8,901	1,710	7,191	4,059
1975	8,901	1,710	7,191	3,690
1976	8,901	1,710	7,191	3,355
1977	8,901	1,710	7,191	3,050
1978	8,901	1,710	7,191	2,772
Total	80,527	15,913	64,614	38,221
Discounted Benefit Value 1979-1988				17,035
Total twenty-year discounted net benefit value				55,256

According to these data the net benefits will increase from about $4.5 million in 1969 to $7.2 million in 1974 when the program is in full operation. There is not expected to be any significant change in net benefits after 1974. Total net benefits for the 10-year period are almost $65 million before discounting. When net benefits are charged an economic interest cost of 10 percent, the discounted present value for the 10-year period is only $38.2 million and 59 percent of the original value. The twenty-year discounted net benefit value is $55.3 million.

As shown earlier, the total capital costs of this proposal is $3.3 million. When this cost is compared to the net benefits accumulating over the first ten years, the cost/benefit ratio is about 1 to 20. In other words, for every dollar the East Pakistan Government invests in the seed improvement program described herein, the country's farmers can expect to receive additional income of about twenty dollars. Even when net benefits are discounted by 10 percent the cost/benefit ratio is still 1 to 12 and represents an excellent return on investment as well as insurance against serious food shortage in years ahead.

SEED PRICES

Except for the traditionally exportable crops such as coffee, cacao, bananas, etc., agriculture in most developing countries has been (and is) largely of a subsistence type. As a result it has been either entirely forgotten or treated with a paternalistic attitude. This paternalism is often expressed by the government in supplying the farmer with cheap seed at a price lower than cost. Government in general and East Pakistan in particular has had little success in maintaining farmer customers when prices of the "cheap" seed were increased, because the seed did not produce a discernible amount more grain than "government seed" when it sold for the cheaper price.

With the advent, or approaching advent, of superior varieties and hybrids which have high yield potential when accompanied by improved agricultural practices, government cheap-seed programs are becoming outdated. When a farmer can increase his crop yield by 50, 75, 100, or 200 percent by using a package of inputs which includes improved seed, then the cost of cheap subsidized seed at 22 Rs/maund (enough to broadcast an acre) and the real cost at 40 Rs/maund makes little difference except in the positive. As often said, "good seed doesn't cost, it pays". In allocating the value of assorted inputs, some authorities have assigned the value of improved seed at about 12 percent. Non-superior varieties properly dried, stored and processed should be worth at least this much, but even so it would still pay the farmer to buy this seed. Still, the yield increase of this single input does not loom large enough to induce the ordinary subsistence farmer to buy, rather than to replant from his own grain stock.

In applying these observations to the EPADC program, the Team recognizes the reason for the subsidy of the government to EPADC but suggests that definite plans be formulated to gradually shift the true and total cost of the seed to the farmer, the user of the seed. This program must be timetabled to the marketing of high quality seed of improved varieties. There is no use raising the price until the seed warrants the increase. But as the seed becomes more valuable, the price should be increased, until finally the production and marketing will be self-sufficient. At this

Table 50. Suggested Prices of EPADC - Produced and Procured Seed - Rs/md

Year	Rice		Wheat	
	Selling Price	Subsidy	Selling Price	Subsidy
1968-69	22	15	22	11
1969-70	22	15	22	11
1970-71	26	11	25	8
1971-72	30	7	28	5
1972-73	34	3	31	2
1973-74	37	0	33	0
1974-75	37	0	33	0
1975-76	37	0	33	0
1976-77	37	0	33	0
1977-78	37	0	33	0

point, the private sector should begin to show interest and the EPADC program should assist in the development of this sector.

Table 50 has been prepared to reflect the present selling prices and subsidies of EPADC rice and wheat seed and the suggested period of phasing out the subsidy, shifting the seed cost to the consumer. Additional information on premiums paid and subsidy costs are given in Appendix Tables 15 to 18. The timetable suggested in Table 50 admittedly is a calculated guess. As previously indicated, the rapidity with which improved seed is used depends on several factors which in the final analysis results in grower acceptability. Should the program gain the stature expected of it, the shift from subsidies should be completed in about five years. The prices quoted are those now in effect. Even though inflation or other factors may affect prices, the relationship between selling price and subsidy is expected to retain the same relationship.

To the skeptics that say the farmer will not pay for good seed it was reported on several occasions that improved seed has sold for over 40 Rs/md in East Pakistan.

In reference to the suggested price for the different generations or classes of seed the following are suggestions but could vary widely depending upon how nearly self-supporting each increase program needs to be. Under the set-up in East Pakistan these prices should not be much out of order if used as guidelines for rice and wheat; vegetable seeds may require different guides:

Breeders seed sold by the Directorate of Agriculture	10 times grain market price
Foundation seed produced by EPADC and credited to itself unless sold outside	3 times grain market price
Registered seed produced by EPADC and registered growers	1½ to 2 times grain market price
Supervised increase of seed purchased from EPADC and registered growers	1¼ to 1½ times grain market price

It is recognized that a price tag cannot be placed on the breeder seed because of the cost of research that has gone into the development of a new variety. The price suggested here is a token price but one which may assure the supply by making funds available for supervision and labor in growing the first increase block.

IMPLEMENTATION PLAN

Operation	Action Agency	Dates Started	Dates Completed
Scope of work group accepted	AID		Dec 1, 1968
Preparation of detailed equipment specifications	AID	Dec 2, 1968	Dec 20, 1968
Advertise for equipment and services, open bids	AID	Jan 1, 1969	Feb 1, 1969
Loan application prepared and authorized	AID	Jan 1, 1969	Jan 15, 1969
Loan agreement negotiated and signed	AID, USAID, GOEP, EPADC	Jan 15, 1969	Mar 1, 1969
Evaluate bids and announce awards	AID	Mar 1, 1969	Mar 5, 1969
Establish letters of commitment and letters of credit	AID	Mar 5, 1969	Mar 15, 1969
Recruit long-term consultant, he arrives	AID, USAID	Mar 1, 1969	Aug 1, 1969
Order equipment, receive shipment	AID, USAID	Mar 20, 1969	Sept 1, 1969
Topographic maps prepared for all farms	EPADC	May, 1968	Aug 1, 1969
Land leveling and irrigation plan prepared	EPADC	Nov, 1968	Aug 1, 1969
Construction of processing plants, bases for storage bins, machine shops consultants quarters, temporary implement sheds	EPADC	March 1, 1969	Sept 1, 1969
Manufacturer's representatives arrive to begin training of construction and operation crews.		Sept 1, 1969	Feb 1, 1969
Equipment in seed processing plant installed under technical services, operators trained	AID, USAID, EPADC	Oct 1, 1969	Dec 1, 1969
Land leveling operations w/equipment gets underway	EPADC	Nov 1 1969	May, 1971
Crop production equipment put into use	EPADC	Jan 1, 1970	
Tubewells installed on leveled fields		Nov 1, 1969	July, 1971

The above plan is only a guide for the major operations. Perhaps the most difficult operations on which to maintain the schedule will be local construction since most of the work would be underway during the rainy season. The failure here would not be extremely severe, however, except for seed processing, since each farm already has a godown to provide shelter and security for spare parts and seed cleaning equipment until final construction is completed.

Presumably, before a loan agreement is signed, the technical staff in EPADC will have opportunity to comment. Notation was made in the text that the seed processing, drying, and storage facilities would be placed in locations where electricity is available. Exact locations were not selected by EPADC while the Team was in East Pakistan. Electric generators, therefore, were recommended for the larger farms only for power requirements of shops and for lighting in buildings. Should EPADC decide, as it may do, that the processing and drying equipment will be located directly on one or more farms, then additional generators will have to be purchased.

Emphasis is made at this point, because there seems to be an element of doubt about exact sites of these installations. To prevent having equipment and no power to drive it, this should be checked out with EPADC by USAID before orders are placed.

In implementing the usage of leveling equipment it is recommended that the 85 h.p. tractors, scrapers, float planes, water planes, and chisel plows be distributed as shown in Table 21. This would leave maintenance equipment on each of the larger farms. Fifteen of the tractors and leveling equipment in the amounts and locations shown in the same table would be used for initial leveling on the larger farms and on the 100-acre farms with the units located on the large farms serving the closest 100-acre farms. Two years is estimated to accomplish this job, although it could take longer.

Funds must be released on a schedule required by the implementation plan of operations. Local funding for construction of farm buildings, godowns, and concrete floors must be the first allocation to EPADC. This operation needs to progress rapidly, and funds should be released as soon as possible after the loan agreement is signed. Upon receipt of the equipment, funds will be needed for construction of field roads, irrigation channels, and installation of culverts. All local funds should be set up for release as these several operations require them. It is recommended

that all equipment be ordered as soon as the loan agreement has been signed. The only type equipment not needed as soon as possible is that for crop production. Since it will be needed within a few months after the land-leveling equipment is in operation and since it is not harmed by weather it should be ordered for immediate delivery.

Inasmuch as the majority of dollar funds are for equipment, purchase and funds for this purpose should be made available as soon as possible. Release of funds for the service contracts, technical services and consultant salary should be scheduled to support the timing of the operational plan.

ALTERNATIVES

There are alternatives with attendant consequences at several levels of decisions. First, there is the alternative of not granting any loan for the proposed project at all. What effect would this have on seed supplies, seed industry development, agricultural development in general, and the economy of East Pakistan?

In answer, it may be said that the degree to which good seed is an essential input is the extent to which the country can suffer without attention to this segment of agricultural development. Pushed by high population pressure that will continue to increase, the country must give attention to utilizing modern technology, including the use of good seed to feed and clothe its people. There is danger that EPADC, like many public production agencies, will exist as a seed producer and distributor by virtue of edicts rather than by producing and distributing superior products. This need not be true, but it can happen. It depends upon administrative aims and procedures. Correct usage of the equipment and facilities requested, trained operators, and good management will offer little excuse for the marketing of any seed less than the best available.

