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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT

WASHINGTON, D.C. 20523

PROJECT PAPER

MAIZE AND OILSEEDS

PRODUCTION PROJECT

(482-0005)

June 18, 1981

UNCLASSIFIED

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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete)

Amendment Number

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: BURMA

3. PROJECT NUMBER: 482-0005

4. BUREAU/OFFICE: ASIA 04

5. PROJECT TITLE (maximum 40 characters): MAIZE AND OILSEEDS PRODUCTION

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 88

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 82 B. Quarter 1 C. Final FY 86

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 82 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total				29,900	(100)	30000
(Grant)	(7500)	( )	(7500)	29,900		(30000)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country	700	800	1500	10000	8000	18000
Other Donor(s)						
TOTALS	8200	800	9000	39,900	8100	48000

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	123	070				30000		30000	
(2)									
(3)									
(4)									
TOTALS						30000		30000	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 076 072 011 012 020

11. SECONDARY PURPOSE CODE: 320

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BF	PART/EQTY	NUTR				
B. Amount	25000	2500	2500				

13. PROJECT PURPOSE (maximum 480 characters)

To increase production of oilseed crops and maize in 28 Townships of rural Burma, with positive effects on rural income and employment, and on national food supply and nutrition.

14. SCHEDULED EVALUATIONS

Interim MM 10 YY 83 MM 10 YY 85 Final MM 10 YY 86

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [X] Local [ ] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED

ERRATA: The contribution of the Socialist Republic of the Union of Burma to the Maize and Oilseeds Production Project (482-0005) was increased during project negotiations from $18,000,000 to $21,000,000.

17. APPROVED BY

Signature: David N. Merrill

Title: David N. Merrill, AID Representative

Date Signed: MM 09 DD 15 YY 83

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-4 (8-79)

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

PROJECT AUTHORIZATION

BURMA

Maize and Oilseeds Production
Project No. 482-0005

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Maize and Oilseeds Production Project ("the Project") for Burma (the "Cooperating Country") involving planned obligations of not to exceed $30,000,000 in grant funds over a five year period commencing in fiscal year 1982, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process to assist in financing foreign exchange and local currency costs for the Project.

2. The Project will assist the Cooperating Country to increase production of oilseed crops and maize by providing technical assistance, fertilizer and other necessary material, support for local staff and costs, and training in Burma, the United States and designated third countries in order to improve the national research capability, introduce improved technology and production practices and establish seed farms and a rhizobium production facility.

3. The Project Agreement which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms, covenants and major conditions, together with such other terms and conditions as A.I.D. shall deem appropriate.

4. a. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by A.I.D. under the Project shall have their source and origin in the Cooperating Country or the United States, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

b. Covenant

The Project Agreement shall contain a covenant providing in substance that the Cooperating Country shall establish a field-level monitoring system, satisfactory to A.I.D., to ensure the distribution and application to acreage and crops in project townships of the total amount of fertilizer contributed to the project by A.I.D. and the Cooperating Country.

Signature _____
M. Peter McPherson
Administrator

Aug 21, 81
Date

Clearance:
Jon Holstine, AA/ASIA _____ Date 8/13/81
John Bolton, GC _____ Date _____
Larry Smucker, A/AA/PPC _____ Date 8/20/81

ASIA/PD/EA:AShapleigh/GC/ASIA:STisa:dw/hp:8/12/81:58910

ABBREVIATIONS

AC	Agriculture Corporation
AFPTC	Agricultural and Farm Products Trading Corporation
AID	Agency for International Development
ARI	Agricultural Research Institute
SRUB	Government of the Socialist Republic of the Union of Burma
MOP	Muriate of Potash
TSP	Triple Super Phosphate

MEASUREMENTS

1 MT (metric ton)	=	2200 lbs.
1 Viss	=	3.60 lbs.
1 acre	=	.40 hectares
1 hectare	=	2.50 acres

CURRENCY EQUIVALENT

US $1.00	=	Kyat (K) 7.2
K1.00	=	US $0.14

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PART I: SUMMARY AND RECOMMENDATIONS

A. Recommendations

A total AID grant of $30,000,000 provided over three years is recommended for a five-year project beginning in October 1981. Total project costs are $48,000,000, including an $18,000,000 contribution by the Government of the Socialist Republic of the Union of Burma (SRUB).

It is further recommended that the schedule of AID obligations be accelerated to the degree possible in order to permit early commitments of funding for grant-financed agricultural equipment, fertilizer, technical assistance and training. The recommended schedule of obligations, if funds are available, is $7,500,000 in FY 1982, $12,500,000 in FY 1983, and $10,000,000 in FY 1984, respectively.

B. Summary Description

1. Goal

The principal goal of the project is to increase production of oilseed crops and maize in 28 Townships of rural Burma, with positive effects on rural income and employment and on national food supply and nutrition. By Year Five of the project, the following increases are expected:

--- Maize production increased by 375,000 MT.
--- Groundnut (peanut) production increased by 375,000 MT
--- Sesamum production increased by 49.100 MT.
--- Sunflower production increased by 65,500 MT.
--- Soybean production increased by 12,000 MT.
--- Gross farm income increased by K 1,160 million ($161.1 million).
--- Exports of oil cake and related products increased by $100.9 million.
--- Value of increased vegetable oil production: $94.5 million.
--- Per capita intake of vegetable oil increased by 30% from approximately 2.8 kg. to 3.8 kg.

2. Purpose

The purpose of the project is to bring about a rapid rate of adoption of high-yielding inputs and tillage practices among an estimated 200,000 farm families who will be planting maize and oilseed crops in the 28 project townships. By the end of the project the cumulative number of acres planted during four crop years using project-recommended higher-yielding technology and inputs will be 1.2 million acres directly attributable to the project and an additional 1.5 million acres benefiting from the spread effect of nitrogen-fixing rhizobium inoculation technology on groundnuts.

3. Technology Transfer and Institution Building Outputs

--- Improved national research capability in maize and oilseeds. On-going trials will be conducted at central research facilities in Yezin and at 40 field-level high technology sites within eight intensive townships on seed varieties, soils, fertilizer application rates, water control and other production variables affecting yields of maize and oilseeds.

--- Introduction of improved maize and oilseed technology and production practices (seed, water, fertilizer, extension services). Newly developed technology will be farm-tested at high technology sites resulting in township and/or village specific production packages for each crop per township.

--- Four fully-equipped and staffed maize and oilseeds seed farms.

--- An operational farm management information system for monitoring farm-level production practices and providing feedback on results to research and extension centers.

--- Returned participant trainees in place within the research, extension, seed farm and fertilizer distribution elements of the project.

--- A functional rhizobium production facility (inoculum for groundnuts and soybeans). Technology for local nitrogen-fixing inoculum production of three million lbs. per year is planned by Year Five of project, leading to long-term reductions in Burma's requirement for urea fertilizer compared with what those requirements would have been in the absence of this project.

4. Costs and Benefits

The project will achieve more than $280 million worth of benefits at a total cost of approximately $48 million, which includes a $30 million grant contribution by AID and an estimated $18 million contribution by the Government of the SRUB.

C. Summary Findings

The Project Design Team has analyzed the technical, economic, social, administrative and financial feasibility of the project and recommends that the project be implemented as outlined in the Project Paper. In summary, the proposed production technology and inputs for maize and oilseed crops should result in very favorable results including fully adequate economic returns (1) at the farm level, (2) from a viewpoint of internal benefit/cost ratios, and (3) in terms of foreign exchange effects of the project. With regard to administrative and management capacity, it should be noted that the Agriculture Corporation, which initially proposed the project to AID and which will have operational responsibility,

has been highly receptive to the Project Team and helped produce a project plan which fully reflects a collaborative effort by the two sides. The project will be a high priority for the Agriculture Corporation during the next five years and should be very well managed.

D. Issues

1. Schedule of AID grant obligations

In order to meet the preferred schedule of expenditures (commitments) in the fiscal years in which funds are needed, AID/Burma recommends a revised obligation schedule as follows:

($ Millions)		FY-82	FY-83	FY-84	FY-85
Previously Planned Obligation Schedule		5.0	10.0	15.0	-
	or-	5.0	10.0	10.0	5.0
Recommended Obligation Schedule		10.0	10.0	10.0	-
	or-	7.5	12.5	10.0	-

The accelerated schedule will permit timely procurement of equipment, fertilizer, technical assistance and training during the first two years of the project. As a fallback position, the SRUB is willing to provide 100% of first-year fertilizer procurements, which would allow AID to meet its commitments under the previously planned obligation schedule. However, it is much preferred to plan for grant-financed fertilizer procurements in each of the first four years of the project, each consisting of 10,000 MT shipments and costing approximately $3.7 million per year. The preferred obligation schedule listed above would accomplish this and would enable benefits attributable to AID financing to accrue earlier.

2. Length of project

The Project Design Team has recommended that the project be implemented over five years versus an earlier estimate of four years. There will be approximately one year for start-up contracting, procurement and organization, followed by four years of implementation coinciding with the 1982-83, 1983-84, 1984-85, and 1985-86 crop years in Burma. Although all other project activities will be completed by September 30, 1986, the Project Assistance Completion Date may be changed subsequently to September 30, 1988 to account for up to two additional years for PhD candidates to complete their training.

3. Fertilizer and development

During the PID review it was asked that special attention be given to the developmental rationale for including fertilizer procurement in the project. The fertilizer applied to project acreage during the four crop years of the project will produce, in conjunction with other inputs and services, a substantial increase in maize and oilseed crop production and farm-level incomes. SRUB studies show that at this stage of development with very low or no fertilizer application, fertilizer alone will account for more than 50% of the increases in yield and production.

From the point of view of economic return, it has been convincingly demonstrated in Burma that a dollar spent on fertilizer leads to several dollars' worth of increased crop value. Confidence in this fact explains the SRUB's willingness to provide $10 million from its own scarce foreign exchange for imported fertilizer contributions to this project. The increased value of production will create a multiplier effect on rural incomes and on economic growth throughout Burma.

Demonstrations of the dramatic technical and financial results accruing from fertilizer applications are part of the package of new technologies which the SRUB will be seeking to convince conservative farmers to adopt under this project. In Burma, without demonstrated production increases, the new technologies recommended by the authorities will not be adopted. Fertilizer is one part, but an integral part, of the package of improved practices, seed farm development, research field trials, water management, technical assistance, and training to be provided under the project, leading to both its high economic rate of return and its high return in terms of changed agricultural practices.

Great care has been taken in the project design to avoid the project's contributing even in a small way to a dependency on imported fertilizer that the SRUB could not afford. First, by virtue of the foreign exchange benefits of the project in terms of import reduction and export earnings from oil cake, Burma's net foreign exchange position will be greatly strengthened by the project. Second, through technology transfer, to be provided by AID, in the technique of producing nitrogen-fixing rhizobium inoculants for use on groundnut and soybean acreage, the need for urea, a fossil-based fertilizer, will be substantially reduced or eliminated for those two crops. There is no technical reason why, with AID assistance, rhizobium cannot totally supplant urea fertilizer for these crops.

4. Fertilizer Fungibility

During the detailed discussions of the procurement plan, it was learned that fertilizer could be purchased more competitively by AID and the SRUB if it were tendered in 10,000 MT units. The second fact which emerged from these discussions was that the United States is most competitive in Triple Super Phosphate (TSP) as compared to Urea or Muriate of Potash. Burma's international tenders for fertilizer from its own foreign exchange resources usually lead to TSP purchases in the USA. Therefore, it was tentatively decided that, as the U.S.-financed fertilizer would be tied to U.S. sources, the U.S. fertilizer input (40,000 tons) should include 30,000 MT of TSP (which would meet all project requirements for TSP) and 10,000 tons of urea, while the SRUB-financed fertilizer purchases (30,000 tons), being bid internationally, should concentrate on urea and MOP requirements. In this way both the U.S. and Burma will get the most fertilizer for their money, maximizing returns to the project.

AID has planned its procurements to coincide as closely as possible with exact annual requirements. To the degree possible, AID-marked bags of fertilizer will in fact arrive at the project townships and be used only on project acreage. However, if U.S. fertilizer should not arrive on schedule for any reason, the SRUB would substitute and increase its own fertilizer inputs to this project. If that should happen, the SRUB would offset its increased contribution by utilizing AID-financed fertilizer on other crop acreage. While it would be possible to insist on an application of all U.S. bags on the AID project acreage, given the vagaries of obligation dates and shipping schedules it was considered desirable to anticipate this problem and to build in flexibility in implementation. A covenant has been added to the authorization to assure that the total amount of fertilizer applied to the project area is no less than the 70,000 tons total being financed by AID and by Burma, and at the prescribed application rates. The Agriculture Corporation will be responsible for insuring this result.

5. Long-Term Technical Advisors

The Project Design Team has prepared a strong case for an average of three (3) long-term specialists per year, for a total of 13 person-years, to be financed from project grant funds. We expect that the technical assistance and the training will be obtained by contract with a university or a university consortium. This amount of long-term technical assistance has been accepted in principle by the Agriculture Corporation.

The team also notes that AID/Burma has no resident agricultural officer, and believes it is mandatory that an experienced Direct-Hire Agricultural Development Officer be assigned to AID/Burma immediately upon the start of the project (October 1981). A project of this size cannot be monitored properly for AID without any agricultural officer on board. In addition, a foreign national, either FNDH or contract, should be on board during FY-82 to assist in the monitoring of commodity deliveries and fertilizer distribution and application. The team notes that this would require an increase in both the AID position and MODE ceilings for Burma from four USDH to five, and from one FNDH to two if the foreign national is FNDH rather than contract.

6. Edible Oil Extraction/Processing

Based upon the guidance of the Asia Project Advisory Committee in the Project Identification Document review, the extraction element has been removed from this project and will be handled as part of a separate project at a later date. The current project will focus on crop development and production with the Agriculture Corporation as the implementing agency. The later project will address the entire spectrum of technologies needed by Burma to make more efficient utilization of oilseed crops, including the increased production resulting from the oilseeds production project.

Those technologies may include solvent extraction, extrusion cookers, technical improvements in traditional oilseed expeller technology at the village and township levels, refining, packaging, and marketing. It is expected that the oilseeds utilization project will be with the Ministry of Cooperatives, subject to further discussions with the SRUB.

7. Environmental Assessment

The PID reviews recommended that a limited Environmental Assessment be completed concentrating on the use of pesticides on maize and oilseed crops in Burma. This has been prepared by the Project Design Team and is included in Annex D.

8. Marketing, transportation, storage and credit

Each of these areas were cited in the PID review as requiring special attention in preparing the Project Paper. An analysis on the possible constraints they impose on project success is included in Part III.

9. Policy Determination on AID Financing of Palm Oil Projects leading to Production for Export (PD-71)

PD-71, dated 5/12/78, states that projects involving production, processing, or marketing of sugar, palm oil, citrus, and related products for export should be carefully reviewed with regard to possible impact on U.S. producers. This project has carefully avoided the inclusion of palm oil, and no part of the project includes palm oil production (there is an ADB project in Burma on palm oil). Moreover, the purpose of the project with regard to the other oilseed crops being promoted is solely to increase available supply for domestic consumption, not for export, so that there will be no potential injury to U.S. producers from exports of related oils, although oilseed cake, for livestock feed, will be exported. Furthermore, as the U.S. presently supplies no edible oils to Burma, no U.S. markets will be affected by the increase in domestic supply. The only international effect foreseen is that the project may ultimately lead to a reduction or elimination of Burma's imports of red palm oil from Malaysia. This effect is clearly outside the scope of PD-71.

PART II. PROJECT BACKGROUND AND DETAILED DESCRIPTION

A. Background

1. Agricultural Development in Burma

Starting in the mid-1970's, the Government of the Socialist Republic of the Union of Burma (SRUB) began a series of major reforms affecting agricultural production and rural income distribution. Top priority was given to agriculture, recognizing that Burma's prospects for economic growth and development hinge on the performance of the agricultural sector, which accounts for 46% of GDP and employs some 53% of the total labor force and most of the rural labor force. Nevertheless, over the past decade the average annual increase in food production has varied from 1.9% - 2.1%, which, together with an average annual population growth rate of 2.2%, yielded a per capita food production index for 1976-78 of 96 (1969-71 = 100). With little prospect for reducing the population growth rate in the near future, food production must increase if the agricultural sector is to develop surpluses to contribute to economic growth.

With the largest land area of any country in mainland Southeast Asia, with significant water resources, and with new agricultural technologies only beginning to be applied, Burma currently has the greatest possibilities for increases in food production of any AID-assisted country in East Asia. Although much could be done to increase production by bringing more arable land under cultivation, the agricultural strategy chosen by the SRUB emphasizes increases in yields on existing cultivated land through more intensive production plus double cropping wherever feasible. Quite appropriately, the SRUB began with rice, by testing high-yielding varieties of paddy received from IRRI and then launching its Whole Township program in 1978-79. The Whole Township program (referred to at various points in the Project Paper and described in greater detail in Part III.A.6, Extension Capability Analysis) now (1980-81) covers five million acres in 72 townships, or 40% of the total area in Burma sown in rice. The Burmese "selective-concentration" extension model involves active participation of elected township and village councils, party officials and extension staff of the Agriculture Corporation in promoting rapid adoption by farmers of improved production technology. The result has been steady and impressive gains in rice production each year, leading to last year's paddy harvest of over 13 million tons, the highest in Burma's history. Exports of rice are estimated at a minimum of 700,000 - 800,000 MT, and with continued expansion of the HYV program, Burma will soon, perhaps this year, exceed the 1,000,000 MT annual export level.

Burma is composed of 14 Divisions and States (seven of each), which include 314 townships (27 urban and 287 rural). Agricultural production can be divided roughly into two regions, Upper Burma and Lower Burma, which constitute Burma proper. Upper Burma, a floodplain created by the Chindwin and Irrawaddy rivers, includes the Divisions of Mandalay, Sagaing, and Magwe. South of Mandalay, the floodplain narrows

for roughly two hundred miles before it opens up again into a second major floodplain known as Lower Burma. The most important single difference between Upper and Lower Burma is water availability. While Upper Burma averages only 30 inches of rainfall annually, Lower Burma receives 100 inches per year. Thus, lack of water resources constrains production in Upper Burma, whereas water management is of greater importance in Lower Burma.

Upper Burma is a rice deficit area, with rice grown on irrigated land or sites adjacent to rivers. Cultivation of oilseeds and other rainfed crops exceeds paddy in many localities. Whereas rice cultivation accounts for less than one-third of croplands in Upper Burma, rice is cultivated on 80% - 90% of Lower Burma croplands. In the past, oilseed production was promoted by the Government only in Upper Burma; further south, where rainfall is heavy, the SRUB promoted production of oil palm. Recently, however, the SRUB has promoted oilseed production as a second crop during the dry season in the Irrawaddy Delta using residual oil moisture after paddy and, in some instances, using irrigation.

Groundnuts (peanuts) are grown primarily for use as an oilseed crop, but also as a snack food and fodder for cattle. In total sown area, groundnut is the third most important crop (after paddy and sesamum) cultivated in Burma. In 1978-79, plantings of groundnuts totaled 1.4 million acres in Central Burma, mainly in Mandalay and Magwe Divisions. Irrigation is currently applied to only about four percent of the area. Both spreading and erect types of groundnuts are planted after the first spring rains; sometimes they are double-cropped with sesamum or pulses following the late summer groundnut harvest. Groundnut yields are particularly sensitive to time of planting, seed inoculation and choice of variety, as well as to seed quality, insects and disease.

Sesamum was grown on 3.1 million acres in 1978-79. It is the most widely planted oilseed crop (although average yield/acre potential is much less than groundnut), and second only to paddy in area cultivated. Nearly 70% of sesamum is grown in Magwe and Mandalay Divisions where it is the principal crop. Almost all sesamum is grown under rainfed conditions without the use of inputs.