Another level of alternatives centers around the question of whether EPADC seed farm mechanization and leveling is necessary. The answer here depends primarily upon the importance of speed in farm improvement and the level of farm production expected. For instance, the farms can be leveled by "Head Basket", the same as the farms all over East Pakistan have been. But it will be time consuming. Equally important, it will be done in such small land segments that use of tractors and irrigation water will be extremely limited. The EPADC farms are large enough to use mechanization efficiently. It is neither practical nor hardly possible to support the number of workers on its farms as on comparable areas of farmer-owned land. Further, as multiple cropping is increased, land for planting will need to be prepared much more rapidly for a succeeding crop than can be done by present methods. Land leveling equipment can level the seed farms into large enough tracts so that the use of equipment and associated practices of modern technology will increase farm production, consequently, seed production.

Questions could arise concerning the need for the quantity of heavy equipment (heavy wheel tractors and leveling equipment) recommended. This recommendation can be justified on two points; (1) the use of the equipment will shorten the time needed to get the farms at top operating performance, and (2) after the farms are reformed the equipment can be used to good advantage in building field roads, auxillary roads and bridges and on other related projects of EPADC. It is estimated that this type of equipment will be used on the farms for only two or three years. The suggestion to eliminate crawler tractors and graders may be questioned. Members of the Team admit that these items could be used to some extent on the farms and would be extremely useful for constructing roads, building bridges, and clearing land. No objection is raised to purchase these for off-farm jobs. But it is difficult to justify the purchase (and associated expenses) for the limited needs of the farms.

Parallel to this level of alternatives is the question of the seed processing, drying, and storage equipment and facilities. Are they necessary? In answer, one need only observe the conditions of the present - uncleaned seed stored at the disposal of rodents and insects at a seed moisture level favoring rapid physiological deterioration. A small farmer can save his own seed reasonably satisfactorily under these conditions, but unless commercial methods are used for production and marketing, improved varieties do not penetrate the farm community quickly. Commercial seed of even reasonably high quality cannot be produced with the equipment and facilities now available to EPADC.

What are the alternatives in selecting locations, equipment, and facilities of the several seed plant installations? As noted earlier, transportation is a serious problem; therefore, several moderately-sized installations will better serve the needs of the country and will stimulate the incorporation of private producers than will the construction of only a few larger, more efficient installations. Although the total transportation requirement is essentially the same in either case, seed can be transported much easier after drying and cleaning than before drying.

In reference to the layout of each installation and the selection of equipment and facilities, attention is called to the fact that seed processing plants and associated drying and storage facilities may be designed in one of many ways, depending upon the types and quantities of seed to be handled, the number of varieties, the degree of mechanical handling desired, the type and amount of labor available, the cost of construction, ease of construction and so forth.

In planning the installations for EPADC some of the more specific considerations included:

1. Selecting the minimum amount of equipment consistent with the requirements to save money.
2. Keeping the number of kinds of equipment at a minimum to facilitate the stocking of spare parts.
3. Selecting equipment for its expected long life, simplicity and ease of maintenance.
4. Keeping the construction simple to allow ease of equipment installation and plant maintenance. Example, no elevator pits to limit equipment placement or to fill with water during rainy weather.

5. Using prefabricated construction where possible to speed construction and obtain the type of construction needed. Example, the selection of steel bins will enable the supplier to advise EPADC the type construction of the concrete floor on which the bins can be quickly assembled, resulting in a known type of construction.

An alternative would be to construct drying-storage bins from local materials. The advantage would be a saving in dollars. The estimated cost of the bins including spare parts and crating is $208,000. The use of local construction would still necessitate the importation of reinforcing steel. This, together with increased costs in engineering, supervision, and horizontal belts instead of elevators, would probably reduce this dollar saving to $150,000. Of course, the rupee cost would increase, and the total cost would probably exceed present estimates because of the necessity of reinforcing locally-constructed bins to accommodate the pressures of bulk rice storage and moisture proofing the walls. The selection of this alternative would delay the project, make standards relating to rodent, insect, and moisture control difficult to attain, add a large burden of construcion supervision, and in general be considerably less desirable. It is doubtful if such an alternative would be acceptable to EPADC. It is not recommended by the Team.

6. In the selection of the specific equipment items there are few alternatives. Although detailed specifications can be presented by the Team upon demand, those items listed and the suggested suppliers are standard in the seed processing equipment field. All have been proven both for domestic use and for international application. Many more items of equipment could have been added, and would have been if a greater diversity of seed kinds were to be handled. For instance, corn and beans would have required additional equipment, forage crops seeds still more. In nearly all installations small amounts of vegetable seeds, wheat, pulses, and other crops will need to be dried, cleaned, and stored. The equipment selected will accomplish these demands, in addition to meeting the requirements of the rice crops. Should these minor crops become major commercial crops, the proposed processing plants are designed with enough height and floor space to accommodate additional equipment with little adaptation of the installation.

These are the essential alternatives, except that in the event the loan cannot be as large as requested, cuts would have to be made in either the number of installations or in reducing Type 1 and/or Type II to Type III size. Type III size cannot be reduced. The location of cuts in numbers or reduction in size of units would have to be a decision of EPADC.

The registered grower program offers some alternatives, in terms of scope of activities, size of operations and general administration. The program is relatively new and appears to have had more success in planning than in action. For example, Appendix Table 2 shows the amount of wheat and rice seed planned (32,000 tons) for production by registered growers and the amount expected to be actually purchased for use (13,000 tons) as seed.

How can foundation seed be produced in quality to plant for such a production when it is expected that only 40 percent will actually be used for seed? If the program is conducted correctly on such a scale and at the quality level required, the government cannot afford the expenses incurred in producing foundation seed, only to have it consumed for food.

The Team would prefer to see the registered grower program remain relatively small and make sure that seed distributed from the program is of the highest level of quality. When accompanied by a vigorous promotion and extension program, two percent of high quality seed of superior adapted varieties infused into the distrubution system of the country each year will make a much greater and longer lasting contribution toward a strong and productive agriculture than will 100% of mediocre seed.

SUMMARY

Because of high population growth and low farm yields East Pakistan does not produce sufficient food to meet its requirements. Basic food needs can best be met by increasing the production of food grains, primarily rice. Quality of foods may be improved by diversifying production, substituting certain amounts of wheat, potatoes, leguminous crops, vegetables and fruits.

Improved seed is one of several inputs required by agriculture to reach the production level necessary to provide adequate amounts of food. East Pakistan with present outside assistance has research, training, and extension capabilities sufficient to administer successful programs in these areas. But the province has virtually no private seed industry.

The Government of East Pakistan, recognizing the value of improved seed in agricultural development, set up the East Pakistan Agricultural Development Corporation (EPADC) to be responsible for the production of seeds. Recently this responsibility has been extended to seed distribution. Eventually, EPADC is to encourage the development of the private sector. Further, the Government subsides the production of seeds by "registered growers" working in conjunction with EPADC and under EPADC administration.

EPADC produces seed on 22 farms varying in size from 100 acres to 3000 acres. To realize full production, the farms need land leveling operations to accomodate control of irrigation water, natural rainfall, and mechanized farm equipment. Only meager processing, drying, and storage facilities are available for farm use. No facilities are available for the registered growers.

The loan which the Government of Pakistan has requested of AID will, if authorized, be used to purchase leveling equipment, farm machinery, and seed processing, drying, and storage equipment and supplies.

After on the spot examination of land and facilities, personal communication with authorities, and study of statistical data, the Mississippi State Team recommends granting of the loan, providing the equipment and facilities are used for the proposed purposes.

The report discusses suggested changes in the proposed program at several points. Although it is believed that the acceptance of these suggestions would improve the effectiveness of the program, acceptance of the suggestions should not be considered a required prerequisite for authorizing the loan.

In reference to proposed program suggestions, the Team warns against the initiation of massive seed production programs. A moderate sized program in which high quality seed standards are maintained will be much more effective and less costly than an over-sized, over-planned one that never gets off the planning table.

ADDENDA

The first draft of this report was submitted in September, 1968, the second draft in November, 1968. On February 17, 1969 AID/Washington advised the Team that USAID and EPADC had decided to delete the land leveling and farm mechanization elements. The question: what effect will this have upon the seed drying-storage-processing recommendations. To answer this question and to add some summary statements this addenda is supplied. Except for corrections, the remainder of the report is essentially as presented in the second draft.

Since the farm mechanization equipment is not to be supplied, it will be necessary to provide threshers, presently listed under farm equipment, for the seed processing units as follows:

	Type I	Type II	Type III
Turner trailer-thresher or equivalent with rice cylinder and 12 h.p. gas engine	4	6	9

It is well to repeat that provisions must be made for electricity at the processing plant locations. The Team was left under the impression that the processing units would be established where there is electricity or, if needed, where power lines could be extended. Should neither possibility be realized, generators will need to be provided.

In reference to technical assistance, it would be highly desirable for AID to provide one man with broad agronomic training and experience (preferably in seed work) who would work in all phases of the program. Although he would not have responsibilities in plant breeding, he should have a working relationship with the organizations and individuals doing plant breeding and introduction. Principal responsibilities would include close cooperation with the leadership in EPADC so that he could be effective on the farms in helping supervise and train technical personnel in the various seed production activities. He would need to assist in the drying-storage-processing activities and, finally in helping devise a satisfactory marketing system. An individual capable in these several areas is not easy to find. On the other hand, supplemental help can be made available. For instance, the AID/Mississippi State University Global Seed Contract number W-607 can provide staff for short periods to help set up the seed processing equipment and train operators and provide training for production personnel. Marketing specialists can probably be supplied by AID for short periods to help analyze marketing problems. If the type drying-storage-structures are used as recommended, the supplier will provide training for erection crews. The use of these several sources should supply sufficient technical assistance without overburdening the budget. An agricultural engineer is suggested in the report, but if the leveling and farm equipment is deleted, it is doubtful that such a position could be justified.

There appears to be concern in some quarters that the report gives too much emphasis to equipment and not enough to other aspects of seed programs. In reality the assignment had to do with analyzing the feasibility of providing a loan to supply certain types of equipment, so naturally the report weighs heavily in this area. A seed program is more than drying-processing and storing seed. Conversely, it is very difficult to develop a successful program without attention to these processes. In East Pakistan, the lack of adequate equipment and facilities for accomodating the attendent problems is a serious deterrant to any type of improved seed program.

The questions arise: Can EPADC get seed stocks of improved varieties? Can EPADC sell good seed if it had it? Should all the installations be constructed now, or should only a pilot plant installation be built? The answers are more a matter of judgment than of actual provable facts. In the judgment of the Team, the Accelerated Rice Breeding Program now in operation will provide superior adapted varieties. In the Team's judgment improved varieties of high physical purity and high germination will find a ready market, if marketing efforts are well organized and pushed. In reference to the number of installations which should be built, it depends on the speed at which one wants to move and how much money one wants to borrow (or loan). While in East Pakistan the Team felt an urgency for meeting the problem and thus made the recommendation to move along with all installations from the beginning. It is possible that we could have misjudged. The final decision must be made by those who have to live daily with the problems of food supply and demand.

Good seed programs are not easy. They are not automatic. They are not necessarily self-perpetrating. Unlike other agricultural inputs such as fertilizer, insecticides, herbicides, etc., a farmer does not have to buy seed. He can plant some grain saved from the previous harvest. Seed programs have to be superior in every respect if they are to have an impact. The program not only has to be good, it has to provide a superior product (seed) and the farmer has to plant the seed before the program is a success and before an impact can be made on the total economy. And a program is no stronger than the weakest portion.

In summary, a seed program consists of coordinated efforts in introducing and breeding superior adapted varieties and hybrids, multiplying introduced or breeder seed stocks to a supply of basic seed stocks, further supervising the multiplication of the basic stocks, releasing adapted stocks for commercial production of seed, controlling quality through a testing and labeling system, and finally marketing the product. Accompanying these basic procedures are the technical work of planting, rogueing, and other field cultural practices, harvesting, drying, processing, storing, testing, labeling, selling, delivering, promoting, educating and other procedures concerned with not only putting high quality seed on the market but also creating a desire on the part of the farmer for the seed.

East Pakistan is in the process of providing the leadership to accomplish the necessary tasks. Admittedly, modern seed processing-drying-storage equipment will not do the whole job, it is not expected to, and everyone connected with the program in the province realizes this. But it is something that has to be done by someone, some agency, or some company before the effects of any of the other portions of the total seed program can be realized.

Appendix Table 1. Consumption, Production, Acreage, and Yields of Wheat, Actual and Estimated, 1965-1975.

Year	Consumption[1]	Production: Actual 1965-67 potential 1968-75	Production: Deficit	Acreage: Actual 1965-67 potential 1968-75	Acreage: Full requirement	Yields: Actual 1965-67 potential 1968-75	Yields: S. M. Farms projections
(1)	(2)	(3) (5x7)	(4) (2-3)	(5)	(6) (2÷7)	(7)	(8)
	1000 L. Tons			1000 Acres		Lbs./Acre	
1965	100	34	66	132	388	577	658
1966	104	35	69	136	374	576	741
1967	108	58	50	180	359	721	823
1968	112	62	50	190	345	727	897
1969	117	70	47	200	334	785	1,234
1970	121	80	41	210	320	848	---
1971	126	90	36	220	308	916	---
1972	131	102	29	230	297	989	---
1973	136	114	22	240	285	1,068	---
1974	141	129	12	250	274	1,153	---
1975	146	145	1	260	262	1,246	---

[1]Data for 1965, 1970, and 1975 from Supply and Demand of Selected Agricultural Products in Pakistan 1961-75, by S. A. Abbas. Other years based on annual increase of 3.9 percent as reflected in 1965-75 projection data.

Appendix Table 2. Programme of Improved Seed Production Through Registered Growers and Proposed Procurement for the Year 1966-67 to 1969-70 and Actual for 1965-1966 and 1966-1967.

Item	Aus Paddy	T. Aman Paddy	Aman DA-31	Boro Paddy	Wheat
	Long Tons				
1965-66					
Actual (a)	1,216	1,819	74	92	588
(b)	735	1,727	55	55	213
1966-67					
Programme (a)	3,986	4,820	143	2,939	2,204
(b)	845	2,755	100	1,837	735
Actual (a)	1,643	2,607	110	943	479
(b)	104	812	3	652	72
1967-68					
Programme (a)	5,367	5,882	180	6,429	2,939
(b)	4,592	2,939	126	2,572	918
1968-69					
Programme (a)	6,587	7,074	213	7,053	3,674
(b)	5,143	2,939	149	3,122	1,102
1969-70					
Programme (a)	7,696	8,569	246	11,407	4,408
(b)	5,143	2,939	172	3,674	1,286

Note: (a) Represents total estimated production of seeds.
(b) Represents quantity of seeds which are expected to be procured for distribution.

Source: Appendix III, page 17, *Third Plan (1965-66 to 1969-70) Scheme for Production of Improved Seeds (Paddy and Wheat) by Registered Growers in East Pakistan* EPADC, May 3, 1968.

Appendix Table 3. Staffing Pattern and Cost as Presented in Third Plan Scheme for SM Farms.

Item	No.of Post	1965-66	1966-67	1967-68	1968-69	1969-70	5-Yr. Total
		Rs. 1,000					
Chief Supt.	1	12	13	14	14	15	68
Seed Agronomist	1	0	11	12	12	13	48
Farm Supt.	26	111(22)	156	163	171	179	781
Medical Officer	1	3	4	5	5	6	23
Overseer	53	100(40)	125(43)	160	166	172	723
Foreman Mech.	1	0	3	4	4	4	15
Head Clerk	5	11(4)	11(5)	12(5)	13	14	61
Accountant	1	2	3	3	3	4	15
Compounder	1	1	2	2	2	2	9
Store Keeper	6	0	12	12	12	13	49
Mechanic	13	7(3)	17(7)	32	33	34	123
Asst. Mechanic	3	0	5	5	5	6	21
Clerk-cum Store Keeper	21	26(17)	33(17)	42	43	44	188
Typist	6	2(1)	2(1)	10	10	10	33
Tractor Driver	31	35(16)	58	60	62	64	279
Vehicle Driver	7	3(2)	4(2)	14	15	15	51
Pump Operator	30	38(25)	45(25)	56	58	60	257
Darwan & Peons	81	81(75)	98	99	100	100	478
Total		433	602	705	729	754	3,223
Travel Allowance		28	28	28	28	28	140
Grand Total		461	630	733	757	782	3,363

Source: Page 43, *Third Plan Scheme for Seed Multiplication Farms.*

Appendix Table 4. Annual Labor Requirements for Seed Processing, Drying and Storage: Man-Days and Costs by Type of Installation.

Item	Type of Installation I	II	III	IV
Days in Operation, number	365	365	365	365
Men required per unit, no.:				
Supervisor	1	1	1	1
Laborers	7	5	4	2
Total man-days, no.:				
Supervisor	365	365	365	365
Laborers	2,555	1,825	1,460	730
Daily wages, dollars:				
Supervisor (Rs. 10)	2.08	2.08	2.08	2.08
Laborers (Rs. 3)	.62	.62	.62	.62
Total wages per unit, dollars:				
Supervisor	759.20	759.20	759.20	759.20
Laborers	4.34	3.10	2.48	1.24
Total	763.54	762.30	761.68	760.44
Number of Units	1	3	9	8
Total wages, dollars	763.54	2,286.90	6,855.12	6,083.52
Total Specified Labor Costs		$15,989.08		

Note: Labor for farm production not included in these data.

Appendix Table 5. Cost Estimate of the Project

1. TO BE FINANCED BY LOAN FUNDS (Dollar)

Item	Quantity Number	Unit Cost	Estimated Value
		---------- Dollars	----------
A. PRODUCTION, HARVESTING, AND LAND-LEVELING EQUIPMENT			
1. Tractor, 85-95, DB, h.p., wheel type	24	7,500	180,000
2. Motor grader, 75 h.p.	1	20,000	20,000
3. Tractor, 35-45, DB, h.p. wheel type	10	5,500	55,000
4. Plow, moldboard, 5 bottom 16"	9	900	8,100
5. Plow, moldboard, 3 bottom 16"	9	600	5,400
6. Plow, chisel, 12'	15	700	10,500
7. Levee plow	9	350	3,150
8. Harrow, disc offset, wheel type 9'	35	900	31,500
9. Harrow, disc offset, wheel type 13'	9	1,150	10,350
10. Scrapers, two 4 yds., wheel type	15	3,500	52,500
11. Float plane, 12 x 40 leveler	12	2,300	27,600
12. Plane for water leveling	6	600	3,600
13. Rotary tiller, PTO drive, 6'	35	850	29,750
14. Fertilizer spin spreader	9	850	7,650
15. Grain drill	9	800	7,200
16. Cultivator, 2-row	9	400	3,600
17. Combine, self-propelled, 7'	2	7,000	14,000
18. Combine, pull type, 7'	4	4,000	16,000
19. Turner trailer - thresher	6	2,500	15,000
20. Blade, 12' rear mount	6	500	3,000
21. Trailer, 3T, 4-wheel	9	800	7,200
22. Truck, 5T, cargo	7	5,000	35,000
23. Shop equipment	1	10,000	10,000
24. Shop equipment, limited	4	3,000	12,000
25. Mechanic tool sets	25	200	5,000
26. Driver tool sets	61	75	4,575
27. Electric generator	5	6,000	30,000
28. Subtotal cost of equipment	--	-----	607,675
29. Spare parts (25% of subtotal)	--	-----	151,919
30. Crate, insurance, and freight (25% of subtotal)	--	-----	151,919
31. Manufacturer service contract (1½ man-years)	--	-----	90,000
32. Long-term service contract (2 man-years)	--	-----	120,000
33. Contingencies (about 9%)	--	-----	103,487
TOTAL PRODUCTION, HARVESTING, AND LAND-LEVELING EQUIPMENT			1,225,000
B. SEED PROCESSING, DRYING AND STORAGE EQUIPMENT AND FACILITIES			
1. Seed cleaner, 54" screen	4	5,200	20,800
2. Seed cleaner, 34" screen	9	4,000	36,000
3. Seed treater	13	1,100	14,300
4. Bagger-weigher	13	340	4,420
5. Scales, platform	13	205	2,665
6. Holding bin (6' x 6' x 6')	13	400	5,200