Sunflower was introduced only recently in Burma as a source of edible oil. Sown acreage is not currently significant, but it is increasing steadily.

Maize is currently grown in Lower and Upper Burma and the Shan State, primarily for direct human consumption, animal feed and export. In 1978-79, sown acres yielded an estimated 314 pounds/acre. Roughly three-quarters of the crop was consumed; most, if not all, of the surplus was exported. Soybeans are a traditional but small-scale crop in the Shan State where they are cultivated exclusively for human consumption. Grown on an estimated 56,417 acres in 1978-79 at an estimated yield of 575 pounds/acre, 100% of the soybean production was consumed directly.

Recently introduced improved cultural practices are leading to increased yields.

Neither maize nor soybeans is currently viewed by the authorities as a source of edible oils. However, the SRUB does have a modest interest in expanding soybean production in the long run, based upon the potential use of soybeans as a source of edible oils, assuming solvent extraction capability is also developed.

Although oilseed crops (principally groundnuts and sesamum) comprise 19.5% of sown acreage in Burma, these crops receive only 5% - 7% of present fertilizer allocations. Pesticide use is also low, with modern pest management practices being applied on an area estimated at less than 5% of the total. In order to increase yields significantly, the authorities intend to shift from current oilseed cultivation practices based upon low input technology to an approach which includes better water management, greater use of fertilizer and other inputs, and improved cultural practices. Under this Maize and Oilseeds Production project, the Agriculture Corporation will seek to induce farmers to change current concepts of seeding rate, plant density and spacing, weeding, pest management, seed inoculation, fertilizer application, and use of available water.

2. Selection of Maize and Oilseeds

The AID agricultural sector assistance strategy for Burma proposes a long-term effort emphasizing increased production of selected agricultural crops, rather than focusing on parts of the problem such as improvements in research, credit, or extension. Projects will therefore be geared toward economically-feasible production increases beneficial to farm family producers and consumers in general. The strategy will be a rolling one moving from crop to crop on a phased basis over a long-term period, expanding and building on successful elements of the initial project.

Maize and oilseed crops have been selected as the first area of concentration after rice, because a project to increase production of these crops fully meets all criteria of the over-all sector strategy:

- it fits into a Burmese program, just getting under way, for which the Burmese have requested AID assistance;

- maize and oilseeds are crops with which the United States in general and AID in particular have a unique competence, stemming from capabilities in U.S. universities and extension services and from AID-supported project experience in other countries;

- it has important direct and indirect economic and social benefits such as improving nutrition among low-income groups, lowering prices for consumers, increasing rural incomes and employment, eliminating edible oil imports, and increasing exports (of oilseed cake).

- the project will build on Burma's operating experience, using the Whole Township rice program as a model and replicating this model for a new set of crops;

- the potential for increased production and incomes and for a high financial rate of return, given Burma's resources and the low base from which to start, is quite favorable;

- the potential for major national impact is quite high, as maize and oilseeds are key national crops. Groundnut and sesamum come only after rice in planted acreage, and cooking oil is second in importance only to rice in the Burmese diet;

- no other donors are, or plan to be, involved in production-oriented projects for these crops.

Although this project is limited to the production side of maize and oilseeds development, AID/Burma, in a subsequent project, intends to work with concerned SRUB agencies in improvement of oilseeds extraction and utilization technology, including edible oils processing, refining and distribution, both small-scale and medium-scale. Low levels of edible oil production result in part from current extraction practices. Present conversion rates for extracting oil from oilseed are estimated at 75 - 85 percent, leaving 15 - 25 percent of the available oil in the oilseed cake. By increasing oil extraction efficiencies, the Burmese can further boost the availability of edible oil for domestic consumption, as well as improve the quality of oilseed cake for domestic use and export.

Funding for feasibility and design studies related to oilseeds extraction and oilseeds utilization technology will be requested from AID/Washington with the possibility that a related project addressing processing and utilization would begin in FY 84.

B. Detailed Project Description

1. Project Area

The Maize and Oilseeds Production Project will be a five-year project reaching an estimated 388,000 acres of maize, groundnut, sesame and sunflower by Year Five. Soybeans will be a fifth crop gradually introduced on a pilot basis and covering an additional 20,000 acres by Year Five.

A list of the 28 townships selected for participation in this project is given in Annex A. Approximately 80% of the fertilizer to be supplied through the project will be concentrated on eight (8) "intensive" townships, the remaining 20% being applied to twenty (20) "extensive" townships.

In defining the project area with the Agriculture Corporation, the administrative unit within the Ministry of Agriculture and Forests responsible for the project, it was determined that the eight intensive townships would receive sufficient fertilizer inputs to cover all acres to be planted in the particular crop of emphasis in each township during the four crop years of the project, and that the rate of fertilizer application would be 100% of the dosages recommended by the SRUB given the limitations of supply.

On the other hand, in order to include as many extensive townships as possible, the Agriculture Corporation decided to reduce by approximately 60% the total potential acres in each extensive township selected for the project which could be expected to be planted in the crop of emphasis, while simultaneously reducing the rate of fertilizer application to "minimum" dosage levels. This reduction was decided primarily on grounds of participation and spread effect expectations and is technically acceptable to AID.

The intensive and extensive townships are located in five divisions of Lower and Upper Burma (see map, Figure 1). They provide a representative coverage for the major oilseed and maize growing areas in Upper Burma and present the greatest potential for developing a double cropping system of oilseed or maize after rice in Lower Burma. The distinction between the two categories of townships is as follows:

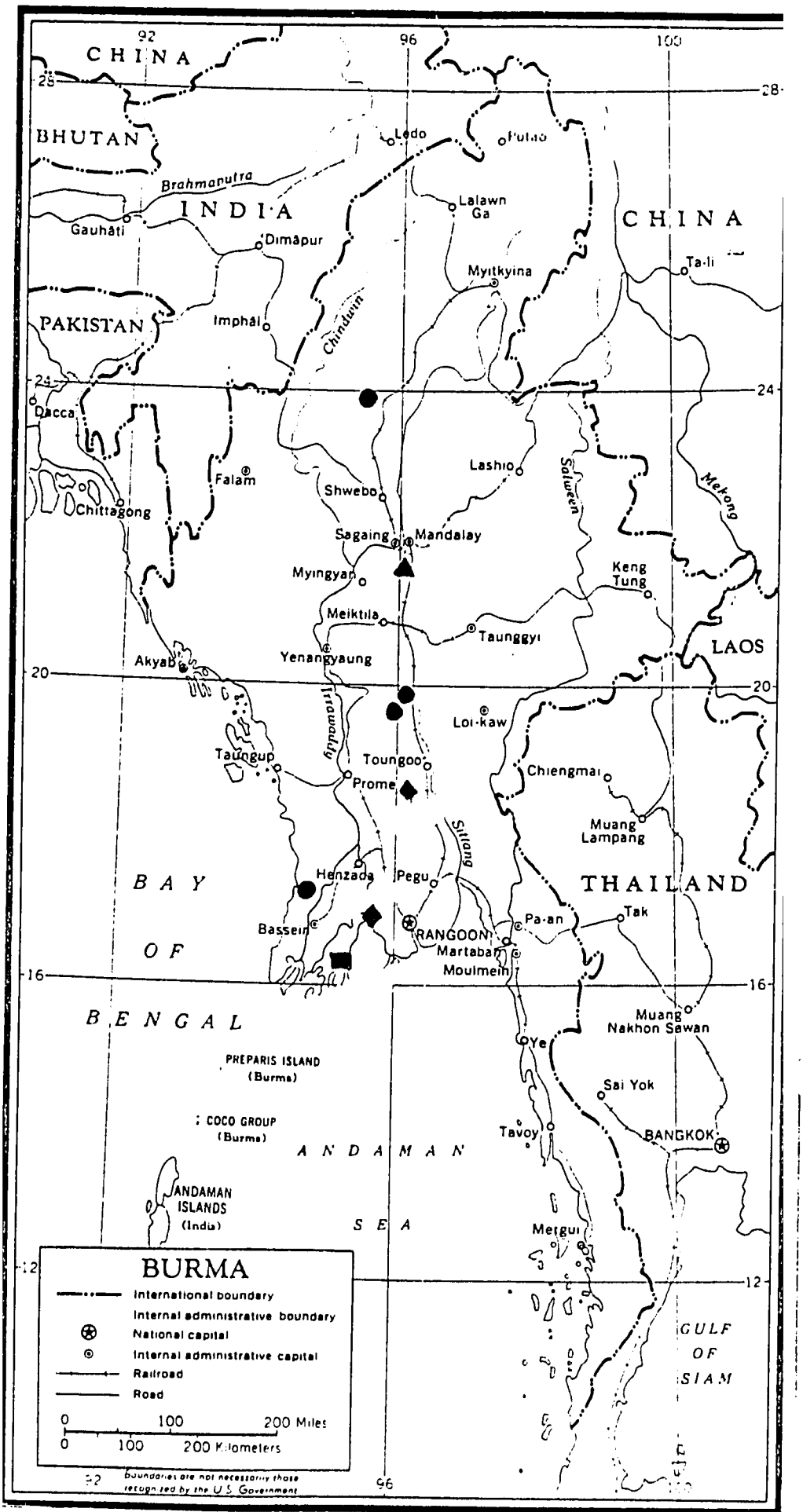
a. Intensive Townships (8)

These are townships identified as having the highest potential for increased agricultural production. They will receive concentrated inputs including fertilizer, improved seed, credit, and intensified services of extension personnel. Where needed, special emphasis will be given to improvements in irrigation and/or water management.

The Agriculture Corporation has defined nine principal constraints to higher yields and increased production of maize and oilseeds. They are: (1) use of improved higher yielding varieties of seed; (2) proper land preparation; (3) plant density; (4) use of organic manure; (5) use of chemical fertilizers; (6) pest and disease control; (7) sowing

FIGURE 1

INTENSIVE TOWNSHIP LOCATIONS



KEY:

- Maize (4)
- Groundnut (2)
- Sesamum (1)
- Sunflower (1)

techniques; (8) weed control; and, (9) timely harvesting. These problems will be addressed in the intensive townships by an expanded Extension Division staff assigned to existing and new "production camps" located at sub-center or village tract levels within each township. Typically, ten or twelve village managers (extension workers) are stationed together at each production camp, from which they service individual villages.

As an integral and essential part of the strategy, there will also be five (5) "high technology sites" located in each intensive township, or a total of 40 high technology sites. Each site will have access to about five acres chosen from among four - five farm units, or a total of about 200 acres in all eight intensive townships. Extension staff, assisted by researchers from the Agricultural Research Institute in Yezin and with technical guidance from AID and SRUB (AC)experts, will use the high technology sites for on-farm field testing of new technologies, to understand benefits, costs and implementation constraints at local levels. This approach, used in the rice program in Burma, is a proven method for research and demonstration resulting in: (1) training of extension workers; (2) learning constraints involved with technology transfer; (3) creating an awareness among government officials of the problems faced by farmers; and, (4) introducing new technology to farmers.

b. Extensive Townships (20)

These are townships identified as also having high potential for maize and oilseeds, but they will receive only a limited amount of inputs and services. As mentioned above, total fertilizer availability and rate of application will be reduced. Fewer extension personnel, trained specifically in the project crops, will be available. Nevertheless, these townships are included in the project and will receive some special attention, particularly for first-spread diffusion of proven new technology where resources permit.

c. Seed Farms (4)

Four sites have been selected for development of a foundation maize seed farm, a foundation oilseed farm, a certified maize seed farm and a certified oilseed farm. All four will be located in Pegu and Mandalay Divisions, as discussed in Part III.A.3.

In selecting the sites for the seed farms, geographic and crop considerations, communications networks, transportation and delivery capability, electric power, and present or planned irrigation capability were all taken into account. The soils at each location are appropriate for the respective crops. The two foundation seed farms are near the Agricultural Research Institute in Yezin, Mandalay Division, where technical and service assistance will be readily available. The certified seed farms are located in an area where contract growing with farmers in the surrounding area is possible.

In addition to the seed farms, there will be three (3) complete seed processing facilities established at the farm sites. One facility will be sufficient to handle the two foundation seed farms in Mandalay Division.

2. The Project

a. Sector or Program Goal

The principal goal of the project is to increase production of oilseed crops and maize in 28 Townships of rural Burma, with positive effects on rural income and employment and on national food supply and nutrition. An auxiliary goal is to improve Burma's balance of trade through reduction of imports of oil and through an increase in exports of oil cake. By Year Five of the project, these broad goals will have been partially met with the following increases expected:

(1) Groundnut production increased by 375,000 MT of which 125,000 MT will be attributable to the intensive and extensive townships in the project and 250,000 MT to other townships through the spread of rhizobium inoculation technology.

(2) Sesamum production increased by 49,100 MT.

(3) Sunflower production increased by 65,500 MT.

(4) Soybean production increased by 12,000 MT.

(5) Gross farm income increased by K 1,160 million ($161.1 million).

(6) Exports of oil cake, and related products increased by $100.9 million.

(7) Value of increased vegetable oil production: $94.5 million.

(8) Per capita intake of vegetable oil up 30% from approximately 2.8 kg. to 3.8 kg.

(9) Maize production increased by 375,000 MT.

b. Project Purpose

The purpose of the project is to bring about a rapid rate of adoption of high-yielding inputs and tillage practices among farmers planting maize and oilseed crops in the 28 project townships. It is anticipated that by the end of the project the cumulative number of acres planted during four crop years using recommended higher-yielding technology and inputs will be:

(1) Direct input from project:	Cumulative	Year Five only
Maize	373,200 acres	129,400 acres
Groundnut	388,000 acres	121,200 acres
Sesamum	312,200 acres	94,000 acres
Sunflower	115,400 acres	44,000 acres
	1,188,800 acres	388,600 acres

(2) Indirect spread effect:

Groundnut	1,500,000 acres
Soybean	20,000 acres

c. Project Outputs

There will be several principal activities carried out during the life of the project with the following outputs:

(1) Improved national research capability in maize and oilseeds. On-going trials will be conducted at central research facilities in Yezin and at 40 field-level high technology sites within eight intensive townships on seed varieties, soils, fertilizer application rates, water control and other production variables affecting yields of maize and oilseeds.

(2) Introduction of improved maize and oilseed technology and production practices (seed, water, fertilizer, extension services). Newly developed technology farm-tested at high technology sites resulting in township and/or village specific production packages for each crop per township.

(3) Four fully-equipped and staffed maize and oilseeds seed farms. Two foundation seed farms of 70 acres for oilseeds and 110 acres for maize plus two certified seed farms of 800 acres for oilseeds and approximately 3,000 acres for maize will be created; all four will be operational and will be integrated with seed processing facilities for drying, bagging and storing 3,500 MT per year of maize, groundnut, sesamum, sunflower and soybean seed.

(4) An operational farm management information system for monitoring farm-level production practices and providing feedback on results to research and extension centers. A functional data collection and farm management information system will be put in place and will be operated by trained staff in eight intensive townships.

(5) Returned participant trainees in place within the research, extension, seed farm and fertilizer distribution elements of the project. After training, 75% - 100% of returned Burmese participant trainees should occupy positions directly or indirectly involved with maize and oilseed production.

(6) Inputs supplied to farmer participants (fertilizer, seed, management equipment - rhizobium inoculum). Cumulative inputs will be supplied as follows to project townships:

Fertilizer: 70,000 MT
Seed: About 9,000 MT
Pest management inputs: (exact mix to evolve from project)
Agriculture equipment: (approx. $5 million)
Inoculum: eight million pounds

(7) A functional rhizobium production facility (inoculum for groundnuts and soybeans). Local nitrogen-fixing inoculum production of three million lbs. per year is planned by Year Five of project, leading to long-term

reductions in Burma's requirement for urea fertilizer compared with what those requirements would have been in the absence of this project.

d. Project Inputs

Inputs supplied by the project to carry out the above activities will include total expenditure of $30 million using AID grant funds, $10 million worth of fertilizer contributions by the SRUB, and K 57.6 million ($ 8.0 million equivalent) provided by the SRUB for local costs of the project. Major project inputs are as follows:

(1) Technical assistance: 156 person-months of long-term technical assistance and 50 person-months of short-term consultants.

(2) Training: 1443 person-months of participant training, based on 11 MS/PhD degrees or 528 person-months; 25 MS degrees or 600 person-months; 70 short-term, non-degree programs or 315 person-months.

(3) Fertilizer: 70,000 MT supplied during the life of the project, with approximately 40,000 MT supplied using AID grant funds and 30,000 MT using SRUB resources.

(4) Agricultural equipment: Approximately $5 million of AID-financed machinery and equipment for seed farms, seed processing facilities, a rhizobium production facility, research equipment for the Agricultural Research Institute at Yezin, water pumps and extension demonstration equipment, and costs of procurement.

The major assumptions for project success are that weather conditions will be near normal on average during the life of the project, that no unexpected difficulties will be encountered in marketing, storage and transportation or distribution of inputs and harvested crops, that new technology can be introduced as planned, that economic incentives for farm family participation remain valid, that necessary incremental extension staff will be assigned as needed in the project townships, and that procurement and delivery of fertilizer and agricultural equipment can be arranged on a timely basis.

To insure that these assumptions are satisfied, several proposed covenants are included in the Project Grant Agreement. Also, as discussed in Part I.D., special attention needs to be given to the scheduling of AID grant obligations during FY-1982 to FY-1984.

3. Other Donor Activity

Over the past six years there have been several multilateral donor activities in support of agricultural development which are complementary to this project. Linkages established will be beneficial from a technical perspective and for resource and information sharing.

a. The World Bank loaned Burma $6.5 million in 1977 for a seed development project whose principal objective is the development of six seed production farms for the production of rice, cotton, groundnuts and jute seed. The major input to groundnut technology is seed storage designed

to maintain seed viability in the Irrawaddy Delta and in Rangoon Division during the hot, humid, monsoon season.

b. The United Nations Development Program (UNDP) granted $2.5 in two phases to the SRUB for a Groundwater Development Project. This program includes a survey of groundwater resources throughout Burma.

c. In 1977 UNDP made a grant to the Agriculture Corporation for a Crop Development project. The project's main objectives are to accelerate the improvement and development of wheat, maize, sugar cane, sunflower, and groundnut seed (including breeder/foundation seed production) varieties and to develop better crop management practices. The UNDP Crop Development project is directly complementary to this project through its identification and development of new improved varieties and release of breeder seed for multiplication.

d. The UNDP Crop Protection project is a $1.0 million project with one expatriate technician. One of the main objectives of that project is to develop teams of crop protection extension staff to work in selected areas throughout the country to monitor and evaluate major pest, disease, and weed problems in all crops. To the extent that the Maize and Oilseeds Production Project will operate near one of the Crop Protection Project sites, there will be spin-off benefits to the new project through pest problem assessments and recommendations for control. The Crop Protection Project headquarters in Rangoon is ready to provide backstopping to the maize and oilseed project through pest identification, disease diagnosis and suggested control measures.

e. The Canadian International Development Agency (CIDA), through IRRI, has placed three technicians in Burma to work on the CIDA/Burma/IRRI farm machinery project. One aspect of that project deals with multiple cropping systems with paddy as the major crop. To the extent that improved maize and oilseed systems are developed, new recommended practices will directly benefit this project. The CIDA/Burma/IRRI project has also been introducing prototype farm machinery designed for small farm rice production systems. Most notable is the IRRI rice transplanter which is being tested widely and being aggressively promoted in Burma.

Until development of the AID/Burma-assisted Maize and Oilseeds Production Project, there have been no programs designed to increase production or otherwise to improve the SRUB's extension capability in the oilseed crop and maize sub-sector.

III. PROJECT ANALYSIS

A. Technical Analysis

1. Production Technology

a. Irrigation and Water Management

It will be essential that this project test the feasibility of providing supplemental irrigation and water management as a production component. One can expect large yield increases to result from irrigation and, in many areas, water is readily available during the dry season. While project grant funds will not be used for irrigation or water management construction works (except on the project seed farms), the grant will provide for long-term technical assistance and provision of up to 500 low-lift electric and diesel pumps for use in the intensive townships. (See Table 1 for comparative use of low lift pumps vs. dug wells).

Testing the feasibility of using available water is essential because the addition of irrigation water 1) causes increased yield, 2) insures against crop failure, and 3) greatly enhances the value of other inputs. Crop yields are definitely limited without the addition of irrigation water. Residual soil moisture after the monsoon season does not exceed six to ten inches of water in the root zone. Winter oilseed or grain crops should have twice this amount of residual moisture for ideal production without irrigation. Therefore, without irrigation, yields cannot be expected to reach more than 60 percent of optimum regardless of what other inputs are used. Applicaton of irrigation water is considered to produce an over-all increase in yields at least 50 percent higher than producing crops on post-monsoon residual soil moisture. There also is the added effect of the interaction between fertilizer and water providing for more efficient use of the fertilizer.

Rainfall patterns are such in Burma that irrigation is usually performed only during the dry season. This is especially true in Lower Burma where average annual rainfall in the important agricultural areas totals 100-120 inches, fairly evenly distributed over the six-month period from May to October. In Upper Burma the average annual rainfall is from 30-40 inches, distributed over the seven-month period May through November. This indicates that supplemental irrigation would be beneficial in Upper Burma during the "wet" season in some years. In Lower Burma the rainfall always exceeds evaporation during the monsoon period. Under this condition, drainage becomes more important than irrigation. However, during the dry season in both Upper and Lower Burma there is essentially no rainfall, indicating the need for irrigation for optimum production.

The project concept is to intensify production inputs on high-technology sites and other acreage within the intensive townships selected as demonstration areas. On these sites production will be optimized by assisting and training farmers in water use as well as in utilizing other appropriate inputs. Another water element is the development of a total

of 3,980 acres on four seed farms which must be irrigated. These seed farms will be located in Mandalay Division, Upper Burma, where drier conditions are well-suited for seed production. and in Pegu Division, Lower Burma, where water is more readily available.

(1) Intensive Townships (8) and High Technology Sites (40)

Provision of an irrigation system is dependent on availability of water in close proximity to the farmed area. Because of the topographic, water source, and climatic differences between Upper and Lower Burma, each intensive township will have a different set of irrigation parameters. Not allof the intensive areas will have water readily available, especially at project initiation.

Irrigat' .. and water management in these areas will include activities which basically involve a determination of appropriate methods of irrigation and an evaluation of the production gains and costs resulting from practices which are used. Irrigation will be placed on all high technology sites and on as many farms as possible in the intensive townships by one or more of the following practices:

(a) By dug wells. In Lower Burma only, this type of irrigation is practiced now by dipping with a bucket and irrigating vegetables. Depending on the infiltration capacities of the sub-soil strata, it may be possible to install very small pumps of approximately 50 gallons per minute capacity to irrigate one farm. These wells are simply dug by hand after the monsoon season to a depth of approximately 8 to 16 feet with the water table being from 4 to 6 feet below ground surface.

(b) By low lift pumping from surface water supplies. Low lift (5-6 h.p.) pumps with diesel engines are available in Burma. They are presently in use for irrigation and are sold to individual farmers, when available. However, each pump is capable of supplying sufficient water for at least five farms.

(c) By medium lift pumping. Also available in Burma (12 h.p.) these would be used only where pumping lifts are higher than 30 feet. These pumps can serve perhaps as many as ten farms.

(d) By gravity surface irrigation. These will be introduced only if the selected intensive units are within an existing irrigation system or if water is readily available from streams with minor diversion works.

(e) From tube wells. These will be considered where adequate ground water is available within the Upper Burma sites, with a capacity of irrigating up to ten farms.

A cadre of extension specialists will need to be assigned to water management within the intensive townships and in the high technology sites, to assist

with irrigation programs. Such on-the-job experience will be essential to the success of introducing and extending irrigation techniques. Depending upon the sources of water and irrigation techniques, technicians from the Irrigation Department and/or the Agriculture Mechanization Department may also need to be involved.

In addition, a method of data collection and analysis on water use and management will be devised at project initiation. Irrigation efficiencies, water use, costs, benefits, maintenance, operational and implementation problems, and the degree of needed farmer cooperation will all be monitored throughout the testing program. This will be necessary in order to know where key implementation problems exist and to develop means of alleviating these problems.

After appropriate means of providing irrigation water are decided upon, a survey will be made to determine sections within the townships where the technologies are suitable. This will include soils and hydrologic surveys of sufficient detail to delineate boundaries of areas in which the tested technologies could be implemented.

(2) Extensive Townships (20)

Regardless of the system of water supply, a determination to develop appropriate water management technologies for the extensive townships will be made, including:

(a) The extent and type of conveyance system needed to get water to each farm;

(b) The cost of construction and maintenance;

(c) Numbers and amounts of irrigations producing the highest return on investment;

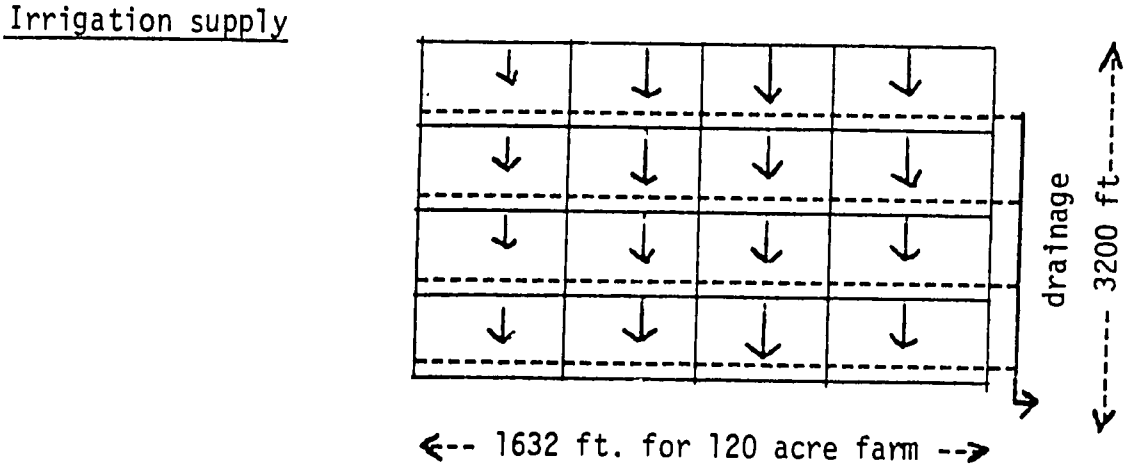
(d) Extent and feasibility of land leveling and field alignment for effective water use; and

(e) An appropriate methodology of extending the selected technologies.

(3) Seed Production Farms (4)

These areas will be entirely different than the other areas from the standpoint of irrigation. They will be located in Upper Burma and Lower Burma. Some will be triple cropped and some of the cropping practices will be mechanized. An irrigation system will be designed to supply sufficient water for each crop grown during the dry season, and each farm will be arranged to that the field alignments permit crop planting and harvesting by machines.

The exact design of the irrigation system will depend on the topography at the selected sites. In general, however, seed crops will be planted in rows, using furrow irrigation on land which has been leveled prior to laying out field boundaries. Irrigation systems will be designed so that water is delivered to a 100-150 acre unit in Lower Burma and smaller units in Upper Burma. Water will be managed in each unit in rotation with other units. Typically, each unit might be as shown below where irrigation runs are 800 feet in length:



This unit contains 120 acres. Even though the irrigation rows are 800 feet long, by using temporary head ditches (rebuilding for each crop), the machine operation rows could be 3200 feet long. Each seed farm will, of course, be made up of one to several irrigation units. Water management aspects specific to seed farms which should be studied during the project include:

(a) Determination of ideal timing and amount of irrigation water for each crop.

(b) Analysis of costs and implementation problems associated with construction, operation, and maintenance of the irrigation system.

(c) Appropriate methods of maintaining fields sufficiently level for furrow irrigation.

(d) Rotational methods and other operational and maintenance techniques which must be controlled through the 120 acre basin irrigation unit system.

TABLE 1

ESTIMATED COSTS OF IRRIGATION WITH LOW LIFT PUMPS AND BY DIPPING FROM DUG WELLS

Cost to Irrigate

With 5 hp low lift pump 300 GPM

Rental costs currently vary from 6-10 K/hr.
If it takes 8 hours to irrigate 1 acre with this pump, theoretically pump should put on:

$$\frac{300}{450} \times \frac{3600}{43560} \times 8 \times 12 = 5.3 \text{ inches of water}$$

This indicates a somewhat inefficient application. Probably 3 inches is all the soil would need at any one irrigation.

Cost of this irrig. = 80 K or 15 K/ac in of water
For seasonal use of 36" of water
Cost of irrigation would be 540 K

To pay for irrigation, irrigation must increase yields as follows:

for groundnuts	$\frac{540}{70}$	=	8 baskets	=	28% increase
" sunflower	$\frac{540}{50}$	=	12 baskets	=	50% increase
" maize	$\frac{540}{32}$	=	17 baskets	=	60% increase
" sesamum	$\frac{540}{200}$	=	3 baskets	=	100% increase

With Dug Well and Dipping with Bucket

One well for about 1/2 acre
One man spends 3 hours each day irrigating
Farm labor costs 5 K/day
Irrigation costs 3/8 x 5 = 2 K/day for 1/2 acre
= 4 K/day/acre.

Assume irrigation season of 100 days.

Cost of irrigation = 400 K

b. Fertilizer Use

(1) Planned Application Rates

Fertilizers currently used in Burma are urea, triple super phosphate (TSP), and muriate of potash (MOP). Since 1976/77, the government has been promoting and implementing a special high yield paddy production program in the Irrawaddy Delta. During this time total fertilizer applications (urea, TSP, MOP) to paddy have more than doubled from 90,000 tons in 1976/77 up to 205,000 tons in 1979/80. Comparison of production data for the years 1977/78 and 1978/79 show a total increase of 528 thousand metric tons of paddy attributable to the high yielding paddy program which is based on increased use of new high yielding varieties and of fertilizer. This performance has confirmed to the SRUB the correctness of their commitment to production programs for other crops based on fertilizer, high yielding varieties and improved cultural practices.

According to the 1977 FAO yearbook (Table 2), average yield per acre in Burma for maize and the three principal oilseed crops included in this project were lower than yields in China, India, Indonesia, Thailand, and Asia in general. Burma is one of the countries in Asia that historically uses low levels of fertilizer (Table 3) and other improved practices. The converse is that the prospect for increasing production of maize and oilseeds in Burma from increased use of fertilizer is therefore very high.

As shown in Table 4, in recent years the acres of maize, groundnut, sesamum and sunflower that received urea were only 17.3%, 8.3%, 1.1%, and 0.4%, respectively, of the total acres sown to each crop. Only 14.6%, 3.5%, 0.8% and 0.2% of acreage sown to the four crops received phosphate. Potassium was applied to 7.1% of the maize and 0.2% of the groundnut acreage. This situation can be expected to change with the inclusion, beginning in 1981-82, of maize, the three principal oilseed crops included in this project, and other crops in the successful whole township approach to increased agricultural production.

Looking at fertilizer only, the Agriculture Corporation plans to use different rates of application for acreage covered in intensive vs. extensive townships under the project. In the intensive townships, 100% of the recommended application dosage (lower than optimum but maximum within the constraint of available supply) will be applied at the following rates for urea, TSP and MOP (lbs/acre):

	Urea	TSP	MOP
Maize	112	56	28
Groundnut	56	56	0
Sesamum	84	56	0
Sunflower	84	56	0

For acreage in the extensive townships, application rates will be lower, yet still high enough to be economic. The rates (lbs/acre) are calculated as follows:

	Urea	TSP	MOP
Maize	84	28	0
Groundnut	28	56	0
Sesamum	56	28	0
Sunflower	56	28	0

(2) Technical Analysis of Planned Applications

Crop plants depend on three or four basic sources for nutrients. In the case of legume plants, nitrogen (N) can be supplied by N-fixing bacteria living in symbiotic relationship on the legume roots. Nitrogen can be supplied in commercial fertilizer such as urea and in manure. Very little N is stored in cultivated soils of the humid tropics. Basically, phosphorus and potassium sources for crop plant nutrition are the mineralization of complex forms in the soil and the application of commercial fertilizer. Leached manures contain almost no phosphorus. In Burma, phosphorus fertilizer is supplied in the form of triple super phosphate (TSP - 46% P_2O_5) and expressed as P_2O_5. Potassium is supplied in the form of muriate of potash (MOP - 60% K_2O) and expressed as K_2O.

Calcium, sulfur, magnesium and other mineral nutrients are required by plants in lesser amounts than N, P, and K but the lack of any essential nutrient element precludes normal plant growth. Base (pH) forming and acid forming minerals and fertilizers provide the acid-base balance (pH) in the soil. Humid zone soils tend to be acidic in nature. A pH of less than 5.6 is considered limiting to maize and oilseed crops in Burma. Fortunately, soil tests of Burma soils indicate that most areas do not have highly limiting soil pH conditions.

Yields of maize and oilseed crops are increased by application of fertilizer rates less than the rates required for maximum production per acre. With the exception of legume crops (groundnut, etc.) that have been inoculated with rhizobium, an N application rate less than 20 pounds per acre (43 lbs of urea) ould probably not be an economical input. The rates of effective P and K will vary widely depending on soil type and fertilizer application in previous crops or years.

The pounds of nutrient element/acre in the seed and plant material from a yield of 2000 pounds (80 baskets) of groundnuts (as reported by Chaplin, Gray and Anderson, Texas, 1975) are N - 165, P_2O_5 - 38, K_2O - 91, Ca - 47, Mg - 18, S - 18, Zn 0.21, B - 0.08 and Mo - 0.02. These data agree in general with those of Henning, McGill et al (Georgia, U.S., 1979, Rev.).

The N-P-K content of 2000 lbs/A (60 baskets) yield of sunflower was reported as 82 - 13 - 60 (Robinson, Minnesota, 1973, Agron. Journal). The same researcher reported that the N and K nutrient requirements to produce 3,634 kg/ha of sunflower were almost equal to the requirements for 7,593 kg/ha of maize. The requirement for the maize was 10% higher for N, about 45% less for P and 10% less for K.

The proposed fertilizer application rates per acre in the project should stimulate yields for each crop involved. Each of the crops would respond to greater amounts of fertilizers than even the maximum rates planned in the intensive townships, except that the rates on groundnuts may be the maximum inoculated with rhizobium. In the extensive townships the proposed rates of fertilizer are minimal for yield responses. Here the rate for groundnuts should be adequate if soil pH and calcium content are in acceptable range and if seed are inoculated. A ton of limestone/acre applied every third year would probably provide additional assurance that the calcium and pH would not limit the response of groundnuts to rhizobium and other nutrient-related inputs.

The maximum N rate proposed for maize in the intensive townships is very low for maize produced under modern technology. The rate (112 lbs/A of urea = 51 lbs N) may be the limiting factor to maize yields in these townships. In general, the fertilizer rates for maize in the project provide for optimum utilization of the added nutrients. The fertilizer inputs in this project used on maize and oilseeds following paddy should be limited to areas with supplemental irrigation.

TABLE 2: YIELD COMPARISON OF OILSEED CROPS AMONG ASIAN COUNTRIES

(Pounds/Acre)

	Asia	Burma	China	India	Indonesia	Thailand
Sunflower Seed	946	328	1250	-	-	-
Ground Nut in Shell	918	763	1181	786	1330	1344
Sesamum Seed	270	181	383	196	313	893
Seed Cotton	973	222	1447	502	938	1047
Maize	1957	500	2962	1133	1188	1458

Source: FAO Production Year book, Vol. 31, 1977

TABLE 3: FERTILIZER CONSUMPTION PER SOWN ACREAGE IN ASIAN COUNTRIES (1975)

	N.	P_2O_5	K_2O	Total
Republic of Korea	193.4	97.8	66.7	357.9
China	35.3	9.7	3.1	48.1
India	12.1	2.7	1.6	16.5
Indonesia	18.4	6.3	1.3	26.0
Thailand	4.8	3.8	2.4	10.9
Burma	3.4	0.6	0.1	4.1

Source: FAO, Annual Fertilizer Review, 1976

TABLE 4. UTILIZATION OF FERTILIZERS BY CROPS (1974/75)

Crop	Net sown Area (Acres 000)	Urea				Super Phosphate				Muriate of Potash			
		Acres Applied		Tonnage used		Acres Applied		Tonnage used		Acres Applied		Tonnage used	
		Area (Acres 000)	% of sown area	Amount (Ton 000)	kg/ Acre	Area (Acres 000)	% of sown area	Amount (Ton 000)	kg/ Acre	Area (Acres 000)	% of sown area	Amount (Ton 000)	kg/ Acre
Maize	410	71	17.3	1,770	25	60	14.6	747	12	29	7.1	181	6
Ground nut	1,666	138	8.3	3,447	25	58	3.5	1,462	25	4	0.2	22	6
Sesamum	2,609	29	1.1	729	28	21	0.8	262	12	-	-	-	-
Sunflower	9	0.4	0.4	10	25	0.2	0.2	6	30	-	-	-	-
Paddy	12,793	2,407	18.8	60,167	25	977	7.6	12,209	13	224	1.8	1,399	6

Source: Agricultural Statistics 1973/74 - 1975/76, SRUB

c. Seed Improvement

Seed quality is a primary concern of producers of oilseed crops in all climates. Seeds of low germination are the primary constraint on oilcrop production in the humid tropics. In this project, a system of seed production and preservation is necessary if the inputs of fertilizer, inoculant and water management proposed are to bring about increases in crop yields.

In general, maize and oilcrop seed supplies in Burma are of uncertain quality and supply availabilities are uneven during any given planting season. For example, it is common for the producers of winter groundnuts in Irrawaddy Division (Lower Burma) to purchase groundnut seeds from Shan State (Upper Burma). The monsoon groundnut crop in Shan State is then planted with seed from the winter crop in Irrawaddy. The SRUB provides preferential shipping of the seeds in the two directions by rail and by water; however, seed movement is often behind schedule and seed is expensive because of shipping costs. To cite another example, in Mandalay Division where monsoon groundnuts are grown, farmers often reserve their own supply of groundnut seeds and attempt to store the seeds in baskets or glazed pots from one crop to the next. Moisture content at storage time is variable from year to year. Groundnut seeds for the monsoon season are in storage during the hottest months of the year (March and April). Consequently, groundnut seed germination is extremely low.

A partial scheme for developing, producing, processing, storing, and distributing planting seed of improved quality has been initiated by the Agriculture Corporation, involving three of its Divisions:

(1) The Agricultural Research Institute (ARI) in Yezin, Mandalay Division, is the major SRUB agricultural research unit responsible for varietal development. Breeders at Yezin have selected cultivars of groundnuts and maize from the so-called World Germplasm Centers such as ICRISAT and CIMMYT. Crossing work in open-pollinated maize resulted in a new Burmese maize cultivar designated Tatkon One.

(2) The Applied Research Division (ARD) is responsible for increasing breeder seed released by the Agricultural Research Institute (ARI). The ARD is to maintain quality control of foundation and registered seed and release an adequate supply of registered seed to the Extension Division. The ARD has multiplied foundation seed and field tested new varieties on 17 central farms and 56 seed farms it controls under the Agriculture Corporation.

(3) The Extension Division is responsible for certified seed production and subsequent distribution to farmers. Extension staff at production camps within the townships are responsible for arranging with selected farmers to grow certified seed for subsequent sale to farmers.