		Quantity Number	Unit Cost (Dollars)	Estimated Value (Dollars)
7.	Holding bin (3' x 3' x 3')	26	300	7,800
8.	Holding bin (2' x 2' x 2')	13	200	2,600
9.	Steel supports for cleaner	13	100	1,300
10.	Steel supports for treater	13	100	1,300
11.	Elevator, 48-foot	36	2,240	80,640
12.	Elevator, 26-foot	13	750	9,750
13.	Elevator, 22-foot	13	720	9,360
14.	Conveyor	17	340	5,780
15.	Grain storage bin	93	1,600	148,800
16.	Auger	19	100	1,900
17.	Fan-heater for main dryer	55	1,000	55,000
18.	Fan-heater for pre-threshing	4	1,000	4,000
19.	Fan-heater for sack dryer	8	2,300	18,400
20.	Scalper	17	1,380	23,460
21.	Dehumidifier	4	1,800	7,200
22.	Cooling tower	4	300	1,200
23.	Scales, laboratory	13	40	520
24.	Moisture tester	13	495	6,435
25.	Sample cans	39 dz.	8/dz.	312
26.	Sample pans	6½ dz.	32/dz.	208
27.	Trier, 10-foot	13	80	1,040
28.	Trier, 63 inches	13	44	572
29.	Bin thermometer	13	38	494
30.	Electrical installation supplies	-	-----	61,000
31.	Subtotal cost (equipment)	-	-----	532,456
32.	Spare parts (10% of subtotal)	-	-----	53,245
33.	Crating and shipping (30% of subtotal)	-	-----	159,737
34.	Manufacturer service contract (4 months)	-	-----	20,000
35.	Technical services (2 men 60 days)	-	-----	15,000
36.	Contingencies (about 9%)	-	-----	69,562
	TOTAL PROCESSING, DRYING AND STORAGE EQUIPMENT			850,000

		Estimated Rs.	$ Equivalent
C.	SEVENTEEN 100-ACRE FARMS		
1.	Managers Quarters (4)	107,600	22,417
2.	Farm Overseers Quarters (14)	222,600	46,375
3.	Storekeepers Quarters (15)	150,000	31,250
4.	Class IV Quarters (18)	75,600	15,750
5.	Laborers Quarters (4)	43,200	9,000
6.	Godown & Shop (3)	67,200	14,000
7.	Office (3)	53,700	11,188
8.	Installation of deep tubewells (13)	286,000	59,583
9.	Irrigation Channels	40,000	8,333
10.	Water & sanitation facilities	2,000	417
11.	Contingencies, 5%	52,395	10,916
	Subtotal	Rs. 1,100,295	$229,229
D.	SEED PROCESSING & STORAGE CONSTRUCTION		
1.	Warehouse storage (40 x 110 x 15) (4)	337,920	70,400
2.	Warehouse storage (40 x 50 x 15) (9)	380,160	79,200
3.	Processing building (27 x 50 x 25) (13)	336,960	70,200
4.	Dehumidified storage (2-40x50x10) (1)	115,200	24,000
5.	Floors (concrete) (1) 150' x 150'	54,000	11,250

	Estimated Rs.	$ Equivalent
6. Floors (concrete) (3) 150' x 100'	108,000	22,500
7. Floors (concrete) (9) 100' x 100'	216,000	45,000
8. Pre-threshing dryer shelter (4) 20' x 50'	38,400	8,000
9. Sack dryer bldg. (8) 30' x 25' x 8'	144,000	30,000
10. Loading shed (8) 30' x 15'	34,560	7,200
11. Contingencies, 5%	88,262	18,388
Subtotal	Rs. 1,853,462	$386.138
II. TO BE FINANCED BY LOCAL CURRENCY		
A. 3,000-ACRE FARM		
1. Chief Superintendent Quarters (1)	41,600	8,667
2. Farm Managers Quarters (5)	134,000	27,917
3. Farm Overseers Quarters (20)	318,000	66,250
4. Class IV Quarters (12)	50,400	10,500
5. Laborers Quarters (15)	153,000	31,875
6. Offices (1)	32,000	6,667
7. Fertilizer & Pesticides Godowns (5)	69,500	14,479
8. Machine Shop (1)	85,600	17,833
9. Tractor & Implement Shed (1)	44,800	9,333
10. Consultants Bungalow (1)	41,600	8,667
11. Culverts	25,200	5,250
12. Roads	150,000	31,250
13. Irrigation Channels	166,000	34,583
14. Installation of deep tubewells	500,000	104,167
15. Water and sanitation facilities	20,000	4,167
16. Contingencies, 5%	91,585	19,080
Subtotal	Rs. 1,923,285	$400,685
B. FOUR 500-ACRE FARMS		
1. Managers Quarters (4)	107,600	22,417
2. Farm Overseers Quarters (12)	225,096	46,895
3. Offices	17,900	3,729
4. Storekeepers Quarters (8)	80,000	16,667
5. Class IV Quarters (16)	64,000	13,333
6. Laborers Quarters (16)	163,200	34,000
7. Fertilizer & Pesticide Godowns (4)	58,464	12,180
8. Machine Shop (4)	160,000	33,333
9. Tractor & Implement Shed (4)	80,000	16,667
10. Inspection Bungalow (1)	15,900	3,312
11. Installation of deep tubewells (3)	120,000	25,000
12. Irrigation Channels	70,000	14,583
13. Water and sanitation facilities	5,000	1,042
14. Contingencies, 5%	58,358	12,158
Subtotal	Rs. 1,225,518	$255,316

Appendix Table 6 - Detail Annual Operating Costs for Crop Production.

Item	Units	Value	Life	Annual Usage	Cost per Hour*	Total Annual Cost
	No.	$1,000	Years	1,000 hrs.	-------Dollars-------	
A. Capital Equipment:						
85 h.p. tractor	9	54,000	10.0	9.00	3.18	28,620
40 h.p. tractor[1]	35	144,375	10.0	35.00	2.28	79,800
75 h.p. motor grader	1	20,000	10.0	.40	6.42	2,568
Float plane	6	13,800	5.0	1.80	.64	1,152
Plane, water level	6	3,600	5.0	.60	.60	378
Scrapers	6	21,000	5.0	5.64	1.30	7,332
Plow, chisel	9	4,725	5.0	1.20	1.38	1,656
(4-5) Plow, moldboard	9	7,425	5.0	2.70	1.05	2,835
(2-3) Plow, moldboard	9	3,204	5.0	2.70	.70	1,890
Plow disc[2]	35	12,460	5.0	7.00	1.00	7,000
Levee Plow	9	3,150	5.0	1.80	.61	1,098
Harrow, disc, 9'	35	31,500	5.0	8.75	1.26	11,025
Harrow, disc, 13'	9	10,350	5.0	2.25	1.60	3,600
Harrow, Drag 8'[2]	35	10,500	5.0	3.50	.25	875
Harrow, Drag 12'[2]	9	3,600	5.0	1.35	.35	472
Rotary Tiller	35	29,750	5.0	14.00	.75	10,500
Fertilizer Spreader	9	7,650	5.0	3.60	.75	2,700
Grain Drill	9	7,200	5.0	4.50	.56	2,520
Cultivator, 2-Row	9	3,600	5.0	4.50	.28	1,260
Combine, Self-propelled	2	14,000	5.0	1.20	6.06	7,272
Combine, Pull	4	16,000	5.0	2.00	2.80	5,600
Trailer-Thresher	6	15,000	5.0	3.00	2.05	6,150
Blade - Rear Mount	6	3,000	5.0	1.20	.87	1,044
Trailer - 3T	9	7,200	5.0	2.70	.51	1,377
Trucks - 5T	7	35,000	5.0	3.50	6.52	22,820
Pickups[3]	27	72,900	5.0	13.50	4.48	56,430
Shop Equipment	1	10,000	10.0	.50	3.90	1,950
Shop Equipment, limited	4	12,000	10.0	2.00	1.24	2,480
Driver Tool sets	61	4,575	3.0	6.10	.42	2,562
Mechanics Tools	25	5,000	3.0	5.00	.66	3,300
Electric Generators	5	30,000	10.0	10.00	3.40	34,000
					Total	312,266

B.	Capital Equipment Cost	Year 1 = 33%	$103,048
		Year 2 = 50%	156,133
		Year 3 =100%	312,266

C.	Long-Term Consultant, Maintenance (over 2-year period)	60,000
D.	Manufacturers Service Contract (over 2-year period)	45,000
E.	Freight and Shipping (over 2 years)	75,960
F.	Depreciation (30 years) Rupee Capital Expenditure equivalent = $1,271,368	42,378
G.	Fertilizer (3 mds./acre - 10,040 acs.) Rs. 25/md. $156,000 - 33% 1st year, 50% 2nd year, 100% 3rd and thereafter	51,948
H.	Pesticides (Rs. 5/ac. - 10,040 acs.) $10,400 - 33% 1st year, 50% 2nd year, 100% 3rd and thereafter	3,313
I.	Seeds (Rs. 22/ac. - 10,040 acs.) $46,000 - 33% 1st year, 50% 2nd year, 100% 3rd and thereafter	15,180

J. Supervisor and Labor (unaccounted for above)		100,000
K. Contingencies (about 10%)		60,000
Total Crop Production Costs:	Year 1	556,827
	Year 2	645,671
	Year 3	727,044
	Year 4	727,044
	Year 5	727,044
	Year 6[4]	847,044
	Year 7[4]	847,044
	Year 8[4]	847,044
	Year 9[4]	847,044
	Year 10[4]	847,044

Cost per hour includes: Depreciation over life, repair cost (Equipment 60% - 100% of new cost), operator cost, fuel, and interest at 6 percent.

[1]Twenty-five on hand before purchase from loan.
[2]On hand.
[3]Purchased with nondollar funds.
[4]Includes loan repayment principal (25 yrs.) and interest (4%).