Improvements in the system for providing adequate quality and quantity of seed are a principal component of the project. This will be accomplished by the development of four well-equipped seed farms (two for foundation seed and two for certified seed) including processing facilities, which will be operated directly by the Extension Division. Details regarding plans for improved seed supply and distribution are discussed further in Part III. A.3, below.

d. Crop Protection

Efforts to increase food production through the use of high yielding varieties, high fertility, continuous cropping, heavy use of pesticides and other intensive agricultural technology frequently have been plagued with serious outbreaks of insects, diseases, weeds, nematodes, rodents and birds. Such problems have been especially severe in Southeast Asia in rice and maize. On rice there have been stem borer, leafhopper, brown planthopper, tungro and rat outbreaks that have limited yields over extensive areas. Increased maize production in the Philippines is now constrained by stalk borers and downy mildew. There is evidence from Thailand that populations of groundnut and maize insect pests have increased as high yielding technology has been applied to these crops.

In considering projects to increase yields it is essential to consider potential crop protection problems and to build in appropriate backstopping activities to avoid or manage resulting pest outbreaks. For this project the examination must include the present array of pests* of the four crops, present control practices including pesticide use, ecological factors and agronomic practices that have impact on pest problems, and project needs in integrated pest management.

(1) Existing Pest Problems

A list of the most serious Burmese pests of maize, groundnut, sesamum and sunflower has been provided by the Agriculture Corporation. Weed species were not included. This information is shown in Table 5. Additional information was derived from discussion with several crop protection scientists and agriculturalists.

(a) Maize. There are no reports of serious disease problems. Borers (Sesamia inferens) are controlled by endrin. Aldrin is sometimes used as a seed treatment at the rate of 0.065 pounds of active ingredient per acre to control termites and other soil pests. Aldrin is also used as a soil treatment against these pests. Weeds are controlled by cultivation and hand weeding. Minimum tillage and herbicides are not used. Estimates by local staff are that only 5% to 10% losses are caused by insects and diseases. This is remarkably low for Southeast Asia in view of experiences in other Southeast Asian countries. Heliothis spp, which attack a wide range of plants including maize, are reported to be on the increase in Burma. There are very few parasites and few effective predators of this group of pests found in this country. Generally Burmese farmers do not use pesticides extensively on maize, using on the average only 0.017 pounds of active ingredient per acre.

* - "Pests" refer in this document to all noxious organisms such as weeds, rodents, birds, disease organisms, insects, etc.

(b) Sesamum. The phyllody disease caused by a microplasma which is vectored by a jassid insect can be very serious and reduce yields significantly. In the Yezin area 15% to 20% of the plants are affected. Infected plants suffer 30% to 40% loss of seed. The sesamum sphingid defoliates plants. The leafroller is most severe in Lower Burma on sesamum crops following paddy. Sesamum is relatively new in the area and effective parasites may not yet be established. The use of endrin for control of this pest is thought to prevent the build-up of beneficials. Information on sesamum pests and pest-induced losses appears to be particularly meagre.

(c) Sunflower. The major problem is an Alternaria blight which can be devastating during the monsoon season. None of the available fungicides gives satisfactory control so the best answer is to grow sunflower after the monsoon. There are differences in susceptability among present varieties so breeding for resistance could be productive.

(d) Groundnut. In spite of several pest problems, less than 5% of groundnuts are treated with any pesticide. In some areas, termites, crickets, and white grubs cause serious losses to sown seeds. Protection is provided by soil or seed treatments with aldrin at the rate of 5 pounds of 5% aldrin dust per basket of seed per acre (0.25 pounds active ingredient per acre). No effective aldrin substitutes are known. A fungicide, daconil, is also used with aldrin to reduce seed rots. More effective management of soil insects and diseases could enable a reduction in the present very high seeding rate. The impact of soil pest organism on groundnut germination and survival should be carefully evaluated, especially under conditions that delay emergence.

Above ground, this plant is subject to a cercospera leaf spot which is severe in the monsoon season. An extensive outbreak of the leaf worm in the Pegu area occurred last year. Leaf miner are often abundant; however, the impact on yield has not been determined. Rats are serious pests of groundnut during both the monsoon and post-monsoon (January-February) seasons. Weeds in the Yezin area are observed to be a serious problem in some fields where Bermuda grass (Cynodon dactylon) and other weeds are abundant enough to cause a 30% to 50% crop reduction. Bermuda grass is not controllable with normal cultivation and may require rotation with crops such as sorghum.

One insect pest, the common hairy caterpillar, is a serious pest of sesamum, sunflower and groundnut. Cropping two or more of these in a rotation sequence could result in increased population levels of this species.

(e) Soybean. Only one pest was reported to be serious, which suggests that relatively little attention has been given thus far to pests of this "minor" Burmese crop.

(f) Post-Harvest Pest Problems. Maize and the oilseed crops included in this project are subject to an array of stored products insects, micro-organisms and rodents. These are especially troublesome in all warm climates with continuous high temperature and high humidities.

(2) Pesticides Used on Maize and Oil Crops in Burma

Relatively limited agricultural use is made of pesticides in Burma except on cotton. All are imported and represent a drain on foreign exchange. Thus, the SRUB favors the least expensive materials which include some of the older insecticides that are no longer approved for use in the United States. Import data for recent years are given in Table 6. Other data show that approximately 28,500 pounds of active ingredients were used on oil crops and about 9000 pounds of active ingredient on 500,000 acres of maize. Only a relatively small percentage of the acreage of these crops are treated during any one season. This is a very small amount in terms of possible environmental impacts but for the individual using the pesticides the hazards can be great.

According to Burmese crop protection scientists the only organochlorine insecticide now used on maize or oil crops that cannot be replaced by other materials is aldrin for protection of seed from termites, crickets and white grubs. Fungicides are very rarely used on maize and oil crops. Herbicides and nematicides are not now used on farms even experimentally.

The present mix of pesticides used in Burma represents some very undesirable products from the points of view of hazards to the user, the consumer, the environment or combinations of these. Assisting Burma in phasing out the uses of endrin, lindane, aldrin and DDT can be an important contribution of this project. (See Annex D, Environmental Assessment, for further discussion of this subject.)

(3) Assessment of Present and Future Pest Management Problems.

Present agronomic practices are dictated in large measure by annual cycles of monsoon, post-monsoon and the extremely hot and dry "summer". Rice is the major monsoon crop except in Upper Burma where rainfall is less and not always adequate for this crop. In some areas rice is preceded by a crop of jute or cotton. Another practice is to follow rice with groundnut, sunflower or grain legumes. In dry-land areas without irrigation, double cropping of such crops as maize, sesamum, peas and beans is practised. The same crop is not usually grown in succession. In all of these systems, except where adequate irrigation is available throughout the year (only on very limited areas in Burma), there is a fallow period of two or more months when the soils become very dry and hot. Most crops are now produced under low fertility conditions.

These agronomic practices appear to account for the relatively low incidence of nematodes, insects, and diseases on maize and oil crops. Thus, there is no continuous supply of hosts for these pests and there are periods of

flooding and drought that reduce populations to extremely low levels. These same harsh conditions are likely to reduce parasites and predator populations. Dry fallow periods are also known to adversely affect rodent reproduction and survival.

These same agronomic practices also have great impact on weed problems. Those species that do survive are well adapted to the extremes of moisture, to low fertility levels, to competition from the crops, and to existing cultivation and weeding practices. For example, Bermuda grass is well adapted to the conditions found in the dry Yezin-Mandalay area and to normal cultivation practices used in cotton and groundnut.

The project proposes to increase productivity of maize, groundnut, sesamum and sunflower and can be expected to affect many pest problems:

(a) The increased use of fertilizer will result in some changes in the composition of the weed complex. Effective and timely weed control will become more critical to avoid competition with high-yielding crops and reduced returns from expensive inputs.

(b) Certain insects and disease organisms are known to be more serious on vigorously-growing plants than on those that are not; on the other hand, vigorous plants can tolerate more defoliation without yield reductions than those at low vigor.

(c) The introduction of new high-yielding varieties will increase many pest problems unless the varieties have resistance or tolerance for the Burmese pest complex. There is also the danger of introducing new disease and other pest organisms with plant material brought in from other parts of the world.

(d) Plans to increase yields of these four crops do not include modifications of cropping sequences or continuous cropping through the use of irrigation. Therefore the pest inhibiting factors of rotations, flooding, and fallow will continue to suppress pest populations.

(e) The project involves increased production and storage of seeds. Protection problems during storage will increase unless suitable management systems are instituted.

(4) Pest Management Research and Extension Requirements.

There are no known methods for predicting precisely what impact the proposed project will have on the several known and many potential pests of maize, groundnut, sesamum and sunflower. Based on similar programs in other regions, however, we know there will be changes in the pest complex and very likely some serious problems. Therefore, it is essential that adequate pest management technology be built into the project through effective backstopping in research and extension. At least the following steps are needed:

(a) Determining the importance of each reputedly injurious organism. Is it reducing yield enough to warrant control procedures? Data must be obtained from carefully-conducted replicated field experiments.

(b) Monitoring the intensive and extensive project areas for evidence of increases or decreases in pest populations and the appearance of new pest organisms. This should include the establishment of base-line information on pests in these areas.

(c) Devising appropriate control tactics for management of important pests. These will include:

- Determining which pesticides are most effective without aggravating other pest problems by reducing biological control agents. Proper timing and minimum effective application rates must also be determined.

- Where there are severe weed problems and inadequate labor at critical periods, determining the feasibility of using appropriate herbicides.

- Evaluating varieties for resistance to key pests.

- Examining the possibilities for modification of cultural practices to reduce pests.

- Considering the potential for the introduction and augmentation of parasites, predators or microorganisms for control of insect pests found not to have adequate biological control.

(d) Devising monitoring techniques that are practical for use by field personnel to anticipate pest outbreaks in time to take suitable remedial measures.

(e) Developing practical delivery systems, training programs and pest management leaflets with aids in pest identification and control information.

Most of the above research will be conducted by ARI personnel either at Yezin or in the high technology sites in the intensive townships in cooperation with local extension staff. Additional professional personnel will be needed at ARI, especially in entomology and weed science where trained personnel are not now in place. The FAO-sponsored Crop Protection Project can provide helpful backstopping of research and extension pest management activities, but this will not be enough.

Until Burmese scientists are in place, technical assistance will be needed in crop protection. The Project Team will include a broadly-trained integrated pest management specialist for at least two years to assist

in the coordination of all crop protection research and extension activities with other phases of the project. Short-term technical assistance in weed science, entomology, plant pathology, stored products pest control, and perhaps rodent control will also be provided, to assist local scientists in the more technical aspects of integrated pest management.

Stored products protection technology is generally transferable, so on-site research is not required; however, expert advice will be needed in the design and construction of the proposed seed storage facilities and the storage of seeds to prevent pest damage during extended storage. Chemical treatment of seeds that might mistakenly or otherwise be used for human consumption necessitates selection of pesticides approved for such uses.

Table 5

Major Pests of Maize, Sesamum, Groundnut,

Sunflower and Soybean in Burma

MAIZE

Leaf worm *Spodoptera litura* (F.)
Maize weevil *Sitophilus zeamais* (Motsch)
Rice weevil *Sitophilus oryzae* (L.)
Maize leaf blight *Dreschlero turcice*
Rodents
Birds - parakeets

SESAMUM

Common hairy caterpillar *Diacrisia obliqua* Walker
Sesamum sphingid *Acherontia styx* Westwood
Sesamum leaf roller *Antigastra cataluanalis* Dup.
Sesamum phyloody (microplasma vectored by *Orosius* sp.)
Stem rot disease *Macrophomina phascoli* (Marble Ashby)

SUNFLOWER

Gram pod borer *Heliothis* spp.
Leaf worm *Spodoptera* spp.
Common hairy caterpillar *Diacrisia obliqua* Walker
Sclerotium blight *Schlerotium rolfsii*
Leaf stem blight *Altenaria helianthi*
Birds - parakeets

GROUNDNUT

Common hairy caterpillar *Diacrisia obliqua* Walker
Cockchaper grub *Anomala antiqua* Gull
Leaf miner, binder *Stomopteryx subsecivella*
Leaf worm *Spodoptera litura* (F.)
Tikka disease, leaf spot *Cercospera personata*
Cercospera arachidicola
Collar rot *Aspergillus niger*

SOYBEAN

Spotted pod borer *Maruca testulalis*

Table 6. Annual consumption of insecticides on maize and oil crops in Burma, 1976-1980, (Agriculture Corporation data).

Insecticides	Formation	Maize				Oil Crops			
		76-77	77-78	78-79	79-80	76-77	77-78	78-79	79-80
Endrin	19.5% EC	5	150	2418	2515	1335	1899	2643	1722
Malathion	90% EC	0	0	362	455	1059	1395	2931	1488
Lindane	P 1.30	0	20	4273	3797	62477	23694	68867	32568
Aldrin	5% D	0	0	28904	32489	151764	28138	1915	101018
DDT	25% EC	0	0	0	0	200	807	26	1000
DDT	75% WDP	1372	1276	1200	0	7153	5291	159	8000
Carbaryl	85% WP	0	0	0	0	1356	616	0	0
Diazinon	40% EC	0	0	0	2	0	0	0	12
Diazinon	10% G	0	0	0	993	0	10	0	0
Dimecron	50 SCW	0	0	0	0	35	0	31	114
EPN	45% EC	0	0	0	0	2	163	0	309

EC = emulsifiable concentrate (gallons)

P = powder (pounds)

D = dust (pounds)

WDP= wettable dry powder (pounds)

WP = wettable powder (pounds)

G = granules (pounds)

SCW= soluble concentrate (gallons)

e. Cultural Practices

(1) Current Systems

Land preparation and oilcrop and corn seeding are performed by animal power and human labor. At the beginning of the cropping season the soil is partially inverted (turned) by a wooden plow equipped with a concave faced turning wing. The point, sole and wing of the plow are in one unit with a total width of about six inches. The swath width per pass of the plow over the field is less than six inches. The depth of soil disturbance varies from three to five inches depending on soil texture, moisture, and general tilth. Soil turning is followed by pulverization with a wooden harrow equipped with a single row of tines approximately nine-by-two inches in dimension. Heavier soils (more clay content) may be re-inverted with the turning plow before further pulverization by harrowing and plank dragging are done. The farmer desires a fine seedbed. The level of success in reaching this goal depends on weather and soil conditions. Some fields in Burma appear as thoroughly prepared at the surface as fields prepared with more sophisticated equipment.

The plowing pattern with the turning plow is circular, beginning at the outside of the small plot (one-third/acre) and progressing toward the center. The direction of movement is necessarily to the left of the plowman due to the design of the plow wing. Continuous use of the same pattern tends to hollow out the center of the plot, interfering with uniform water distribution.

Crop placement in farmers' fields is done by hand. Seed furrows are opened by a wooden harrow. The seed furrow is closed after seeding by a bullock drawn plank or a harrow body without tines. Groundnut kernels are sometimes pressed into the soil by bare feet before the furrow is covered.

Inter-row tillage is done with a one-row gang cultivator (Planet Junior brand) on the same frame as the turning plow. The turning wing may be replaced by a bilateral shovel point. The gang cultivator is adjustable in width and has five to seven 3-inch by 5-inch shovel points. These cultivation tools are powered by bullocks. Other inter-row tillage and tillage in the row are accomplished by hoeing and hand weeding. Weeds are common in the primary irrigation ditches.

Spacing between rows of maize and oilseed crops varies among crops and among planting seasons. Groundnut rows are spaced 18 - 24 inches in the monsoon crop and spaced about 9 inches in the dry season. Corn and sunflower are spaced approximately 36 inches. Sesamum is spaced 12 inches between the rows. Spacing within the row also varies among crops and seasons of planting.

Seeding rates per acre for groundnut, sesamum, sunflower and maize are 150, 9, 18, and 20 pounds, respectively. Maize and oilseed crops are hand harvested in Burma. Field drying is common. Most crops and fields are harvested in the dry season when drying conditions are good.

(2) Evaluation

Plowing is too shallow and at a constant depth year to year. A farmer with an average size farm (5 acres) will own one pair of bullocks. The bullocks are worked one-half day per day and turn about one-third acre of land in this time. At this rate land preparation is spread over a long period. The number of passes over the land for pulverization is excessive for marginally wet land (destroys soil structure) and time consuming in any case. In the dry period, moisture is lost unnecessarily from the soil. In the wet season several rains may occur before a field is prepared adequately for seeding.

The lack of animal-drawn planters is a great impediment to proper seeding. One planter man and a pair of bullocks could plant more maize/day than a five-man crew planting by hand. One-row planters were introduced into one region of Burma (perhaps by International Harvester) many years ago. A cone-type planter box would be required for groundnut planting.

Irrigation berms are built and maintained by hand labor. This work could be done by tractor or tandem-hitched bullocks pulling a straddle or side-winder border disc. Breaking plows, clod busters and disc harrows could be tractor drawn. This will be necessary on seed farms if adequate seed are to be produced for high yielding varieties. Cooperatively owned equipment would speed land preparation.

The excessive seeding rates now required to gain a crop stand of sesamum and groundnuts could be reduced by 50% by improving the germination level of the seeds. Maize seed of known origin could provide doubled yields of this crop.

Inter-row cultivation in monsoon groundnuts should be by shallow sweep or flat blade to prevent covering the early fruiting nodes. Corn cultivation should be by flat sweeps to prevent root damage. Weeding of crops earlier in the growing season would eliminate the need for deep cultivation. Corn N should be split with side dressing six weeks after emergence.

Row spacing of dry-season groundnuts should be increased to prevent drought stress and to allow light penetration to the basal leaves. Cultivation by knife or rod-type weeders would establish a dust mulch between the rows.

Weed control must be more timely in order to prevent huge losses of fertilizers and moisture to weeds. Weeds are, in general, more efficient accumulators of N than are crop plants. Increasing N fertilization without increasing weed control is counter-productive. Other pest control should be increased proportionately. Fields that are infested with perennial weeds should be diverted from row crops and planted in forage sorghums.

Monsoon crops should be harvested immediately upon maturity in order to preserve residual soil moisture for the sequential crop. Partial mechanization of rice harvest would speed the process and free the land for successive crops.

(3) High Technology Sites

High technology sites are included in the project for eight townships with five sites per township and five participating farms per site. The total farms would be 200. Each participating farm would have one acre under the high technology scheme. Presently the projected sites are equipped with the standard farm implements described above.

A list of equipment needed for the high technology sites is listed in Annex B.

f. Nitrogen Fixation - Rhizobium inoculum

Groundnuts and soybeans (as well as the pulses) are members of the legume plant family and can establish a symbiotic relationship with bacteria of the Rhizobia genus. The bacteria live on the roots of legumes and transform atmospheric nitrogen (N_2) to ionic forms (NO_3-; NH_4) that are useable by plants such as legumes. In Burma, groundnuts, soybeans and pulses are currently planted on more than 3.6 million acres annually. Groundnuts occupy 1.8 million and pulses occupy nearly 1.7 million acres with soybeans on the remainder. The national plan is to increase groundnut acreage and yield significantly over the period of this project.

Yield of groundnut responds well to available nitrogen. Comparing costs of rhizobium inoculum to urea, an increase in groundnut acreage in Burma to 2 million acres (11% increase) using 56 pounds of urea (46% N) per acre would require 50,910 metric tons of urea. At current prices of approximately $220/MT FOB the urea for the groundnut crop would cost $11 million or $5.60 per acre.

If Burma produced its own rhizobium for the same acreage, the cost would be $1 million or $0.50 per acre.

Adapted and productive selections of rhizobium for groundnuts have been selected by the Agricultural Research Institute. A pilot program produces sufficient inoculant for one million acres of chickpea, cowpea, and groundnuts. The same species of Rhizobia serve cowpea (vigna) and groundnuts. The inoculum is packaged in 250 g. plastic bags. Each bag is sufficient for one acre of planting seed.

The system of production in the pilot plant is basically a "cottage industry" type system. For example, nutrient soup is produced from chickpea in pots boiled over charcoal heaters, the peat is dried in ovens, and inoculum is cultured in cotton-stoppered bottles stored in open-sided rooms. A count of organism is taken as the bags are inoculated. The project is highly productive considering the rustic conditions under which it operates.

A distinct need exists for the construction of a facility for systematic production of inoculum in Burma and will be installed through this project. A list of equipment for such a production plant is included in Annex B.

III. A.

2. Fertilizer Supply and Distribution

a. Requirements

Total estimated fertilizer requirements for the project are listed in detail in Annex A. This plan calls for a joint commitment by the AID Office in Burma and the SRUB to allocate at least US$25 million in fertilizer to a cumulative total of approximately 1.2 million acres during the 1982-83, 1983-84, 1984-85 and 1985-86 crop years in Burma.

The total commitment is in dollar terms rather than tonnage, based on a best estimate of average CIF prices per ton during the four procurement seasons of the project. At these prices, approximately 39,000 MT of urea, 27,000 MT of TSP and 4,000 MT of MOP would be procured during the life of the project. However, as actual average CIF procurement prices are negotiated during the course of the project, the total fertilizer tonnage purchasable during the four years will either increase or decrease. A rise in price may be coverable in part by use of contingency funds. A drop in price will allow more import tonnage.

For ease of procurement, AID has proposed and the Agriculture Corporation has agreed to define the AID-financed fertilizer commitments as 10,000 MT of urea and 30,000 MT of TSP. Depending on prices, these amounts may vary slightly either up or down. In addition, because it may be impossible, owing to timing of initial obligations for the project, to use AID financing for fertilizer procurement during Year One, the Agriculture Corporation has agreed in that event to a fallback solution whereby it would cover all fertilizer provision for the project for the 1982-83 crop year while AID reschedules and consolidates its shipments into Years Two, Three and Four. This is described in detail in Part V.B, Procurement Plan.

Owing to the possible fluctuations in fertilizer availabilities, careful accounting for fertilizer by the Project Team will be required during the course of the project, possibly including decisions on reallocations of available fertilizer supplies among the participating townships. Because of the central importance of fertilizer as a component of the project, a covenant to the Project Grant Agreement is proposed to provide assurances that fertilizer allocations to the project will be no less than $25 million, properly applied.

Note: CIF import costs of fertilizer have been used for all fertilizer to be used in the project whether purchased internationally or, in the case of domestically-produced urea, in Burma. Therefore,

should domestic urea be destined to crop acreage under the project, it would need to be replenished by additional imported urea.

b. Supply and Demand

Burma will continue to have a demand for fertilizer which outstrips available supply for the foreseeable future. Total demand, at subsidized prices, is growing at a rate of 100,000 MT per year, which cannot be met by supply, including domestic production (urea only), foreign exchange purchases, and international grants and loans (see Tables 7 and 8). For allocating scarce fertilizer, the SRUB has established a controlled supply system at heavily subsidized prices through which fertilizer is distributed on a Division/State, township, village and crop basis. The availability of fertilizer at low cost is an important part of the package of inputs used to persuade conservative farmers to adopt new agricultural practices, and also part of government policy to keep product prices low while still allowing farmers adequate incentive to produce. This program has resulted in major increases in rice production, exports and foreign exchange earnings, while keeping prices stable. Since 1975 approximately 81% of available fertilizer has been applied to paddy on an annual basis, with maize and all oil crops combined receiving approximately 7%. It is foreseen that after fertilizer use becomes widespread, the subsidy element may gradually be reduced.

This project is designed to assure sufficient supply of fertilizer for an approximately 20% expansion in total acreage planted to maize, groundnut, sesamum and sunflower, coupled with significant increases in yields and production. By the end of the project (1985-86 crop year), fertilizer on these crops will reach approximately 23,000 MT in the 28 townships participating in the project, compared with consumption of less than 13,000 MT on all maize and oil crops in all townships in 1979-80.

Factors affecting future fertilizer supply include plans for increased domestic production of urea, increased imports using available foreign exchange, and sustained or increased assistance from foreign donors. The SRUB's commitment on its side to high priority for oilseed and maize is evidenced by its share of 40% of the fertilizer cost during the period of the project. After the 1985-86 crop year, continued supply will be necessary. However, Burma's ability to meet the cost of rapidly growing fertilizer imports will be substantially enhanced by the direct foreign exchange earnings attributable to the project, in the form of increased exports of maize and oilcake and reduced expenditures for imports of edible oils. Moreover, the project will provide technology transfer in the use of nitrogen-fixing rhizobia as a substitute for urea on groundnut. This technology will reduce Burma's requirements for urea substantially over what they would have been in the absence of the AID project.

c. Procurement and Distribution System

Fertilizer is imported with the exception of domestically-produced urea which equaled 135,000 tons in 1980-81 and is scheduled to rise to 166,000 tons/year in 1983 with expansion of a presently-operating urea plant. Capacity is scheduled to increase to 346,000 MT by 1986-87 with completion of a German-assisted 600 tpd urea plant. This plant is expected to come on stream in 1985 with 90,000 MT production and come up to maximum production of 180,000 MT the following year.

Imports are normally planned for each crop year (April-March) during the preceding 7-8 months. Because of difficulty in handling fertilizer during the monsoon season (May-August), most landings are scheduled between November and March. Because most winter crops are planted in October-December, almost all fertilizer for the full crop year must be off-loaded and stored by April of each year.

Storage capacity at Rangoon is limited to 14,000 MT with additional godown storage capacity of 264,000 MT located at division, township and village tract levels throughout the country. As a consequence, fertilizer as it reaches Rangoon is rapidly moved out to the other godowns. This does not appear to have presented severe problems to date. In the short supply situation that prevails, upcountry receiving units are anxious to replenish stocks and fertilizer is quickly distributed, stored and in turn sold to farmers either directly or through village cooperatives acting as intermediaries.

With the increased supplies that can be expected with stepped-up domestic production and an accelerated import program, fertilizer storage may become a serious bottleneck. This will especially be so if the SRUB succeeds in building up average on-hand stocks through a proposed buffer stock system which is needed to improve timely delivery of fertilizer for all intended uses. The pipeline of new supplies will be squeezed if storage capacity proves to be inadequate.

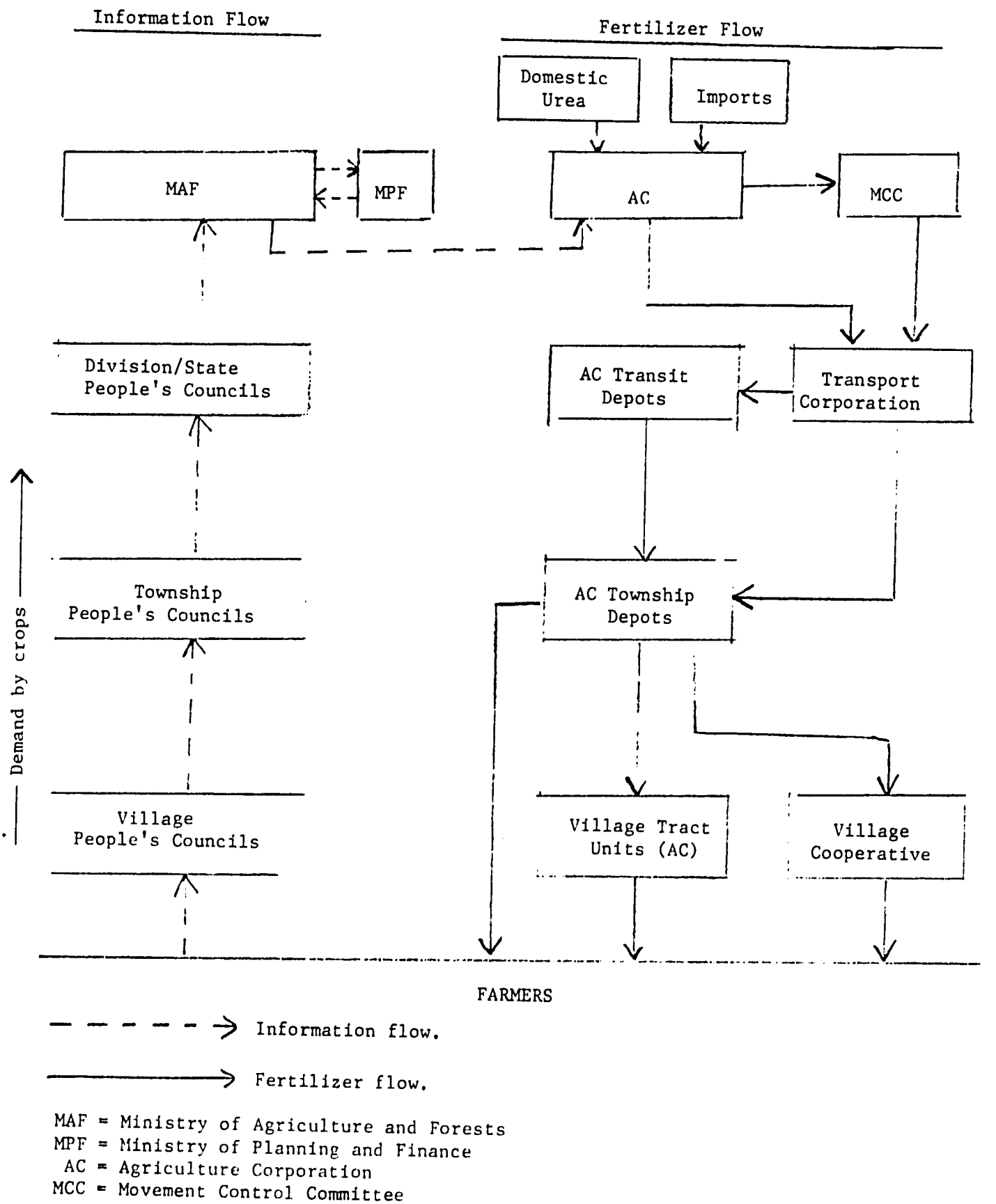
Current plans of the SRUB, using domestic resources, call for construction of an additional 40 fertilizer godowns with 2,500 MT capacity each or 100,000 MT and a new total of 378,000 MT by March 1982. Also, other donors, principally Japan and the Federal Republic of Germany (FRG), are involved in fertilizer grant programs, including a detailed study just now underway by the FRG of the storage, transportation and distribution system as it relates to fertilizer. The AID Office in Burma should follow the results of the study closely and also monitor supplies or movement to insure that amounts it finances can be handled effectively and moved as needed to project sites.

d. Responsibility

Responsibility for procurement and distribution rests within the Agriculture Corporation and is outlined in Figure 2. Annual procurements are based on production targets and fertilizer requirements are

FIGURE 2

FERTILIZER DISTRIBUTION SYSTEM



determined through a planning process involving consultations at village, township and division/state levels. This results in a fertilizer allocation plan which the Agriculture Corporation is responsible for implementing within the limitations of available supply. In addition to CIF costs, the Agriculture Corporation pays for port clearance, customs duties and taxes, as well as for storage, transportation and distribution costs up-country. Transportation is handled under contract with the Transportation Corporation, which delivers the fertilizer by rail, truck or barge to final distribution points at township and village tract depots operated by the Agriculture Corporation. The Agriculture Corporation sells the fertilizer to farmers both directly and through the village co-ops.

A detailed description of proposed procedures for AID-financed international procurement is contained in Part V.B.

e. Project Monitoring

Fertilizer is a scarce commodity in Burma sold at subsidized prices approximately 20% below delivery cost for urea and 50% - 60% below cost for TSP and MOP. Two concerns in this regard are (a) the potential for misappropriation and resale on the open market at higher prices, and (b) the need to insure that project-funded fertilizer is indeed applied to maize and oilseed crops as planned in the project townships.

The first concern is mitigated largely by the controls inherent in the Burmese system. Because fertilizer allocations are calculated in the first place based on village production targets, quotas have been established down to the individual farmer level on allowable pounds per acre (depending on crop, HYV or local seed, etc.). Farm families are aware of the value represented by the fertilizer in crop yields and the increased farm income it can produce. While it is possible that some fertilizer could be diverted, village life is closely watched by the Village People's Councils making illegal transactions risky. For the same reason, misappropriation is unlikely at higher levels within the townships. However, with continuous monitoring by the authorities, backed up by AID monitoring, along with readiness and ability to take corrective measures where necessary, such a program should be feasible.

The second concern relates to assurances that the fertilizer in the planned amounts be applied to maize and oilseed crops in the townships included in the project. Assuring this will require active project monitoring, particularly in the intensive townships where higher results are expected. Accurate checks will be needed to insure that the recommended dosages per acre are in fact sold and applied. Availability for winter crops after paddy is more vulnerable given the fact that fertilizer for both monsoon and winter crops must be laid in by March or April of the crop year. Because fertilizer supplies for practical reasons will be fungible, the only real way to guarantee planned applications to

acreage covered under the project is through a township-level monitoring system mutually satisfactory to AID and the SRUB. This concern is of vital importance to project success and is therefore included in the proposed covenant on fertilizer use in the Project Grant Agreement.

Table 7

Fertilizer Consumption By Years

1962-63 to 1985-86

(Metric Tons)

Year ACTUAL	Urea MT	TSP MT	MOP MT
1962-63	7,644	3,921	-
1963-64	8,769	4,322	-
1964-65	11,056	7,398	-
1965-66	9,607	5,935	-
1966-67	9,121	6,391	43
1967-68	14,641	6,703	396
1968-69	37,745	13,814	119
1969-70	27,845	8,076	586
1970-71	26,554	9,143	276
1971-72	59,162	34,918	2,254
1972-73	69,119	32,706	12,418
1973-74	19,368	9,517	1,174
1974-75	83,269	17,518	2,067
1975-76	92,327	23,954	2,459
1976-77	93,389	14,937	2,125
1977-78	108,636	23,727	2,933
1978-79	156,743	29,252	5,028
1979-80	151,462	46,047	3,627
1980-81	178,379	66,518	4,618
PROJECTED/1			
1981-82	248,000	93,000	21,000
1982-83	268,000	105,000	22,000
1983-84	306,000	111,000	34,000
1984-85	309,000	116,000	34,000
1985-86	316,000	124,000	44,000

/1 Based on actual and expected supply, not on projected demand which is much higher.

Table 8

Available Fertilizer Supply

Domestic Production of Urea and Imports of Urea, TSP and MOP, 1965-66 to 1985-86

(Metric Tons)

Year	IMPORTS Urea MT	IMPORTS TSP MT	IMPORTS MOP MT	PRODUCTION Urea MT
ACTUAL				
1965-66	7,500	1,500	-	
1966-67	11,000	10,000	250	
1967-68	120,884	78,854	28,079	
1968-69	22,000	18,300	-	
1969-70	-	-	-	
1970-71	-	-	-	
1971-72	-	30,000	-	
1972-73	-	22,500	-	
1973-74	-	15,000	-	
1974-75	-	-	-	
1975-76	-	-	-	118,800
1976-77	-	30,000	4,500	130,600
1977-78	8,363	20,000	4,500	135,100
1978-79	20,618	54,414	2,000	120,800
1979-80	39,000	64,118	4,000	132,300
1980-81	80,700	63,130	9,000	135,000
PROJECTED				
1981-82	118,360	92,790	20,660	135,000
1982-83	124,700	96,130	21,000	135,000
1983-84	127,000	102,000	33,000	135,000
1984-85	130,000	107,000	33,000	166,000
1985-86	137,000	115,000	43,000	166,000 /1

/1 Does not include projected increase FRG-assisted urea plant scheduled to come on stream in 1985-86.

III. A.

3. Improved Seed Supply and Distribution

a. Current Situation

Specific land blocks have been designated by the Agriculture Corporation for production of foundation (registered) and certified seeds of maize and oilseed crops. Presently, selected quality planting seeds are produced and processed on various government farms.

Some field operations are done with tractors. Grain quality grading, sorting, and processing of seed are done by hand labor. Irrigation water is not available now to all farms where planting seeds are produced. In some areas, "helping farmers" are working under contract arrangements for seed production. However, sufficient seeds of high quality are not available for the present acres planted of any of the oilseed crops or of maize.

Recognizing the present constraints of the seed multiplication system and the requirements for improved seed under the High Yielding Paddy Program, the World Bank has initiated a $5.5 million "Seed Development Project" designed to lay the groundwork for the future seed industry in Burma. This project has included strengthening the Agriculture Corporation's applied research capability through activities at six central research farms; starting modest rice, cotton and groundnut seed multiplication programs; establishing some seed processing and storage facilities; initiating a seed quality control program; and providing funds for overseas and in-service training and technical assistance. Of the commodities which this project will address, groundnut is the only one included to any extent under the "Seed Development Project." However, the improved seed development procedures developed in the World Bank project will be useful in developing, multiplying and maintaining improved, quality seed for sesamum, maize, sunflower, and soybeans.

The seed production, supply and distribution situation as it existed in 1977-78 is tabulated below for groundnut, sesamum, and maize (Table 9) and for paddy (Table 10). It can be seen in the final column of Table 10 that only 71% of the rice seed produced was distributed to farmers, which gives an indication of the potential room for improvement under the current system.

b. Project Seed Farms

This project will require development of four (4) seed farms, all of which will be operated directly by the Agriculture Corporation. These will be: a farm for foundation maize seed; a farm for certified maize seed; a farm for oilseed crop foundation seeds; and a farm for oilseed crop certified seeds. The approximate tillable acres of these four farms will be 110, 3000, 70, and 800, respectively and the land has been set

aside for this purpose. On those farms will be three (3) seed processing plants. One will be located on the oilseeds farm in Yamethin Township (Mandalay Division) and serve both the foundation oilseed and foundation maize seed farms. A second seed processing plant will be located on the certified maize seed farm at Thitco in Natalin Township (Pegu Division). The third seed processing plant will be located on the certified oilseed farm at Kyaung-su in Kyauktaga Township (Pegu Division). These locations are summarized in Table 11.

The processing capacities of the three seed plants will exceed the requirements for seed on acreage in the intensive townships included in the project. It is anticipated that planting seed will also be produced by helping farmers under contract arrangements and that this seed will also be processed at the seed processing plants. If the plants are operated by experienced managers, seed supply will become available for many more townships and carry the possibility of shifting several currently designated extensive townships to intensive ones in future years.

This conclusion is drawn from information assembled in Table 12 and Table 13. This shows that the registered (foundation) and certified maize seed required for the 1985-86 acreage levels in the intensive townships will be far less than planned production capacity on the designated seed farms (which are sized at an economic scale). For oilseeds, while the projected seed production is more closely in line with planned requirements in the intensive townships by 1985-86, here also it is possible that with the addition of seed grown on cooperating farms that total production will exceed requirements limited solely to the project's intensive townships.

A list of the equipment needed for the three seed processing plants as well as the field equipment proposed for all four seed farms is given in Annex B. This list includes storage requirements; in the latter years of the project, storage space for certified seed will probably require expansion. A projection of storage required by 1985-86 is shown in Table 14.

Table 9. Seed Supply in 1977-78 for Groundnut, Sesamum and Maize

Crop	Seed Produced (MT)	Acres Plantable	Seed Rate Per Acre	Acres Planted
Groundnut	119,000	1,745,333	150 lbs.	1,481,000
Sesamum	7,250	1,992,500	8 lbs.	2,696,000
Maize (grain)	2,683	295,100	20 lbs.	295,000

Source: Agricultural Statistics (SRUB, 1980).

Comments on 1977-1978 seed situation:

Groundnut: Generally of known variety; very low germination (± 25%).

Sesamum: Generally of unknown origin; excessive seeding rate indicates very low germination (± 20%).

Maize: 68,287 (23%) acres were planted to local yellow maize; 12,859 (4%) to Guatemala maize; and 214,101 (73%) to "other" maize.