Appendix Table 7. Specified Equipment and Facilities for Use in Seed Cleaning, Processing and Storage

Item	Units	Value	Life Years	Specified Annual Costs			
				Deprc.	Int.	Maint.	Total
	No.	Dollar					
A. Capital Equipment:							
Seed Cleaner	4	20,800	10	2,080	688	624	3,392
Seed Cleaner	9	36,000	10	3,600	1,188	1,080	5,868
Seed Treater	13	14,300	5	2,860	468	572	3,900
Bagger	13	4,420	10	442	143	221	806
Scales, Plt.	13	2,665	10	260	91	130	481
Bins 6' x 6' x 6'	13	5,200	20	260	169	52	481
Bins 3' x 3' x 3'	26	7,800	20	390	234	78	702
Bins 2' x 2' x 2'	13	2,600	20	130	78	26	234
Cleaner Supports	13	1,300	10	130	39	13	182
Treater Supports	13	1,300	10	130	39	13	182
Elevator-48'	36	80,640	10	8,064	2,664	1,620	12,348
Elevator-26'	13	9,750	10	975	325	195	1,495
Elevator-22'	13	9,360	10	936	312	182	1,430
Conveyor	17	5,780	10	578	187	119	884
Storage Bins	93	148,800	20	7,440	4,650	1,488	13,578
Auger	19	1,900	5	380	76	95	551
Fan Heater	55	55,000	10	5,500	1,815	2,200	9,515
Fan Heater	4	4,000	10	400	132	160	692
Fan Heater	8	18,400	10	1,840	608	736	3,184
Scalper	17	23,460	10	2,346	782	935	4,063
Dehumidifier	4	7,200	10	720	236	216	1,172
Cooling Tower	4	1,200	10	120	40	48	208
Lab. Scales	13	520	5	104	13	13	130
Moisture Meter	13	6,435	10	650	208	195	1,053
S. Can Sets (3 dz.)	13	312	5	65	13	13	91
S. Pan Sets (½ dz.)	13	208	5	39	13	13	65
Trier - 10'	13	1,040	5	208	39	52	299

Trier - 63"	13	572	5	117	26	26	169
Thermometer	13	494	5	104	13	13	130
Elec. Supplies	--	61,000	20	3,050	2,013	1,220	6,283
Total		532,456		43,918	17,302	12,348	73,568

B.	Capital Equipment Annual Cost	Year 1 - 33%	24,277	24,277
		Year 2 - 50%	36,784	
		Year 3 -100%	73,568	
C.	Electricity (Year 1 - 33%, Year 2 - 50%, Year 3 - $8,180)			2,699
D.	Fuel (Year 1 - 33%, Year 2 - 50%, Year 3 - $1,717)			567
E.	Labor (Year 1 - 33%, Year 2 - 50%, Year 3 - $15,989)			5,276
F.	Treating, Sacks, Closures, etc. (Year 1 - 33%, Year 2 - 50%, Year 3 - $64,464)			21,273
G.	Crating and Shipping (30% of Capital Cost over 2 year period)			79,868
H.	Manufacturers Service Contract			20,000
I.	Technical Services			15,000
J.	Contingencies (about 10%)			16,000
K.	Total Seed Processing Costs	Year 1		184,960
		Year 2		177,828
		Year 3		179,918
		Year 4		179,918
		Year 5		179,918
		Year 6[1]		179,918
		Year 7[1]		179,918
		Year 8[1]		179,918
		Year 9[1]		179,918
		Year 10[1]		179,918

[1]Loan repayment included in Appendix Table on "Detail Costs of Crop Production".

Appendix Table 8 - Purchase Cost, Life, Annual Use and Annual Specified Costs per Equipment.

Items	Purchase Cost	Life	Annual Use	Depre-ciation	Labor	Interest	Repairs	Fuel	Total
	$	yrs.	000 hrs.	Dollars					
85 h.p. tractor	7,500	10	1.00	750	520	225	750	1150	3,395
40 h.p. tractor	5,500	10	1.00	550	520	165	550	720	2,505
Scraper	3,500	5	.94	700	nc	105	420	nc	1,225
Plow, Moldboard (5-16")	900	5	.30	180	nc	27	108	nc	315
Plow, Moldboard (3-16")	600	5	.30	120	nc	18	72	nc	210
Plow, Chisel 12'	700	5	.13	140	nc	21	84	nc	245
Levee Plow	350	5	.20	70	nc	10	42	nc	122
Float Plane	2,300	5	.30	460	nc	69	276	nc	805
Plane, Water level	600	5	.10	120	nc	18	72	nc	210
Harrow, Disc wheel 9'	900	5	.25	180	nc	27	108	nc	315
Harrow, Disc wheel 13'	1,150	5	.25	230	nc	34	138	nc	402
Rotary Tiller	850	5	.40	170	nc	26	102	nc	298
Fertilizer Spreader	850	5	.40	170	nc	26	102	nc	298
Grain drill	800	5	.50	160	nc	24	96	nc	280
Cultivator, 2 Row	400	5	.50	80	nc	12	48	nc	140
Combine, Self propelled	7,000	5	.60	1,400	250	210	840	937	3,637
Combine, Pull type	4,000	5	.50	800	nc	120	480	nc	1,400
Trailer - Thresher	2,500	5	.50	500	nc	75	300	150	1,025
Blade, Rear mount	500	5	.20	100	nc	15	60	nc	175
Trailer, 3T 4 wheel	800	10	.30	80	nc	24	48	nc	152
Trailer, 5T Cargo	3,500	5	.50	700	50	210	700	1600	3,260
Pickup, truck	2,700	5	.50	540	50	162	540	800	2,092
Shop Equipment	10,000	10	.50	1,000	50	300	600	nc	1,950
Shop Equipment (limited)	3,000	10	.50	300	50	90	180	nc	620
Mechanics Tool Sets	200	3	.20	67	20	6	40	nc	133
Driver Tool Sets	75	3	.10	25	nc	2	15	nc	42
Electric Generators	6,000	10	40% cap.	600	200	180	600	2600	4,180

Source: Agricultural Engineers Yearbook, Cost of Production Research Studies and Officials of Implement Manufacturing Firms.

Appendix Table 9 - Actual and Estimated Area, Production and Value of Crop on Seed Multiplication Farm, 1964-65, 1965-66, and 1969-70.

Name of Crop	1964-65 Area in Acres	1964-65 Production in 1,000 Mds.	1964-65 Value[1] in Rupees Iakh	1965-66 Area in Acres	1965-66 Production in 1,000 Mds.	1965-66 Value in Rupees Iakh	1969-70 Area in Acres	1969-70 Production in 1,000 Mds.	1969-70 Value[2] in Rupees Iakh
Aus Paddy	1,078	19.2	2.88	1,324(k)	26.5	5.3	2,500(k)	75.0	15.0
Aman (B. C. & Tr.)	1,688	30.2	4.53	1,570(k)	32.1	6.8	2,000(k)	88.0	19.0
Boro Paddy	172	2.5	0.37	85(R)	0.1	0.2	600(R)	21.6	4.1
Wheat	283	1.8	0.23	400(R)	3.3	0.7	1300(R)	19.5	3.9
Mustard	586	2.4	0.84	412(R)	1.2	0.6	800(R)	4.8	2.4
Jute Seed	207	0.5	0.22	204(k)	0.8	0.5	500(k)	3.0	1.8
Pulses	——	2.6	0.39	520(R)	3.1	0.5	1050(R)	10.5	1.6
Sugarcane	55	10.1	0.23	26(kR)	8.6	0.2	60(kR)	42.0	0.9
Winter Vegetables				30(R)	5.5 lbs.	0.0	70(R)	15.4 lbs.	0.1
Fruit (grafts, Gooties,				70(kR)	6.0	1.8	82(kR)	10.7	3.2
seedlings)				———	14.0 nos.	0.1	——	82.0 nos.	0.6
Quick Growing Fruits				20(KR)	4.5	0.9	28(kR)	9.5	1.9
(suckers & seedlings)				———	160.0 nos.	0.4	——	307.0 nos.	0.8
Groundnut				30(R)	0.3	0.1	150(R)	2.4	0.7
Totals	4,069	——	9.69	4,699	——	18.3	10,040	——	56.0
Dollar Equivalent			201,875			381,250			1,166,667

[1]Basis of 1962-63 prices
[2]Basis of 1965-66 prices

Appendix Table 10. Improved Seeds from ADC's SM Farms, Acres Planted, Per Acre Value of Yield Response at Three Response Levels, and Total Additional Value of Crops from Improved Seeds at Three Response Levels for Ten-Year Period.

Year	ADC's SM Farms Improved Seeds[1]	Area Planted[2]	Per Acre Value of Additional Yield[3] (Yield Response Level)			Total Additional Value From Improved Seeds (Yield Response Level)		
			1 md	2 mds	4mds	1 md	2 mds	4 mds
	1,000 L. Tons	1,000 Acres	Rupees			1,000 Rupees		
1969	3.0	135	22	44	88	2,970	5,940	11,880
1970	4.0	180	22	44	88	3,960	7,920	15,840
1971	5.0	225	22	44	88	4,950	9,900	19,800
1972	5.0	225	22	44	88	4,950	9,900	19,800
1973	5.0	225	22	44	88	4,950	9,900	19,800
1974	5.0	225	22	44	88	4,950	9,900	19,800
1975	5.0	225	22	44	88	4,950	9,900	19,800
1976	5.0	225	22	44	88	4,950	9,900	19,800
1977	5.0	225	22	44	88	4,950	9,900	19,800
1978	5.0	225	22	44	88	4,950	9,900	19,800
	Ten-Year Additional Value from Improved Seeds					Rs. 46,530	93,060	186,120
					(1,000)	$9,694	19,388	38,775

[1]MSU Team recommendation.
[2]Area planted at 50 pounds per acre.
[3]Value estimated at Rs 22 per maund of grain.

Appendix Table 11. Improved Seeds from Registered Growers, Acres Planted, Per Acre Value of Yield Response at Three Response Levels, and Total Additional Value of Crops from Improved Seeds at Three Response Levels for Ten-Year Period.