Table 10. Improved Strains of Paddy*, 1977-78

Production Unit	Farms	Total Acres	Baskets** Produced	Baskets Distributed	%
Pure Seed Farms	26	8,848	75,355	50,237	67
Central Farms	10	5,038	50,363	38,613	77
Total		13,886	125,718	88,850	71%

*Paddy is unhulled rice.

**1 basket paddy = 46 lbs.

Source: Agricultural Statistics, (SRUB, 1980).

Table 11. Seed Farm Locations Selected for Project

Seed Farm Type	Processing Plant	Name of Farm	Approx. Acres	Township	Division
Foundation maize	No	Tatkon	100	Tatkon	Mandalay
Certified maize	Yes	Thitco	3000	Natalin	Pegu
Foundation oilseeds	Yes	Meaungkan	70	Yamethin	Mandalay
Certified oilseeds	Yes	Kyaung-su	800	Kyauktaga	Pegu

Table 12. Flow of Improved Seed Required from Registered Seed Farm to Certified Seed Farm Necessary to Supply Intensive Townships for 1985-86

	Maize	Groundnut	Sunflower	Sesamum	Sum of Oil Crops
1. Acres of certified seed required to supply intensive township needs, 1985-86.	469	2500	376	185	3061 acres
2. Acres of foundation seed required to supply seed to certified seed farms in No. 1, 1985-86.	3	125	7	2	134 acres
3. Planting rate of certified seed/acre.	20 lb	4 baskets (100 lb)	20 lb	5 lb	
4. Planting rate of foundation seed/acre.	20 lb	4 baskets (100 lb)	20 lb	5 lb	
5. Yield of certified seed/acre.	4480 lb (80 baskets)	80 baskets (2000 lb)	50 baskets (1600 lb)	20 baskets (1080 lb)	
6. Yield of foundation seed/acre.	4480 lb (80 baskets)	80 baskets (2000 lb)	40 baskets (1280 lb)	15 baskets (830 lb)	

Table 13 Certified Seed Supply Required for 8 Intensive Townships, 1982-83 through 1985-86 (Includes 40 High Technology Sites)

Crop	Crop Year 1982/3	1983/4	1984/5	1985/6	Seed & Yield Rates Per Acre
1. Maize					
Commercial crop Acres/year (000)	57	75	91	105	
Pounds/year (000)	1140	1500	1820	2100	20 lb (seed)
Acres of certified seed required	254	335	406	469	80 baskets (yield) (56 lb/basket)
2. Groundnut					
Commercial crop Acres/year (000)	37.5	42	46.5	50	
Pounds/year (000)	3750	4200	4650	5000	4 baskets (seed)
Acres of certified seed required	1875	2100	2325	2500	80 baskets (yield) (25 lb/basket)
3. Sunflower					
Commercial crop Acres/year (000)	15	20	25	30	
Pounds/year (000)	300	400	500	600	20 lb (seed)
Acres of certified seed required	188	250	313	376	50 baskets (yield) (32 lb/basket)

Table 13 (cont'd)

Crop	Crop Year 1982/3	1983/4	1984/5	1985/6	Seed & Yield Rates Per Acre
4. Sesamum					
Commercial crop Acres/year (000)	34	36	38	40	
Pounds/year (000)	170	180	190	200	5 lb (seed)
Acres of certified seed required	157	167	176	185	20 baskets (yield) (54 lb/basket)
5. Sum of Three Oil Crops					
Commercial crop Acres/year (000)	86.5	98	109.5	120	
Acres of certified seed required	2220	2517	2814	3061	

Table 14. Storage Requirements for Seed to Supply 8 Intensive Townships, 1985/86

Seed Class	Crop Category			
		Oilseeds		
	Maize	Groundnut	Sunflower	Sesamum
1. Registered				
Baskets	240	10,000	280	30
Cu Ft	300	12,500	350	40
Pounds	13,500	250,000	8,960	1,620
Total Cu Ft				
Maize - 300				
Oilseed - 13,000				
2. Certified				
Baskets	20,357	150,000	9,375	3,148
Cu Ft	25,446	187,500	11,720	3,935
Pounds (000)	1,140	3,750	300	170
Total Cu Ft				
Maize - 25,500				
Oilseed - 205,000				

(Certified oilseed storage requirement: Godown 30,000 sq ft x 14 ft (205,000 cu ft of seed).

III. A.

4. Other Inputs

a. Water Supply

Only about 12% of the cropped area is irrigated. This places serious limitations on crop production. During summer monsoons much of the area is handicapped by excess rainfall, flooding and cloud cover. October-May weather is ideally suited to crop production with little flood risk and high percentage of sunshine, but most of the country has little or no rainfall. In the long run, Burma will have to develop its abundant surface and ground water resources to capitalize on the potentially very high producing October-May season when two crops must be produced. Neither the time frame nor the scope of this project permit dealing with development of water resources except on a limited basis to test on-farm water management systems and to develop irrigation on seed farms. The project is designed otherwise to operate with existing water sources, mainly rainfed and benefits/cost analyses are based on such technology.

The principal input on water supply for this project will be the provision of long-term technical assistance, possible short-term training, and a significant expenditure on pump equipment. The latter will be procured in two phases: in year I, fifty 5 HP electric pumps and fifty 10 HP diesel pumps will be installed at project locations for field-testing of their relative efficiency. The electric pumps may be augmented by purchases of step-down pole transformers of the type typically found on U.S. farms. Based on field test results, an additional 400 pumps (electric and/or diesel) will be ordered and installed. The Agriculture Corporation will own, maintain and protect all pumps until such time as they may be sold to farmer users or cooperatives.

b. Farm Machinery

There are reported to be between 4,000 and 10,000 operable tractors in Burma together capable of tilling 3-4% of the tilled area. Bullock, the principal source of power, average about one pair for each 9-10 acres, the minimum considered necessary. With uneveness in distribution, some areas obviously are short. The project is fairly heavily oriented towards increased cropping intensity, which places a heavy load on bullocks at paddy harvest time when they are needed to thresh (tread) paddy and prepare seed beds for winter crops. Within planned levels of intensity, this bullock load factor is not expected to present insurmountable difficulties, but if intensity continues to grow in future years, some increase in power will be needed. The five year project life will permit breeding to maturity for draft cattle. The Government has initiated a credit program to provide bullock power. It also is expanding cooperative tractor operations.

Planters are needed to increase rate of planting, to improve stands and to reduce seed requirement. Small precision seeders will be introduced on high technology sites in intensive townships during the life of the project. Similar machines can be manufactured locally or assembled from imported parts. Both the Agriculture Corporation of the Ministry of Agriculture and other Departments and Ministries are keenly interested in further development of such equipment as it is tested and proven. The production targets of this project are predicated on use of present power, tillage and seeding machinery and equipment.

A list of equipment and machinery to be procured using project grant funds is included in Annex B.

c. Inoculum Production Plant.

Annual production of rhizobium inoculum for groundnuts is in critically short supply in Burma. The provisional pilot production plant described in Part III.A.1.f. is inadequate for permanent production of inoculum. Quality control is not sufficient to guarantee inoculum species purity for this project.

A permanent inoculum production plant should be constructed as a part of the project. Personnel to operate the plant would be trained under the short-term and long-term training program. Short-term consultants in plant operation will also be required. As the plant becomes operational, a specialist at the M.S. degree level will be needed to monitor quality control of the product and should be among the first to be selected for training.

The equipment list for a total installation designed to produce an adequate supply of high quality inoculum is included in Annex B.

The location of the production plant is planned to be in Mandalay Division, north of the city of Mandalay. This site is preferred for the plant because of the proximity of an excellent but cheap supply of peat. The proposed site is also in the same division as the Agricultural Research Institute at Yezin.

The production facility would be of the same basic model as the facility planned by USAID in Zambia during 1980.

The following inoculum production stages are planned for the installation near Mandalay.

1. Sterilizing peat cut from the supply in local lakes;

2. Drying, grinding and storing peat;

3. Maintenance of pure strains of the proper species of rhizobium by aseptic laboratory techniques;

4. Sterilization of all instruments and glassware used in the commercial multiplication step by use of steam sterilizers;

5. Production of nutrient broth for rhizobium from fruit of leguminous plants;

6. Incubation of rhizobium organisms in sterilized nutrient broth by using aeration in sterile incubation tanks;

7. Packaging ground peat in 250g capacity plastic bags;

8. Inoculation of bags with rhizobium organisms;

9. Culture plating of growth media and inoculant tc determine freedom from contaminating bacillus types;

10. Labeling packages for species, strain and date of production complete with handling instructions;

11. Storing product in climate control chambers until distribution immediately before crop planting time; and

12. Testing new strains of rhizobium for efficacy on legumes.

III. A.

5. Research Capability Analysis

The Agricultural Research Institute at Yezin, Mandalay Division, is the national center for agricultural research in Burma.

With regard specifically to the needs of this project, the research program at ARI in oilseeds and maize mostly involves selection of superior lines of groundnuts and maize from international germ plasm sources. Some cultural practices work on row spacings and plant population is also being done. However, most of the activities in oilseed and maize are service functions to townships and other organizational entities. Insufficient data are being generated to warrant research conclusions. The service functions such as soil testing and inoculant production are useful, but do not provide the bases for agricultural decision making that a strengthened research program could provide.

Research land area and buildings for laboratories and offices are available or under construction at Yezin. Water for irrigation is taken from the Yezin reservoir. Supplemental tube wells have been drilled, but work remains to be completed on the distribution system from the wells to research areas.

For oilseed crops, field research on approximately 60 acres is interrupted for several weeks per year due to monsoon flooding. Plans have been formed to correct the waste of land and research time associated with the flooding problem.

Research laboratories are partially equipped. The soils laboratory is more nearly equipped than other laboratories at Yezin. Glass houses for pathology and glass-screen houses for entomology are needed.

The greatest need of ARI is research personnel. Persons with advanced degrees are needed for every crop and in every research discipline for which the institute is responsible. Research assistants must be trained to operate laboratory instruments and to install and evaluate field plants. The list of recommended training for advanced degrees (Ph.D., M.S.) and short term training to be funded under this project will assist ARI to broaden and upgrade its research capability, but it should be pointed out that the project can only answer a part of the long-term need for advanced degree training at ARI. A list of equipment that would enhance the productivity of the present research staff at Yezin is included in Annex B. Mainline irrigation pipe is needed for the tube wells. Sprinkler systems are needed for some research work. Field plot planting equipment that approximates the action of mechanical field planters should be made available for some of the cultural practices research. Tillage equipment (roto-tiller) that can be transported to off-station sites is needed.

Plot threshers, land planes, and a considerable amount of equipment is now or will be arriving at Yezin in connection with this and other projects. It is recommended that an equipment maintenance shop such as that to be constructed for the certified seed farms also be established at Yezin. Storage sheds will also be required to protect this new equipment.

III. A.

6. Extension Capability Analysis

The Agriculture Corporation is responsible through its Extension Division for extension activities throughout the country. Organizationally, there is a manager for each state/division, each township, each village tract, and each village. The extension managers are in constant touch with the farmers at the village and village tract levels. Workers at the local level are assigned to a group of villages differing in area according to the accessibility of the villages and the number of farmer families. On the average, each village manager covers 1500-2500 hectares.

Under the system developed for the whole township model, ten or twelve village managers are stationed together at a technology diffusion center commonly called a "Production Camp". Each camp has a central facility for training farmers. Over time they have come to serve as community halls. Each production camp has a dormitory, where village managers live together and are able to pool ideas and come up with shared solutions. National research workers and state farm workers who are subject matter specialists pay frequent visits to the camps and provide training to extension workers as well as farmers.

a. The Program for Rice

The whole township program was first tested in 1975-76 on 162 hectares in Phalon village where ten critical production variables of the new rice technology were employed. This pilot program served as a training ground for 41 extension workers not only in the new technology of rice production but also in extension procedures.

Results were encouraging; rice yields increased from an average of 1907 kg/hectare to 5139 kg/hectare. The success of the pilot program at Phalon Village led to expansion to include five village tracts in 1976-77, covering 11,886 hectares with 506 farmers and average yields rose from 2114 kg/hectare to 4021 kg/hectare.

In 1977-78 the first Whole Township program was launched in two townships: Shwebo in Upper Burma and Taikkyi in Lower Burma. Again the results were encouraging, although this time there was a diluting effect due to the larger areas involved (38,315 hectares in Shwebo and 52,662 hectares in Taikkyi) and to a shortage of subject matter specialists. Nevertheless, it was decided to extend the program to 23 townships covering 850,000 hectares in 1978-79, and to 43 townships in 1979-80. During 1980-81, the program has been expanded to 76 townships.

Special high-yielding varieties with a yield target of 3610 kg/hectare are allocated to the best areas in the townships. Areas with less favorable growing conditions are also sown with HYV but are given

second priority in terms of both inputs and extension workers. The least favorable areas are sown with local varieties, though cultural practices are being improved.

The overall technology diffusion effort exceeded expectations. Most encouraging was the enthusiastic response of farmers and their acceptance of the new technology. Although the area of operation has been greatly extended, the selective-concentration extension strategy remains valid for assuring participation.

b. The Program for Maize and Oilseeds

The basic approach that proved effective in rice will be applied to maize and oilcrops in this project. The Extension Division will concentrate efforts to supply new technology and production inputs to the eight intensive townships selected for the project, while providing as much support as feasible for the extensive townships. New production packages must be developed for four or five crops rather than for one as in the case of the rice program. Because oilseed crops will be grown in Lower Burma as a second crop after rice, this will require that rice be harvested before post-monsoon and winter plantings. Oilseed crops will also often depend on irrigation for economical utilization of fertilizers and improved seed and crop pests will increase with increased fertilizer use. The plethora of interactions involved in double or triple cropping land will require much more technical assistance than single cropping.

Nine constraints to higher yields of maize and oilcrops have been identified by the Agriculture Corporation:

(1) Use of higher quality seed of higher yielding varieties; (2) proper land preparation; (3) plant population and distribution; (4) application of manure; (5) use of chemical fertilizer; (6) control of pests and diseases; (7) planting methods; (8) weed control; and (9) timely harvesting. The use of chemical fertilizer has been singled out as the most important constraint to yields of maize and oilcrops.

To field-test new technology before it is scheduled for wider adoption, the Extension Division has selected five sites in each intensive township for application of a series of high technology inputs. Each high technology site will in turn work with five farms. About one acre per farm will receive closely monitored applications of production inputs. Precise records must be kept of crop response to variations in soil preparation, fertilizer application, water management, and control of weeds, insects and diseases. The information gained from this applied research will form the bases for crop production recommendations to other townships as well.

Information to farmers is disseminated by the Extension Division through the division-township-village-production camp channels described earlier. Extension materials are prepared in the national office in Rangoon. A series of radio programs on crop production are also beamed to all parts of the country. Printed materials and information to be presented orally and visually are distributed to the extension leaders at the production camps.

The extension program has performed admirably in diffusing the technology for the HYV rice program. The organizational chart is complex and ponderous; however, the system succeeds in interacting with the farm producer. This interaction is the key to the success of the extension program of Burma. Nevertheless, a substantial expansion and strengthening of extension staff will be required to fully carry out the maize and oilseed program. Potential new extension workers are available among the graduates of the Institute of Agriculture at Yezin (equivalent to U.S. level).

The Agriculture Corporation is prepared to provide these graduates with in-service training in maize and oilseed production which will permit filling of the many new extension positions which are required to carry out the project. The importance of additional field-level staff capacity in the high technology sites, intensive and extensive townships is reflected in a covenant to the Project Grant Agreement.

III. A.

7. Marketing, Storage and Transportation

Marketing of most agricultural products involves a combination of private and public marketing and pricing systems operating in parallel. The relative importance of public and private systems varies substantially from product to product as does the differential between prices in the two systems. The Agricultural and Farm Produce Trading Corporation operates the public marketing system for most farm products, and the Agriculture Corporation is responsible for most farm inputs sold to farmers (fertilizer, pesticides, seed, equipment). Most transactions with farmers are handled through township or village cooperatives.

For controlled farm products, quotas are assigned at the national, division (or state), township, village and individual farm levels by discussion at different levels of requirements and production capability. Inputs to be made available, other production-oriented development activities planned for particular geographic areas, and degree of involvement of the individual farmer are also considered in setting quotas.

As a rule, farmers in areas involved in a production-increasing program, thereby receiving more inputs, are assessed a higher quota. The individual is allowed, as a minimum, sufficient produce to feed his dependents (family and members) adequately. For rice this amounts to some 300 kg equivalent of milled rice per person per year. Further, quotas, even subtracting for home consumption, are assigned conservatively. On the average nearly half the rice surplus available for sale may be sold on the free market where prices in recent years have fluctuated between 10% and 100% or more over the controlled price which now is K9 to K12 per basket, depending on quality. 1/

Of the commodities included in this project, only maize is subject to controlled price and market quotas. The controlled price of maize of K20 per basket of 55 lbs compares favorably with the controlled price of paddy rice of K9 per basket of 46 lbs of the most common variety (Ngasein ordinary). It is also favorable relative to the price of urea (K360/MT for urea and K900/MT for maize). At the current official price, it takes only 1 kg of maize to buy 1 kg of nitrogen. 2/ Phosphate costs almost four times as much per pound of P_2O_5 as does a pound of N for Burmese farmers. The phosphate/maize price relationship is near world levels.

1/ See for example IBRD Report #2395B, "Burma Grain Storage Project," p 4, Nov. 26, 1980.

2/ In the U.S. it takes about 4.5kg of maize to pay for 1 kg of N.

The other crops included in the project, namely groundnuts, sesamum, sunflower and soybeans, are free market commodities. In some areas the local cooperatives have imposed a form of quota on producers to meet local needs, but prices generally have been fairly near prices paid on the free market. In fact, recent prices of vegetable oils quadrupled as a result of a reduced crop in 1979-80.

In June 1980 village prices were approximately as follows in $/MT: 1/

Maize	$135.38	(K22/55 lbs)
Millet	272.95	(K50/62 lbs)
Paddy	88.29	(K12/46 lbs)
Groundnut	812.31	(K60/25 lbs)
Pulses	318.67	(K65/69 lbs)
Sesamum	940.17	(K150/54 lbs)
Sunflower	805.86	(K50/21 lbs) 2/

Compared with the above, the following prices in Kyauktaga Township are typical of current (May 1981) farm level prices:

Maize	K20/basket (55 lbs)
Groundnut	K38/basket (25 lbs)
Sesamum	K120/basket (54 lbs)
Sunflower	K42/basket (32 lbs)

Prices near these levels reflecting the large 1980-81 crop are expected to prevail during the life of the project. 3/

a. Market Channels for Maize

Production of maize is quite small at about 1,000,000 MT per year, but growing quite rapidly. Relatively little information is available on the marketing system, storage or processing for maize. AFPTC quotas currently result in accumulation of small amounts available for export (5% - 15% of the crop), although there is no storage *per se* for maize held for export or sale outside the township where it is grown. Resident sources say there are inadequate supplies of feed stock to meet needs of the modernizing livestock industry in Rangoon (mainly poultry). The Livestock Development Corporation, which is principally responsible for such operations, would need to obtain its supplies from the AFPTC or from the free market to manufacture mixed rations. The policy on use of increased grain production appears to give priority to supplying domestic livestock, but to date such a policy seems not to have been fully implemented.

1/ Appendix D, Source ABD 1980, p. 1, 2.
2/ Price as given to team; the usual unit is per basket of 32 lbs.
3/ These prices are close to IBRD projected 1980-81 prices in $ at an exchange rate of K7.2 to $1. The price (CIF) for sunflower would be somewhat less than this.

Given the present small level of production and marketing of maize, channels clearly are only in a formative stage. A major increase in volume of production must be carefully coordinated with measures to increase marketing facilities and operating capability. The problem could be particularly acute for summer-grown maize in paddy areas which had to compete with expanded paddy supplies resulting from the rice intensification programs. Although roasted ears of corn are sold as food, there is little evidence at this point that Burmese consumers would increase direct food use of maize grain by significant amounts. About 50% of the total maize area now is planted for vegetable use (consumed as immature ears). The potential for increase in animal consumption, especially broilers, is large but this will require coordination of a number of disparate elements. In the interim, additional exports appear to be the most likely method of disposing of surpluses generated by the project. This may imply farm prices over the next 2 - 3 years at about current levels (K20 per basket) unless some subsidy is provided or the Kyat is devalued.

b. Channels for Oilseed

Oilseeds marketing and prices are classified as uncontrolled. Though officially disapproved of, some local cooperatives assign quotas on amounts to be supplied to the cooperatives for use by non-producers. Illustratively, in Kyauktaga Township in Pegu, farmers were required to consign 50% of their oilseed marketed to the cooperative.

Most of the oilseeds are taken by farmers to small, traditional oil crushers for crushing where the farmer may sell the seed or have his oilseeds crushed on a customer basis paying a small cash charge or share and receiving back crude oil and cake. Some of the cake and oil moves into the commercial market after processing by small-scale village crushers. A part of the cake ultimately is exported.

Most crushers are very old and quite inefficient in extracting oil. As a result cake used for livestock feed or exported generally contains about 10% residual oil (by weight). In the 1970's, between 1,000 and 9,000 MT of residual oil was exported in cake. In an average year exports of about 40,000 MT of cake contained about 4,000 MT of residual oil. Another 15,000 - 20,000 MT of residual oil in cake is used domestically primarily for livestock feed. Though this oil has a real value as feed, use in this form represents a major net loss to the economy.

Vegetable oil recently has been selling at K 30/viss and maize selling at K 1.3/viss. At this price, the feed value of a residual viss of vegetable oil in cake would be no more than K 2 to K 3 depending on method of feeding and type of livestock. Thus the loss in value is 90% or more of the feed use value. Applying a CIF wholesale price of US 30 cents per lb ($1.08/viss) and FOB price of maize of $0.22/viss

still leaves a loss of 65%. The feed value at these price relationships is about 65% of the CIF oil value for food.

Currently, vegetable oil production is more concentrated in Upper Burma where oilseeds are commonly grown as a monsoon crop. The project will place major emphasis on growing oilseed in rotation with monsoon paddy as a post-paddy (fall-winter) or pre-paddy (pre-monsoon) crop. Therefore, the project will result in rapid expansion in new and higher yielding oilseeds in areas where only relatively low production was obtained from sesamum in the past. This is expected in intensive townships to result in production levels several times present production. Because consumption in these areas has been constrained by low levels of sesamum output, some of the increased output will be consumed locally, but a major part will be available for sale outside the area. Similarly, while some of the additional cake may be absorbed by local livestock, much is likely to be available for sale outside the area. This will be especially true where intensive paddy programs are simultaneously increasing supplies of paddy straw, bran, broken rice, and polishings for feed.

c. Storage

Problems in storing, crushing and moving of oilseed and oilseed products can be expected. Immediate problems on crushing capacity are not anticipated since most oil mills are run only three months a year and only a few hours a day at present. However, more intensive use of existing processing capacity will be dependent on availability of increased storage capacity at farm, village cooperative or privately-owned crusher levels, as well as incentives to store.

Joint use of paddy godowns at township and village levels can be depended on to partially meet the needs for storage of crops included in the project. The World Bank's current Grain Storage Project is aimed at closing a large deficit between storage needs and available capacity for paddy which will assist in solving the long-term storage problem. Use of fertilizer godowns for harvested crops will be an unlikely solution considering the expansion of fertilizer inputs planned for the years ahead.

On-farm storage is currently practised for paddy but may be difficult for oilseeds. Paddy stored for the farmers' own use is stored in bulk in bamboo cages known as "poke" and in bamboo bins. Both are plastered by mud and cowdung. Quality of paddy stored in these structures is generally good and losses are estimated at less than 3% per year. Home storage of oilseed has not been widely practised in Lower Burma except for sesamum.

Concerning storage facilities connected to crushing operations, the Ministry of Cooperatives is attempting to promote village and township level oil processing cooperatives. This includes assistance to the cooperatives in godown construction for oilseed storage when this is necessary.

d. Transport

For 1978-79, the Government estimated transport requirements to be 56 million total domestic MT of transport, but only a little over 4 million MT could be transported by the three public corporations. Private capacity was estimated at 44.5 million MT, leaving a deficit of 7 million MT. Actual amount transported was reported to be 54.6 million MT (See Table 15). With very small investment being made on transport and especially small allocations for private sector equipment and maintenance, prospects for improvement are not bright.

Intra-village and intra-township transport under the project should not create major problems in view of the large and growing number of bullock carts, reported in 1976-77 to be 1,300,000 carts and more than enough oxen to pull and use them for most local transport. However, transport of additional fertilizer and other inputs, including construction materials to townships and increased produce to major consumption and export points may become a problem to Burma's agriculture in general. This project in the fifth year will only impose a relatively small increase on transport requirements. The largest part of that will be for maize, most of which is expected to be exported.

Volume that can be handled in the port also may become a problem in the next five years, but up until now Burma has done a creditable job of unloading and loading vessels, despite the Rangoon local limitations of 13,000 MT of cargo per vessel. Both ship to dock and ship to barge unloading is employed. For fertilizer, Burma has been successful in a ten-day or less unloading time for up to three ships simultaneously.

Storage in the ports and land movement are reported to be a problem for Rangoon arrivals in general. Casual observations suggest that a much higher rate of movement of freight over present roads in the Rangoon area could be achieved if adequate numbers and sizes of trucks and railcars and barges were available. Most of the rolling stock is very old -- some of it pre-1940. The continued intensive operations of many ancient vehicles with severe spare part limitations speaks highly of Burmese maintenance capability.

Shortage of storage facilities for inputs and crops at village and township levels may aggravate the long distance transport problems.

In general, it appears clear that the intensive maize and oilseed townships included in the project will need to be looked at very carefully in terms of storage, marketing and transport facilities at the end of each crop year of experience. Periodic evaluation should be planned to insure adequate attention to this problem, appropriate feedback, future planning and, if needed, rescheduling of implementation.

Table 15. Freight Allocations to Various Kinds of Transport (000 MT)

	1974/5	1975/6	1978/9	1979/0
Public Sector				
Burma Railroad Corp.	1,675	1,831	1,884	2,325
Inland Water Corp.	912	1,037	1,016	1,163
Road Transport Corp.	1,042	1,006	953	967
Subtotal	3,629	3,874	3,853	4,455
Other Public Sector	3,709	3,005	3,322	4,418
Private Sector				
Truck	12,200	14,614	16,227	17,789
Inland water by power	9,168	9,168	9,312	9,456
Coastal transport by power	1,258	1,334	1,397	1,373
Small & slow water craft	19,578	19,917	20,449	20,426
Subtotal Private Sector	42,204	45,033	47,385	49,044
TOTAL	49,542	51,912	54,560	57,917

Source: IBRD 1980 Report, Table 10.3.

III. A.

8. Credit

Since achieving independence the SRUB has followed a policy of eliminating private lending of money for agricultural investment and production. As of 1948 when private lending was made illegal, the only legal sources of credit were government agencies, village banks and cooperative societies. In 1953 the State Agricultural Bank was formed. Loans were channeled through cooperatives while a network of village banks was being formed. In 1958 bank financing through cooperatives was discontinued and production loans channeled through village banks. The number of village banks has increased from 208 in 1955 to 11, 134 in 1972 and 11,207 in 1977. In 1972 about two million farmers were "members" of these banks.

From 1953 to 1977 a total of K 2,134 million was loaned through village banks -- an average of K 90 million per year. This works out to an average of K 3-4 per acre of cropland. Limits of the Myanma Agricultural Bank have been set as follows:

(See Table 16, overleaf)

Table 16

Crop	K/Acre		
	1964/5	1978/9	1981/2
Cotton	-	210-280	*
Cassava	-	200	NA
Jute	20	124	*
Groundnut	50	100	100
Early rice	25	70-90	70-140
Potatoes	75	90	NA
Onions	75	75	NA
Local tobacco	60	70	50
Sunflower	-	50	50
Soybeans, pulses	10	35	35
Maize	10	30	30
Sesamum	10	20	20

* Textile Corporation advance purchase of up to 50% is available in lieu of credit.

Source: J. M. Burr, "Aspects of Burmese Development 1920-79."

In 1964 a system of advance purchase of paddy was instituted under which sale was made to AFPTC, in advance of planting, of up to five baskets of paddy in order to pay advance cash costs of production (e.g. fertilizer and seed.) The AFPTC had a monopoly on purchase of paddy. Cooperatives purchased other crops, mainly oilseeds. In 1977 the advance purchase plan for paddy was ended. The State Agricultural Bank was subsequently changed to the Agricultural Finance Division of the Union Bank of Burma and in 1976 the Agricultural Finance Division became the Myanma Agricultural Bank charged with handling all agricultural loans including loans for livestock.

In order to obtain credit, village (tract) banks have been formed by farmers who buy shares at K 1-10 per family. Upon deposit of the share capital in the township bank, the village bank becomes eligible for loans at 8% and to relend to members at 12%. Farmers in default on prior loans (a major problem) may be ineligible for new loans. Alternatively they may obtain new loans only by agreeing to a firm repayment schedule possibly including a penalty interest rate. In general, maximum credit per farm is fixed at K 1,400.

The Textile Industry Corporation offers advance purchase of cotton. Advance purchase payments generally have been made a month or so after planting and loans for other crops often are received late. To overcome this problem, the Agriculture Corporation, which handles inputs, defers payment by eligible farmers until the advances or loans are received.

In addition to the problem of late payment, amounts of credit available per acre are very small as shown above. Further, crop loans relative to crop values are very low. The highest relationships were for groundnuts (8.1%), pulses, and sesamum (5.4%) (see Table 17). In 1977-78 only a small percentage of the total planted acres received loans. Though oilseeds fared much better than most crops, still about three-fourths of the area planted received no credit (see Table 18). Considering these loan rates and that not all farmers obtain loans, financing of modern high input farming systems will present problems.

The Agriculture Corporation has indicated that credit will be available for the townships and acreage included in the project. Even should credit not be available in all areas, given the low price of fertilizer this should not be a major constraint for participating farmers. As with the concerns relating to storage and transportation relates to the project, credit availability should be carefully monitored as the project expands.

Table 17

CROP LOAN AND VALUE RELATIONSHIPS[1/]
1977-78 CROP YEAR

Crop	Myanma Agricultural Bank Loans (thousand kyats)	Percent of Total Loan	Crop Production (thousand tons)	Crop[2/] Value (million kyats)	Loan Value (percent)
Paddy	9,790	8.5	9,313	4,263[3/]	0.2
Wheat	5,523	4.8	92	187	3.0
Maize	1,817	1.6	74	60	3.0
Groundnuts	66,251	57.4	457	819	8.1
Sesame	12,161	10.5	109	226	5.4
Matpe	558	0.5	39	60	0.9
Butter beans	2,417	2.1	40	39	6.2
Sultani	223	0.2	32[4/]	31	0.7
Sultapya	1,181	1.0	30	29	4.1
Peboke	220	0.2	16	16	1.4
Grams	2,250	1.9	100	98	2.3
Pesingon	1,328	1.2	20[4/]	19	7.0
Other pulses	2,602	2.2	83[4/]	81	3.1
Chillies	3,275	2.8	26[4/]	113	2.9
Onions	1,713	1.5	106[4/]	113	1.5
Garlic	573	0.5	22[4/]	110	0.5
Potatoes	368	0.3	54[4/]	74	0.5
Burmese tobacco	2,753	2.4	54	508	0.5
Sunflower oil	342	0.3	13	69	0.5
All crops	115,345			6,915	1.67

1/ Data from: (a) Report to the Pyithu Hluttaw on the Financial, Economic and Social Conditions of the Socialist Republic of the Union of Burma for 1979/80; Tables 35, 42, 131, 133, 134; (b) Some Statistics in Agriculture, Burma: pages 3 and 4.

2/ Government purchase prices are used where they are available; otherwise the lowest wholesale price at source is used.

3/ A price of 9.4 kyats per basket was used. This is based on a weighted average of the government prices paid for the different paddy groups.

4/ Data for 1978-79 crop year.

TABLE 18

SELECTED AGRICULTURAL CROP LOANS 1/
1977/78 CROP YEAR

	(1000 ha) Sown Area 2/	($/ha) Crop Loan Rate	(1000 $) Potential Amount Loaned	(1000 $) Loans Disbursed	Percent of Sown Are Not Receiving Loans
Paddy	5,316	26.61	136,669	1,506	99
Wheat	95	19.01	1,806	850	54
Maize seed	84	11.40	958	280	78
Groundnuts	599	38.02	22,774	10,192	55
Sesame	1,091	7.60	8,292	1,871	78
Sunflower	36	19.01	684	53	92
Grams	171	7.60	1,300	346	74
Chillies	58	19.01	1,103	504	54
Burmese tobacco	59	19.01	1,116	424	61
Total:	7,329		174,702	16,026	91

1/ Data from: (a) Report to the Pyithu Hluttaw, 1979/80: Tables 41, 35; (b) Some Statistics in Agriculture, Burma: pages 3 and 4.

2/ For the 1977/78 crop year, 88.9 percent of the total sown area matured; Report to the Pyithu Hluttaw, 1979/80: Table 39.

III. A.

9. Training Requirements

The Agricultural Corporation currently has a total staff of 18,000, but only 15 trained scientists with PhDs and 29 specialists with MS degrees. Of the 15 PhDs, only one has been educated in the United States, ten in the USSR and East Germany, and the rest in other countries.

The core of trained agricultural scientists holding advanced degrees which are required for general Burmese agricultural development is very thin. This project will directly address the deficit by providing, over a five to six year period, sufficient funds for 11 new PhD and 25 MS degrees. In addition, 70 individuals will receive short-term, non-degree training varying in length from three to six months at specialized agricultural research and other educational institutions in the United States and third countries.

These needs are consistent with the demands of the Maize and Oilseed Production project as detemined by the project appraisal team. For PhD training, the areas of specialization recommended, subject to approval of the SRUB and of the AID, include:

No. of PhDs	
4	Crop Breeding(groundnut, sunflower, maize, disease resistance)
3	Crop Protection (entomology, integrated crop protection, weed control)
2	Agronomy (soil/plant relations, nitrogen fixation)
2	Agricultural Economics (agricultural biometry , agricultural production/marketing)

Because of difficulty in releasing scarce talented staff for long-term overseas degree training, and in view of the even scarcer individuals already possessing MS degrees who may be in a position to pursue PhDs, the AC has requested that for PhD training there be a reliance primarily on top BS-level graduates who will enter a phased MS/PhD program. After completion of initial two-year MS degrees, those with the best potential to continue for the PhD will do so while others may opt to discontinue and return to Burma. Those who continue at the same institution (the

preferred sequence) will require a minimum of an additional two or three years overseas, two years if field work for the PhD thesis can be done in Burma (a desirable sequence if this can be programmed), or three years if thesis work is done in the U.S. or in a third country, such as at IRRI in the Philippines. It is planned that all PhD course work would occur in the United States.

The MS/PhD candidates, as described above, would be scheduled as early as possible to begin their academic programs. The first group will be selected to arrive in the U.S. in time for the August-September start of the 1982 academic year. However, many may not begin until 1983 or possibly 1984, meaning that for this portion only of the grant a Project Assistance Completion Date (PACD) of October 1988 may be required, stretching to two additional years beyond the PACD for the remainder of the project (10/86).

For the 25 MS-level trainees, the same constraint will hold for selecting qualified candidates but commitment by the AC to release them will be less difficult given the shorter (two-year) duration of training. Fields of specialization will include Crop Breeding, Crop Protection, Agronomy, Engineering (Irrigation, Water Management), Agricultural Economics, Seed Technology, Extension and Grain Quality. Location for MS-level degree training will be in the United States and third countries with all degrees to be completed and students returned to Burma by October 1986.

In addition, short-term training for 70 individuals will be scheduled throughout the life of the project at specialized institutions in the United States and third countries. Fields of study will be sub-categories within the same specializations listed for MS degrees, plus other specialized training in subjects such as fertilizer procurement that are related to the project. The SRUB views this type of practical, short-term training as the most immediate response to its needs and the number of participants has therefore been kept as high as possible within the limitations of available funds while still retaining sufficient budget for PhD and MS training essential to provide depth in long-term research and institution-building.

Specific cost information is included in Annex B. On the SRUB side, it should be noted that a commitment will be made when necessary to utilize the Foreign Language Institute in Rangoon to bring the English language capability up to levels required for admission to receiving universities. A scarcity of younger students with English is becoming a major constraint in Burma owing to policies which until recently had de-emphasized the learning of English at grade school levels. The project will almost certainly encounter needs for time to be set aside for special language learning through the Foreign Language Institute, to be budgeted as a local cost item covered by the SRUB. This may affect the timing of starts for PhD and MS degree training and argues all the more forcefully for advanced

planning for the training component.

Finally, for all overseas degree opportunities, the SRUB follows a competitive announcement, examination and selection procedure which will be built into the planning schedule. While causing some additional delay in selection, this procedure will help to quarantee high-quality candidates, and may even accelerate placement if English language qualifications are included in selection criteria.

III. A.

IO. Technical Assistance Requirements

a. AID Contribution

The project as proposed will require an estmated 13 person years (PY) of long-term technical assistance, which is equivalent to an average of three (3) long-term specialists during a 4 1/2-year period. (The remaining 1/2 year at the start of the project will be used to contract for the technical assistance team, as summarized in Part V. B. 1.)

Draft scope of work and technical qualifications of long-term specialists are included in this section. It is proposed that a total of four (4) individuals comprise the project-financed team, as follows:

	Person-Years (PY)
Intensive Program Agronomist	4 1/2 PY
Water Management/Irrigation Specialist	4 1/2 PY
Seed Technology Specialist	2 PY
Crop Protection Specialist	2 PY
	13 PY

Short-term assistance is also required. A total of 50 person-months (PM) is proposed, consisting of one-to two-month consultancies, and identified in preliminary scheduling as follows:

Technical Area	Man Months Per Year of Project (year) 1	2	3	4	5	Man Months Total
Seed Technology		1	1	1		3
Rhizobium	1	1	1			3
Soil Testing		1	1	1		3
Ag Mechanics	1	1	1	1		4
Farming Systems Irrigation			1	1	1	3
Cropping Systems		1	1	1		3
Computerization in Management			1	1		2
Research Planning		1	1	1		3
Extension Material and Extension Development		1	1	1	1	4

Technical Area	Man Months Per Year of Project (year) 1	2	3	4	5	Man Months Total
Integrated Pest Management	2	1				3
Land Use Planning			1	1		2
Weed Control				2	1	3
Insect Control		1	1	1	1	4
Land Drainage			1	1		2
Grain Storage				1	1	2
Rodent Control				1		1
Disease Control		1	1	1	1	4
						50

The long-term experts in seed technology and crop protection will be needed towards the beginning and towards the end of the five-year project, respectively. The project seed farms will be constructed and equipment installed during the first three years of the project. Crop protection will become increasingly important as acreage under production expands during the last three years of the project.