Year	Registered Growers Improved Seeds[1]	Area Planted[2]	Per Acre Value of Additional Yield[3] (Yield Response Level) .75 md	1.5 md	3 mds		Total Additional Value From Improved Seeds (Yield Response Level) .75 md	1.5 md	3 mds
	1,000 L. Tons	1,000 Acres	Rupees				1,000 Rupees		
1969	3.0	135	16.5	33	66		2,228	4,455	8,910
1970	4.0	180	16.5	33	66		2,970	5,940	11,880
1971	5.0	225	16.5	33	66		3,712	7,425	14,850
1972	5.0	225	16.5	33	66		3,712	7,425	14,850
1973	5.0	225	16.5	33	66		3,712	7,425	14,850
1974	5.0	225	16.5	33	66		3,712	7,425	14,850
1975	5.0	225	16.5	33	66		3,712	7,425	14,850
1976	5.0	225	16.5	33	66		3,712	7,425	14,850
1977	5.0	225	16.5	33	66		3,712	7,425	14,850
1978	5.0	225	16.5	33	66		3,712	7,425	14,850
	Ten-Year Additional Value from Improved Seeds					Rs	34,894	69,795	139,590
					(1,000)		$7,270	14,541	29,081

[1]MSU Team recommendation.
[2]Area planted at 50 pounds per acre.
[3]Value estimated at Rs. 22 per maund of grain.

Appendix Table 12 - Improved Seeds from Farmers, and Sources Other Than ADC's SM Farms and Registered Growers, Acres Planted, Per Acre Value of Yield Response at Three Response Levels, and Total Additional Value of Crops from Improved Seeds at Three Response Levels for Ten-Year Period.

Year	Other Improved Seeds[1]	Area Planted[2]	Per Acre Value of Additional Yield[3] (Yield Response Level) .5 md	1 md	2 mds	Total Additional Value From Improved Seeds (Yield Response Level) .5 md	1 md	2 mds
	1,000 L. Tons	1,000 Acres	Rupees			1,000 Rupees		
1969	14	630	11	22	44	6,930	13,860	27,720
1970	14	630	11	22	44	6,930	13,860	27,720
1971	14	630	11	22	44	6,930	13,860	27,720
1972	16	720	11	22	44	7,920	15,840	31,680
1973	18	810	11	22	44	8,910	17,820	35,640
1974	20	900	11	22	44	9,900	19,800	39,600
1975	20	900	11	22	44	9,900	19,800	39,600
1976	20	900	11	22	44	9,900	19,800	39,600
1977	20	900	11	22	44	9,900	19,800	39,600
1978	20	900	11	22	44	9,900	19,800	39,600
		Ten Year Additional Value from Improved Seeds				Rs. 87,120	174,240	348,480
					(1,000)	$18,150	36,300	72,600

[1]MSU Team recommendation.

[2]Area planted at 50 pounds per acre.

[3]Value estimated at Rs. 22 per maund of grain.

Appendix Table 13. Total Additional Value of Crop Production from Improved Seeds at High Response Level for ADC's SM Farms, Registered Growers, and Other Sources.

Year	Total Additional Value of Crop Production From Improved Seeds at High Response Level			
	ADC's SM Farms	Registered Growers	Others	Total
	1,000 Rupees			
1969	11,880	8,910	27,720	48,510
1970	15,840	11,880	27,720	55,440
1971	19,800	14,850	27,720	62,370
1972	19,800	14,850	31,680	66,330
1973	19,800	14,850	35,640	70,290
1974	19,800	14,850	39,600	74,250
1975	19,800	14,850	39,600	74,250
1976	19,800	14,850	39,600	74,250
1977	19,800	14,850	39,600	74,250
1978	19,800	14,850	39,600	74,250
Ten-year Rs.	186,120	139,590	348,480	674,190
(1,000)	$38,775	29,081	72,600	140,456

Appendix Table 14. Total Additional Value of Crop Production from Improved Seeds at Lowest Response Level for ADC's SM Farms, Registered Growers, and Other Sources.

Year	Total Additional Value of Crop Production from Improved Seeds at Lowest Response Level			
	ADC's SM Farms	Registered Growers	Others	Total
	1,000 Rupees			
1969	2,970	2,228	6,930	12,128
1970	3,960	2,970	6,930	13,860
1971	4,950	3,712	6,930	15,592
1972	4,950	3,712	7,920	16,582
1973	4,950	3,712	8,910	17,572
1974	4,950	3,712	9,900	18,562
1975	4,950	3,712	9,900	18,562
1976	4,950	3,712	9,900	18,562
1977	4,950	3,712	9,900	18,562
1978	4,950	3,712	9,900	18,562
Ten-year Rs.	46,530	34,894	87,120	168,544
(1,000)	$9,694	7,270	18,150	35,114

Appendix Table 15. Consolidated Statement for Third Plan Period Showing ADC's Procurement for Distribution, Gross Cost, Recoveries, and Net Subsidy.

Item	Unit	1965-66	1966-67	1967-68	1968-69	1969-70	5-yr. total
Aus Paddy							
ADC Procurement	1000 md.	-0-	30.0	35.0	35.0	40.0	140.0
Gross Cost	Rs 1000	-0-	1,100	1,283	1,283	1,466	5,132
Recovery	Rs 1000	-0-	660	770	770	880	3,080
Net Subsidy	Rs 1000	-0-	440	513	513	586	2,052
Aman & Boro Paddy							
ADC Procurement	1000 md.	-0-	45.0	45.0	50.0	50.0	190.0
Gross Cost	Rs 1000	-0-	1,400	1,400	1,555	1,555	5,910
Recovery	Rs 1000	-0-	900	900	1,000	1,000	3,800
Net Subsidy	Rs 1000	-0-	500	500	555	555	2,110
Wheat							
ADC Procurement	1000 md.	5.8	20.0	25.0	30.0	35.0	115.8
Gross Cost	Rs 1000	135	666	833	1,000	1,166	3,800
Recovery	Rs 1000	75	440	550	660	770	2,495
Net Subsidy	Rs 1000	60	226	283	340	396	1,305
Jute							
ADC Procurement	1000 md.	-0-	1.5	3.9	5.7	6.2	17.3
Gross Cost	Rs 1000	-0-	167	431	632	695	1,925
Recovery	Rs 1000	-0-	60	155	227	250	692
Net Subsidy	Rs 1000	-0-	107	276	405	445	1,233
Total							
ADC Procurement	100 md.	5.8	96.5	108.9	120.7	131.2	463.1
Gross Cost	Rs 1000	135	3,333	3,947	4,470	4,882	16,767
Recovery	Rs 1000	75	2,060	2,375	2,657	2,900	10,067
Net Subsidy	Rs 1000	60	1,273	1,572	1,813	1,982	6,700

Source: Appendix D - *Third Plan (1966-67 to 1969-70) Scheme for Procurement and Distribution of Improved Seeds in East Pakistan*, EPADC.

Appendix Table 16. Cost of Registered Grower Premiums for Third Plan Period for Rice and Wheat

Item	Aus Paddy	T. Aman Paddy	Aman DA-31	Boro Paddy	Wheat	Total
			Rs. 1,000,000			
Premium rate Rs/md	3/-	2/-	3/-	3/-	3/-	xx
Annual Cost:						
1965-66	0.60	0.94	0.05	0.05	0.17	1.81
1966-67	0.08	0.44	---	0.52	0.06	1.10
1967-68	3.75	1.60	0.10	2.10	0.75	8.30
1968-69	4.20	1.60	0.12	2.55	0.90	9.37
1969-70	4.20	1.60	0.14	3.00	1.05	9.99
Total	12.83	6.18	0.41	8.22	2.93	30.57

Source: Appendix IV - page 18. *Third Plan (1965-66 to 1969-70) Scheme for Production of Improved Seeds (Paddy & Wheat) By Registered Growers in East Pakistan.* May 3, 1968.

Appendix Table 17. - Financial Involvement with Regard to Procurement and Distribution of Improved Seeds for 1969-70.

Item	Amount
	1,000 Rupees
A. GROSS COST	
i. Procurement price and on cost of 35,000 mds of wheat seeds @ Rs. 33.32 per md.	1,166
ii. Procurement price and on cost of 6,250 mds of jute seeds @ Rs. 111.28 per md.	695
iii. Procurement price and on cost of 40,000 mds. of Aus paddy seeds @ Rs. 36.66 per md.	1,466
iv. Procurement price and on cost of 50,000 mds of Aman and Boro paddy seeds @ Rs. 31.10 per md.	1,555
Total	4,882
B. RECOVERIES	
i. Sale of 35,000 mds. of wheat seeds @ Rs. 22/-per md.	770
ii. Sale of 6,250 mds. of jute seeds @ Rs. 40/-per md.	250
iii. Sale of 40,000 mds. of Aus paddy seeds @ Rs. 22/-per md.	880
iv. Sale of 50,000 mds. of Aman and Boro paddy seeds @ Rs. 20/-per md.	1,000
Total	2,900
C. NET COST (A-B)	1,982

Source: *Third Plan Scheme for Procurement and Distribution of Improved Seeds in East Pakistan.*

Appendix Table 18. Per-Maund Estimate of Cost of Procurement, Cost of Distribution and Other Incidentals, Recovery, and Subsidy of Wheat, Jute, and Paddy Seeds.

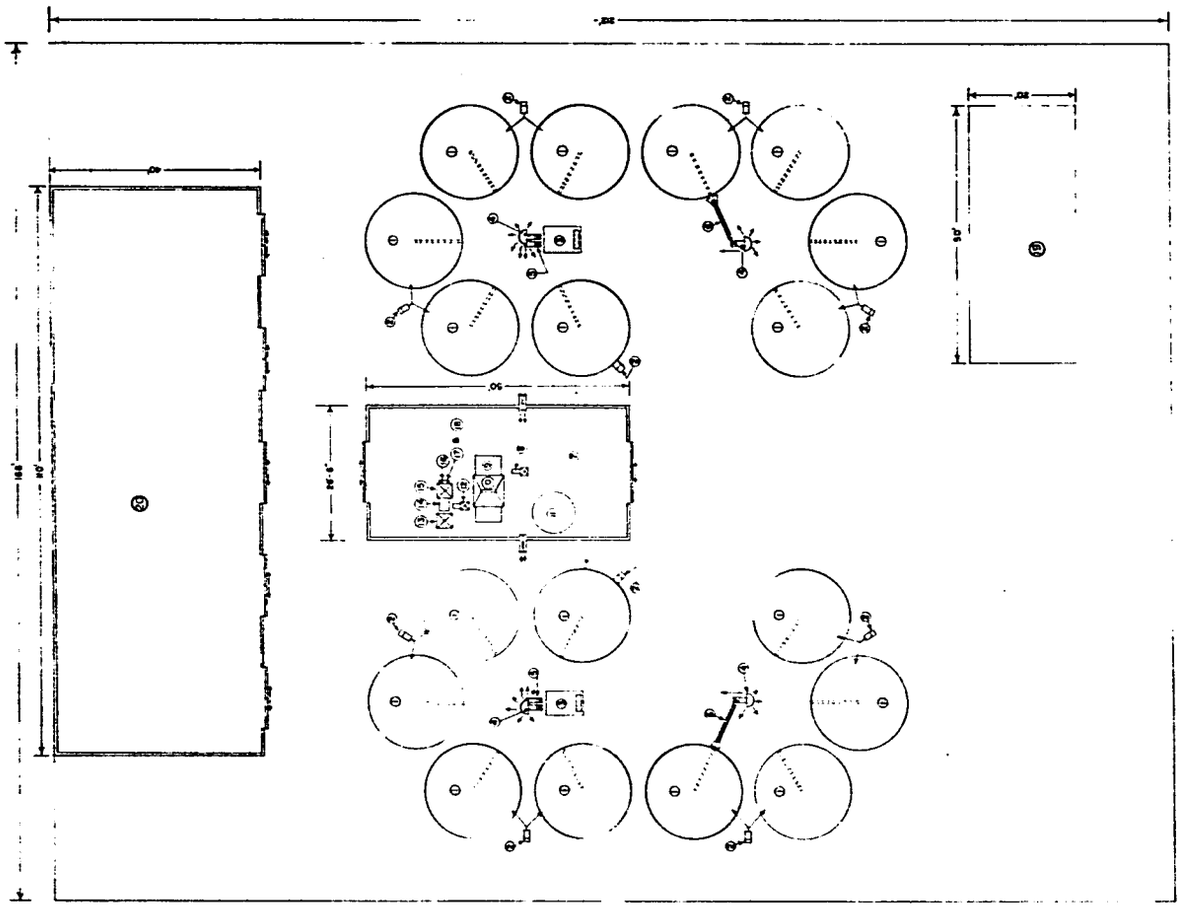
Item	Wheat	Jute	Aus Paddy	Aman & Boro Paddy
	Rupees			
A. Cost of Procurement				
Price of seeds	22.00	80.00	25.00	20.00
Cost of bags (a)	1.50	8.00	1.50	1.50
Cost of carrying, sewing, & labeling	0.25	4.00	0.25	0.25
Transport cost from grower to collecting center	1.00	1.00	1.00	1.00
Collecting center to nearest Rly. station	0.75	0.75	0.75	0.75
Transport cost from Rly. station to storing godown	1.50	1.50	1.50	1.50
Treatment cost	0.50	0.50	0.50	0.50
Storage charge (b)	1.00	1.00	1.00	1.00
'A'	28.50	96.75	36.50	26.50
B. Cost of Distribution				
Cost of distribution (handling and transport)	1.50	1.50	1.50	1.50
Interest charge @ 6¼%	1.88	6.14	2.00	1.75
'B'	31.88	104.39	35.06	29.75
C. Overheads				
ADC's overhead charge at the rate of 2½%	0.80	2.61	0.88	0.74
'C'	32.58	107.00	35.94	30.49
Shortage in storage 2%, 4% and 2% (c)	0.64	4.28	0.72	0.61
Total gross cost	33.32	111.28	36.66	31.10
Recovery from farmer	22.00	40.00	22.00	20.00
Subsidy amount	13.32	71.28	14.66	11.10
Percentage of subsidy	40%	64%	40%	36%

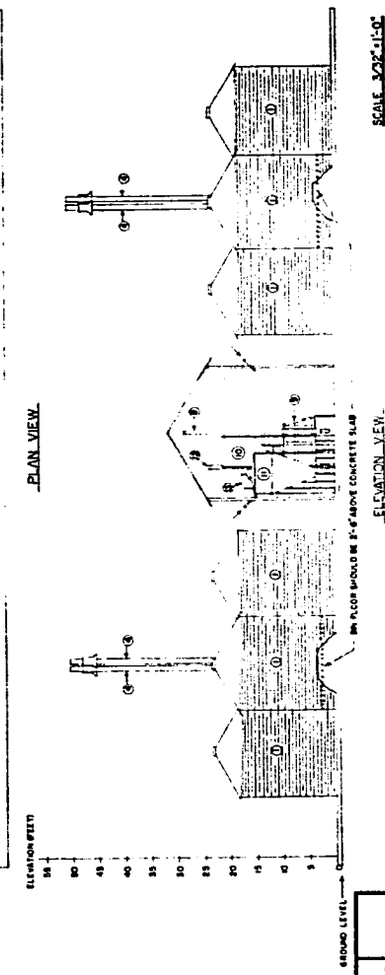
Source: *Third Plan Scheme for Procurement and Distribution of Improved Seeds in East Pakistan.*

a. Bags-For wheat seeds double gunny bags contained one maund. Jute - For jute seeds cotton bags contained 1¼% srs. Paddy - For paddy seeds gunny bags contained one maund each.

b. Storage-For wheat seeds store for 7 months, for jute seeds store for 5 months and paddy seeds 15 months.

c. Shortage-2% for wheat seeds, 4% for jute seeds and 2% for paddy seeds.





LEGEND

1. SEED DRYING & STORAGE BINS
2. DRIER FAN & HEATER
3. FIELD SCALPER
4. BELT & BUCKET ELEVATOR ASSEMBLY (44'D.H.)
5. " " " " "
6. BELT CONVEYOR
7. PROCESSING PLANT BUILDING
8. BELT & BUCKET ELEVATOR (26'D.H.)
9. AIR-SCREEN CLEANER
10. SURGE BIN (175 BU. CAPACITY)
11. DUST COLLECTOR
12. BELT & BUCKET ELEVATOR (22'D.H.)
13. SURGE BIN (25 BU. CAPACITY)
14. SEED TREATER
15. SURGE BIN (25 BU. CAPACITY)
16. " " (8 BU. CAPACITY)
17. BAGGER-WEIGHER (NOT SHOWN)
18. PLATFORM SCALES (" ")
19. PREDRYER
20. WAREHOUSE

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STATE COLLEGE, MISSISSIPPI

SEED DRYING, PROCESSING AND STORAGE FACILITIES FOR EAST PAKISTAN
TYPE I

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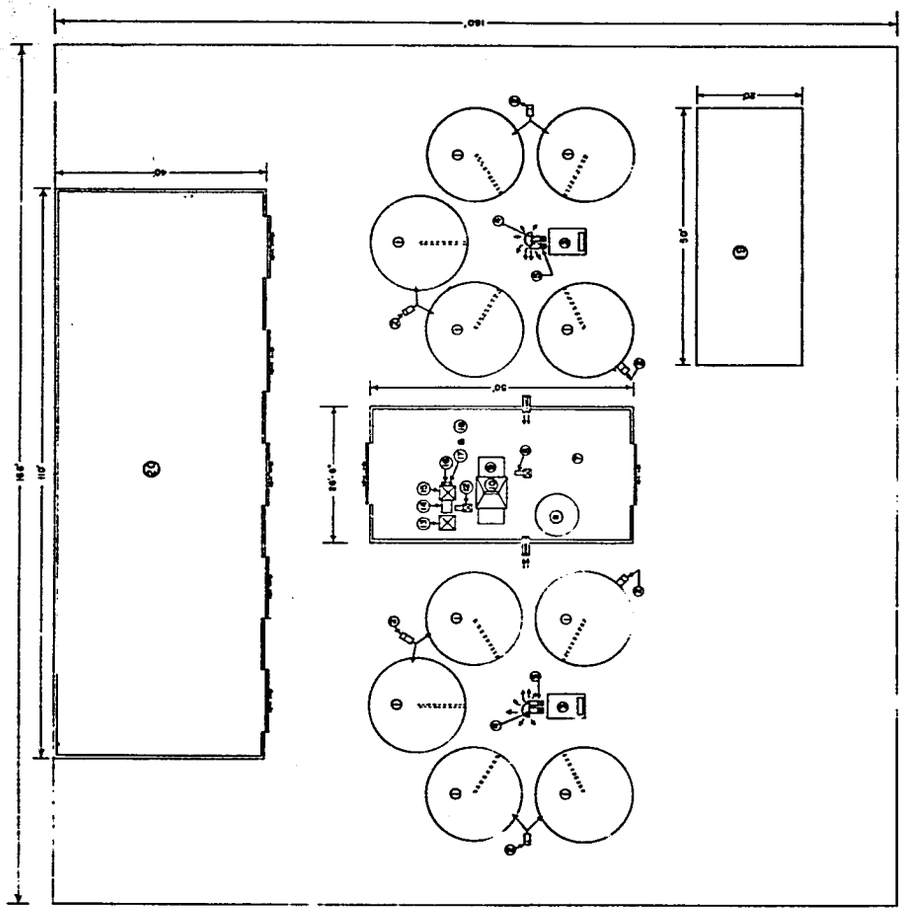

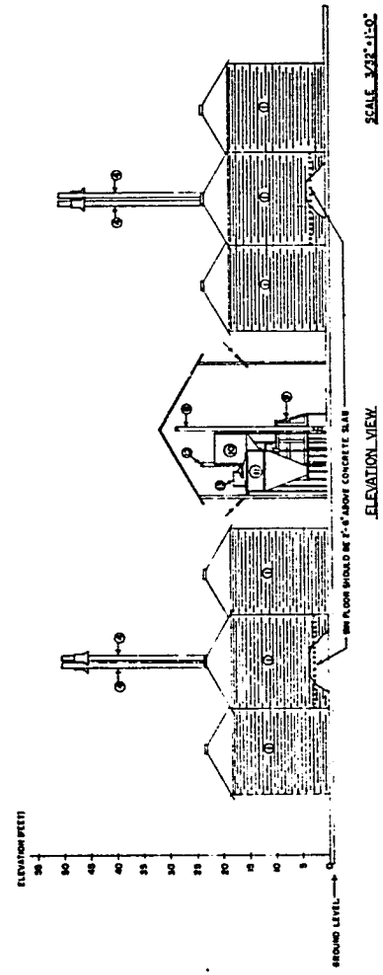

LEGEND

1. SEED DRYING AND STORAGE BINS
2. DRIER FAN AND HEATER
3. FIELD SCALPER
4. BELT & BUCKET ELEVATOR ASSEMBLY (48' D.H.)
5. " " " " " "
6. BELT CONVEYOR
7. PROCESSING PLANT BUILDING
8. BELT & BUCKET ELEVATOR ASSEMBLY (26' D.H.)
9. AIR SCREEN CLEANER
10. SURGEBIN (175 BU CAPACITY)
11. DUST COLLECTOR
12. BELT & BUCKET ELEVATOR ASSEMBLY (22' D.H.)
13. SURGEBIN (25 BU CAPICITY)
14. SEED TREATER
15. SURGEBIN (25 BU CAPICITY)
16. " (8 BU CAPICITY)
17. BAGGER-WEIGHER (NOT SHOWN)
18. PLATFORM SCALES
19. PREDRYER
20. WAREHOUSE

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TYPE II

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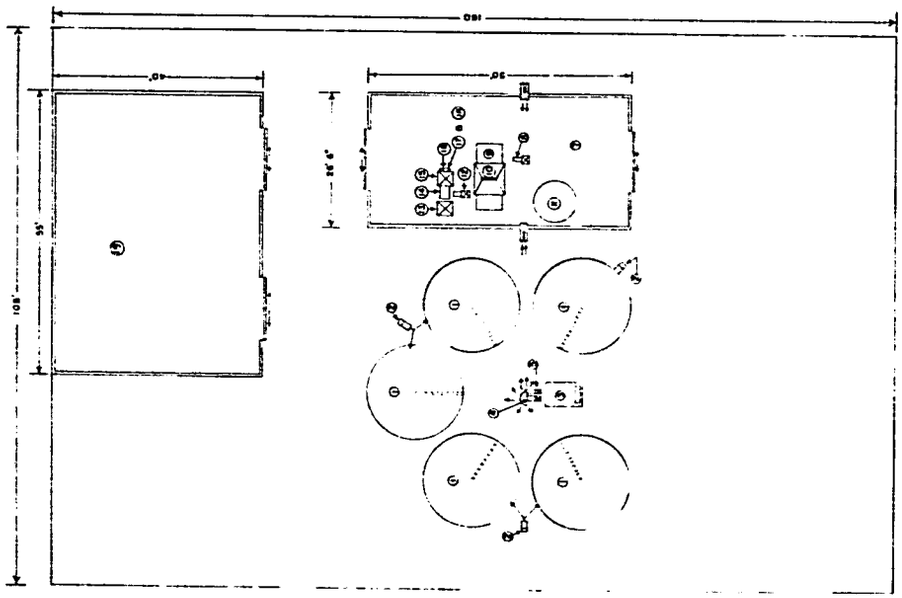
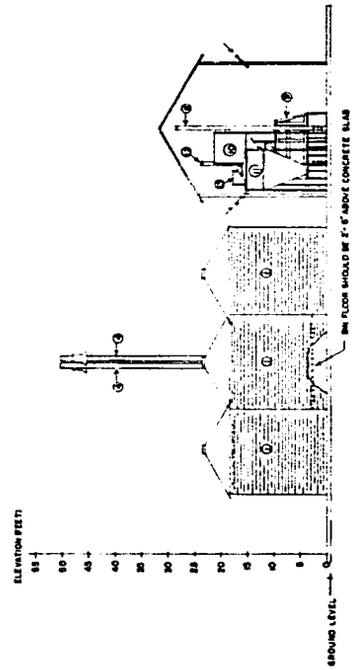


PLAN VIEW



ELEVATION VIEW

LEGEND

1. SEED DRYING & STORAGE BINS
2. DRIER FAN & HEATER
3. FIELD SCALPER
4. BELT & BUCKET ELEVATOR ASSEMBLY (48' D.H.)
5. " " " " "
6. BELT CONVEYOR
7. PROCESSING PLANT BUILDING
8. BELT & BUCKET ELEVATOR (26' D.H.)
9. AIR-SCREEN CLEANER
10. SURGE BIN (175 BU CAPACITY)
11. DUST COLLECTOR
12. BELT & BUCKET ELEVATOR (22' D.H.)
13. SURGE BIN (25 BU CAPACITY)
14. SEED TREATER
15. SURGE BIN (25 BU CAPACITY)
16. " (6 BU CAPACITY)
17. BAGWEIGHER (NOT SHOWN)
18. PLATFORM SCALE "
19. WAREHOUSE

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SEED DRYING, PROCESSING AND STORAGE FACILITIES FOR EAST PAKISTAN
TYPE III

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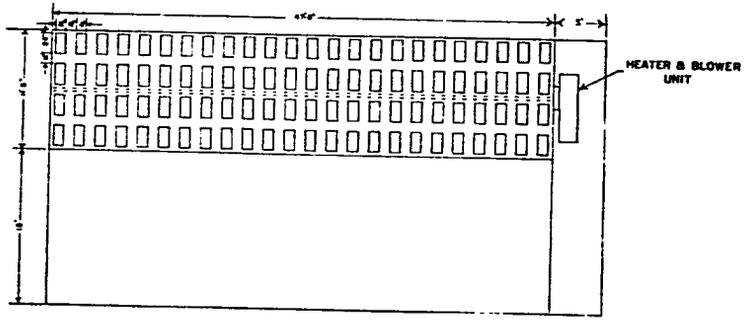

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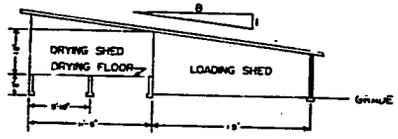
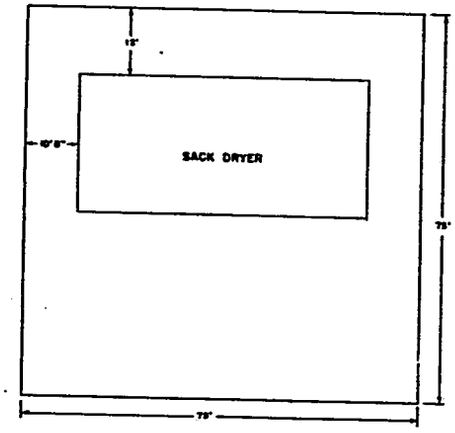


ELEVATION

SACK DRYER



TYPE IV INSTALLATION

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SEED DRYING, PROCESSING AND STORAGE FACILITIES FOR EAST PAKISTAN
SACK DRYER - TYPE IV

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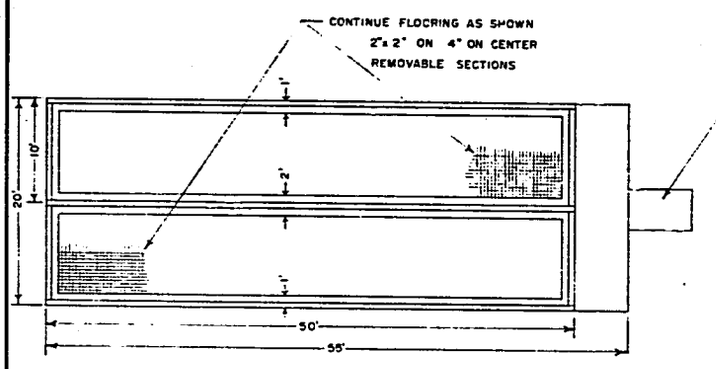
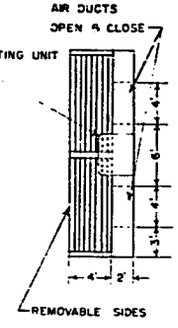
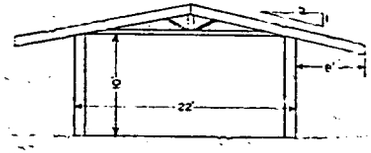


TOP VIEW



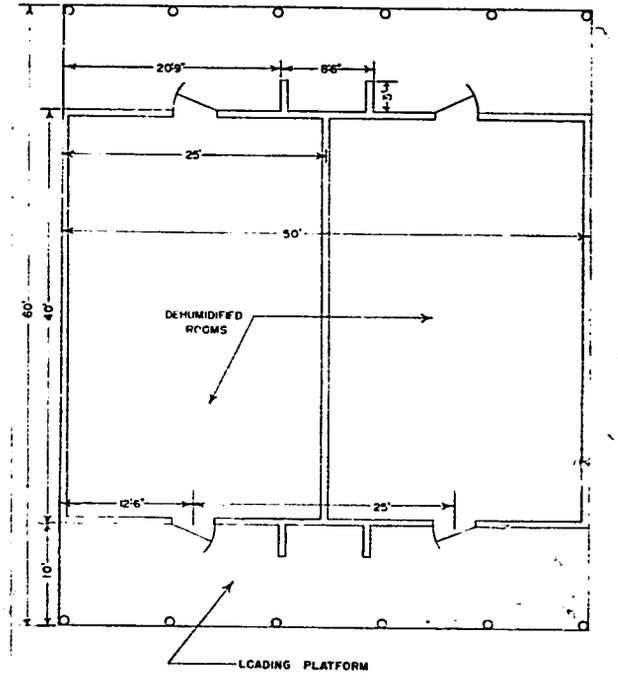
END VIEW

"PREDRYER"

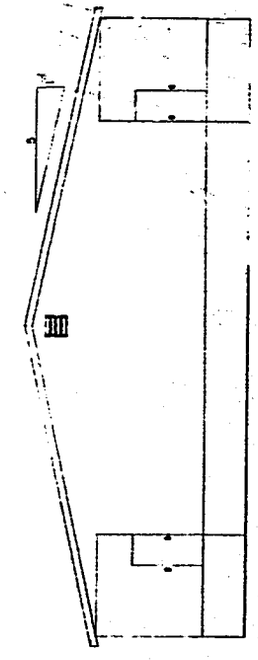


CROSSECTION OF SHELTER
POLE ON MASONRY
OPEN SIDES

DEHUMIDIFICATION STORAGE



FLOOR PLAN



END VIEW

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STATE COLLEGE, MISSISSIPPI

SEED DRYING, PROCESSING AND STORAGE
FACILITIES FOR EAST PAKISTAN
FREDRYER AND DEHUMIDIFICATION STORAGE

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