One of the two long-term experts scheduled for the full duration of the project will, in addition to performing technical duties, be designated as Team Leader. There will be continous operational management decisions which must be made by the Project Team and which will require strong administrative ability. This individual, as Team Leader, will have principal liaison and coordination responsibilities including:

a. Leadership and supervision of Project Team in Burma during the period of the project.
b. Principal spokesman for the Project Team vis-a-vis the Agriculture Corporation and in conjunction with the Burmese counterpart team leader assigned to the Project Team by the AC.
c. Principal liaison on the team with the AID/Rangoon Agricultural Development Officer.
d. Principal liaison with universities in the U.S. and the university consortium office responsible for project activities in the U.S.
e. Planning, coordination and supervision of all short-term technical assistance required during the period of the project.
f. Planning, coordination and assignment in conjunction with SRUB selection procedures of all PhD, MS , and non-degree training in the U.S. and third countries.

g. In conjunction with AC and other SRUB officials, coordination of all equipment and machinery specifications, procurement, inventory control and delivery/installation at project sites.
h. Planning, in conjunction with AID/Rangoon and AID/Washington, for annual fertilizer procurements; and monitoring of fertilizer applications each year in the townships included under the project.
i. Coordination of all reports, evaluations and liaison activities of the project with other donors, SRUB officials or AID/Washington visitors.

b. SRUB Contribution

The project will also require assignment of substantial Agriculture Corporation staff. At headquarters, a technical team will be assigned to work as professional counterparts with the AID-financed long-term advisors, constituting the Burmese side of the Project Team. In addition, a substantial number of incremental field staff will be needed by the Extension Division to strengthen its capacity to carry out the project in the intensive and extensive townships. Among these staff will be project coordinators, or project teams, under the supervision of Township Managers, who will have full-time operational responsibilities in each township for the maize and oilseed project. Also required will be sufficient staff to manage and operate the seed farms and assist the ARI in Yezin in strengthening its research on project crops.

Further detail on staffing requirements are discussed in Part V.C., Administrative Arrangements. Budget detail on technical assistance, including local cost support for the Project Team, is in Annex B.

Intensive Program Agronomist

A full time agronomist is critical to the success of this program. There are going to be concentrated high technology sites in the intensive townships for maize, groundnuts, sesamum and sunflower. The Burmese have done an outstanding job in implementing the High Yielding Rice Program which in turn helps them to prepare the way for an intensive program for other crops. However, this is not good enough. A good long-term oil/seed/maize agronomist with familiarity with strong applied production programs, and one who by experience knows the potential that can be reached, is required to help Burmese counterparts to implement the on-farm research/testing work to be initiated on the high technology sites. Some of the factors which necessitate this expertise include:

a. On-farm plant population adaptation.
b. Seed planting depth.
c. Placement of fertilizer (broadcast, banding, hill).
d. Weeding practices (hand vs. chemicals).
e. Crop protection (no. of applications).
f. Cultivation (no till vs. tillage techniques).
g. Harvesting and grain drying techniques.

The qualifications for the agronomist should be broad, general production experience in maize and one or more of the oilseed crops included in the project. Experience in growing row crops under irrigation would be desirable. The major qualification will be the ability to work with small farmers and their problems in addressing constraints to increased production.

Water Management/Irrigation Specialist

A full time water management/irrigation specialist is essential to the success of the project. A striking difference between a major production program in oilseeds and one in rice is that rice is grown when water is available and oilseeds are grown when water is not readily available. Therefore, management of limited water in the soil becomes an important, if not the most important, production variable.

Burma, to date, does not have extensive experience with irrigation water management. This is especially true for small scale irrigation where small amounts of water are applied as supplemental water for fairly drought resistant crops.

Expertise will be needed in development of programs in the intensive areas, in extending them to the extensive areas, and in designing a reliable irrigation system for the seed multiplication units. There are many unknowns which need to be analyzed and resolved before optimal use of irrigation water can be realized. Some of these include:

a. An appropriate way to deliver water to the farms including lifting where necessary, and conveying the water from the source to the fields.
b. The degree and need for land leveling in order to get water spread over the field. Undoubtedly where rice has been grown as a first crop it will be sufficient to use furrowed basin type, this technique will have to be tested and demonstrated.
c. How to use and manage water on and among a few farms must be examined. For example, low lift pumps are of sufficient capacity to irrigate several farms; therefore, to be efficient they should be operated cooperatively among several farmers.
d. Economic considerations must be investigated such as how many irrigations will produce the optimum benefit per unit of cost.

The irrigation expert should be broadly experienced in on-farm engineering and agronomic aspects of irrigation. Formal training could be in agricultural or irrigation engineering, agronomy or general agriculture; however, experience must have been in design, development operation, and maintenance of small-scale irrigation systems at the farm level. In addition to these specific project-related activities, there will be a role as advisor on irrigation matters at the research station and with other Agriculture Corporation programs where irrigation water use is important.

Seed Farm Specialist

The Agriculture Corporation plans to establish three 500-1000 acre seed farms under the SRUB/AID Maize and Oilseed Production project. It is intended that these seed farm units will be mechanized and have on-farm seed processing capability. The seed farms will produce foundation and certified maize, sesame, groundnut, sunflower, and soybean seed. Because the farms will be highly mechanized from production through seed processing, there is a requirement for management skills for the first few years which may not be available in Burma. In addition to the seed farm operational management, there will be a unique requirement for agronomic management where three crops per year can be grown and the associated water management that goes with the program. Specifically, the seed farm specialist will be an individual with the following expertise:

a. Certified seed production experience.
b. Seed processing facility management.
c. Irrigation and farm management experience.
d. Mechanized farming experience.
e. Coordination, planning and implementation of seed production programs where multiple cropping patters are developed.
f. Farm management expereince where the most effective cropping rotations are established.
g. Ability to identify and attract short-term assistance as required.

The seed farm specialist should be a person with considerable experience in seed farm management and operation. The person should have prior international experience, preferably in Asia, and the ability to provide on-the-job training to Burmese counterparts who will assume active management of the farms.

B. Economic Analysis

Introduction

The economic analysis for the project is approached from three points of view:

- The economic feasibility or profitability for individual farmers of adopting improved practices, specifically improved seed, chemical fertilizer, inoculum for legumes and pest management when pests reach an economic threshhold.

- The rate-of-return to the project in macroeconomic terms when all of the various factor costs including incremental services, facilities, inputs and increased outputs are compared, using local market cost and output prices.

- The direct foreign exchange costs and benefits of the project.

1. Farm-level Costs and Returns

Several efforts have been made to estimate costs of production per acre for different crops. However, most suffer from the difficulty of obtaining reliable cost data on the over-all farm enterprise and even more from the difficulty in allocating costs of production inputs by commodity, especially costs of fixed assets such as labor, draft power, machinery and land.

Cost data for 1976-77 were assembled by the World Bank for major crops including paddy, oilseeds and fiber crops (Table 19). Costs of production for both groundnuts and sesamum are based on traditional practices with little or no chemical fertilizer on most fields and with poor tillage practices. Inoculum of uncertain quality is applied on some groundnuts. Results show average production costs well below average market prices. No comparisons are available for low and high technology for oilseeds or maize, but they are available for rice. These show a reduction of costs of production as farmers shifted from traditional practices to HYVs and to use of fertilizer. Very little of any crop, other than cotton, is covered by pesticides. Similar animal-drawn implements are used for all crops, including HYV programs for rice.

Table 20 compares costs of production and prices per unit for selected crops and Table 21 shows profits per acre for major crops. All the data show substantial losses on traditional paddy production systems, yet farmers continue to produce paddy under these systems. Part of the explanation offered is the profits on other crops. Paddy is necessary to meet subsistence needs of the family and to a certain extent required by the Government. Another notable aspect of oilseeds compared with paddy,jute and cotton is that as monsoon crops the latter have peak labor requirements when labor is scarce. Oilseeds grown as second crops will permit spread of employment over the year.

It can be safely concluded that farmers will continue to plant a substantial area to oilseed and maize. In the past this has averaged about five million acres per year. The principal issue in determining the farm-level feasibility of the project is determining the incremental costs and returns from application of improved seed, fertilizer, inoculum and pest management to cropping systems similar to those which now exist. Estimates of costs of purchased inputs and return have been prepared for traditional, medium and high technology, based on current prices to farmers. Incremental production has been estimated and valued at current prices (Table 22). Marginal revenue relative to marginal cost is extremely high in absolute terms for groundnuts and sesamum. For both crops the marginal return at current prices over the marginal cost of seed, fertilizer, inoculum, pest management (and lime for high technology groundnuts) is between 16:1 and 19:1. For sunflower the ratio of marginal return/marginal cost is between 9:1 and 10:1. Returns to soybean production, a crop which may be introduced during the project on a limited basis, do not appear, on the surface, to be as favorable. A high subsidy on urea favors other crops but not soybeans or groundnuts. If urea were priced at the world market price, groundnuts and soybeans, which are able to fix their own nitrogen (with suitable inoculant), would compare more favorably with chemical nitrogen-requiring crops (rice, sesamum, sunflower, and maize). However, the evidence clearly indicates a favorable rate of economic return at the farm level at current crop prices for all crops included. Crop prices and physical input/output relationships are sufficiently favorable to permit a significant increase in local urea prices for crops covered by the project without impairing the project feasibility.

World prices rather than internal prices have been assumed for soybeans, since there presently is little internal demand for soybeans for processing.

Spread Effect:

Use of improved seed and inoculum on groundnuts by individual farmers not involved directly in the project will have a beneficial spread effect. This will occur (a) by buying improved seed from neighbors and buying inoculum from the AC, or (b) by buying only inoculum.

Either of these steps will produce a substantial increase in groundnut production at nominal cost. Seed costs will be about the same and inoculum will cost K 4-7 per acre. Returns with good inoculum should increase by a minimum of 5 to 10 baskets per acre valued at K 200 to K 400 for a marginal return over marginal cost of 193 to 396 and a $\frac{MR}{MC}$ of 20:1 or more.

TABLE 19

Agriculture Corporation Farm Budgets by Crop, 1976/77

	In Kyats			
	Cash	Own	Total Cost	Cost per Acre
Paddy LV (10 acres)				
Labor	1,096.00	2,378.00	3,474.00	347.40
Inputs (seed 40 lbs)	409.50		409.50	40.95
Land tax	35.00		35.00	3.5
Total:	1,540.50	2,378.00	3,918.50	391.85
Cost/basket				
@ Yield 33 baskets				11.87
@ Yield 40 baskets				9.80
Paddy HYV (10 acres)				
Labor	1,268.00	2,045.00	3,313.00	331.30
Inputs (seed $6 lb)	712.38		712.38	71.24
Land tax	35.00		35.00	3.50
Total:	2,015.38	2,045.00	4,060.38	406.04
Cost/basket				
@ 49 baskets				8.29
@ 60 baskets				6.77
Groundnuts Winter (3 acres)				
Labor	478.00	875.00	1,353.00	451.00
Inputs (Seed 150 lb)	1,170.00		1,170.00	390.00
Land tax	9.00		9.00	3.00
Total:	1,657.00	875.00	2,532.00	844.00
Cost/basket @ yield of 30 baskets				28.13
Groundnuts Monsoon (3 acres)				
Labor	28.00	1,010.00	1,038.00	346.00
Inputs (seed 150 lb)	1,091.00		1,091.00	363.67
Land tax	9.00		9.00	3.00
Total	1,128.00	1,010.00	2,138.00	712.67
Cost/basket @ yield of 25 baskets				28.51
Sesamum Long-Period (2 acres)				
Labor	24.00	214.00	238.00	119.00
Inputs (9 - 10 lb seed)	136.00		136.00	68.00
Land tax	3.00		3.00	1.50
Total:	163.00	214.00	377.00	188.50
Cost/basket @ yield of 2.25 baskets/acre				83.78

Table 20

Estimates of Costs by Agriculture Corporation for 1976/77 and Prices received by Farmers, 1976/77
(in Kyats)

Crop	Unit	Costs	Free Market Price (CY 1976)	Monopoly Purchase Price 1975/76	Monopoly Purchase Price 1976/77
Paddy, Local Strain 1/	Basket (46 lbs)	11.87	11.59	9.00	9.00
Paddy, HYV 1/	Basket (46 lbs)	8.29	11.59	9.00	9.00
Cotton, Long Staple	Viss, Seed Cotton	6.29		5.50	7.00
Jute, Monsoon	Viss	3.05		2.70	3.10 2/
Jute, Premonsoon	Viss	2.91		2.70	3.10 2/
Groundnut, Winter	Basket (25 lbs)	26.38	48.00	-	-
Groundnut, Monsoon	Basket (25 lbs)	35.63	48.10	-	-
Chilli	Viss	8.8	14.00 3/	-	-
Onion	Viss	1.18	4.50 3/	-	-

1/ Surplus area, at yields of 33 baskets per acre for LV and 49 baskets per acre for HYV.

2/ First Grade, 1976/77; prices for other grades are lower.

3/ 1975.

Table 21

Profits per Acre from Selected Corps, 1975/76
(K per acre)

Paddy, AC Budget (Local Variety)/a	- 94.71
Paddy, 100 Farm Sample, All Varieties	50.00
Paddy, 100 Farm Sample. Local Variety	31.00
Paddy, 100 Farm Sample, HYV	62.00
Cotton	- 79.00
Jute	
Monsoon	- 59.50
Pre-monsoon	4.80
Groundnuts	
Winter	578.10
Monsoon	472.25
Sesamum	928.26

/a Based on yield of 33 baskets per ac.

TABLE 22

Estimated Marginal Cost and Marginal Revenue per acre to Farmers of Application of Modern Yield Increasing Inputs and Practices (Improved Seed, Fertilizer, Inoculum, Pest Management.)

Crop/Price	Seed Cost	Fert Rate	Fert Cost	Pest	Yield (Baskets)	Input Costs	Crop Value	MR-MC	Return Ratio: Crop Value / Input Costs	Return Ratio: MR / MC
Pady K9/B		Lbs urea TSP/MOP								
Ordinary	9	-	-	-	30	9	270		30:1	
HYV-Intensive	12	112-56-28	57	30	60	99	540	180	5.5:1	3.0
HYV-High Tech	12	224-112-56	113	60	100	185	900	454	4.9:1	3.6
Groundnuts K40/B										
Traditional	240 1/	3-3-1	4		25	244	1000		4.1:1	
Intensive	240 1/	56-56-0+INC	45	15	52	300	2080	1024	7:1	19
High Tech	240 1/	0-112-112+INC	147 2/	30	100	417 2/	4000	2837	9.5:1	18
Sesamum K120/B										
Traditional	30	-			2.25	30	275		9.2:1	
Intensive	40	84-56-0	44	15	10	99	1400	1056	11:1	16
High Tech	40	168-112-112	119	30	20	189	2800	2366	13:1	16
Sunflower K40/B										
Traditional	30	-	-	-	15	30	600	-	20:1	
Intensive	30	56-56-0	40	15	30	85	1200	549	14:1	11
High Tech	30	168-112-56	107	30	50	167	2000	1279	12:1	10

1/ Traditional 6 Basket/acre at K40; Intensive, High Tech 3-4 baskets at K70-80 for improved seed.

2/ Assumes 1 ton of lime every 3 years at K150/ton.

TABLE 22

Crop/Price	Seed Cost	Fert Rate	Fert Cost	Pest	Yield (Baskets)	Input Costs	Crop Value	MR-MC	Return Ratio: Crop Value / Input Costs	Return Ratio: MR / MC
Maize K20 /B										
Traditional	10	-	-	-	15	10	300 3/		20:1	
Intensive	20	112-56-28	64	30	55	114	1100	696	10:1	8
High Tech	20	224-112-112	128	40	100	188	2000	1522	10.6:1	9.5
Soybean K55/B										
Intensive	50	0-28-28+INC	28	20	12	98	660		6.7:1	
High Tech	50	0-112-112+INC	147 4/	30	25	227	1375	586	6.1:1	5.5

3/ For about 80,000 acres of traditional varieties farmers sell ear sheath (husk) for smoking purposes at about K6-7/Kg with yields of 90 Kg/acre, this would be about K550/acre.

4/ Assumes 1 ton of line every third year.

2. Macro Economic Return

a. Direct Effects

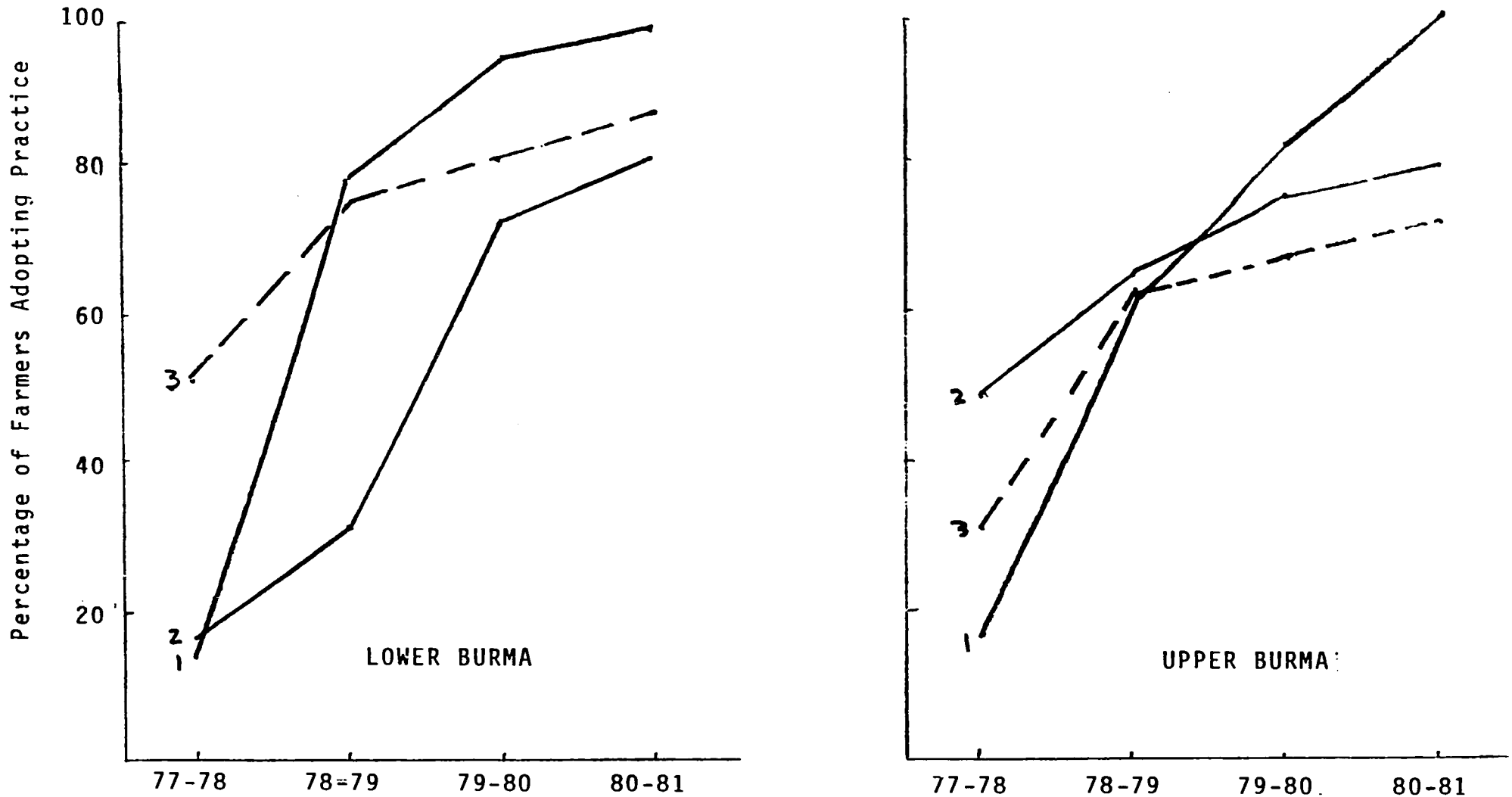
Returns to this project will depend on the success in introducing improved technology, on supply of inputs, on the rates of adoption actually achieved by farmers, and on ability to market the increased produce. Review of progress made by the SRUB in the Whole Township rice program points to a high rate of adoption if the other three elements can be put in place. The proposed technology, though not simple, is fairly well known to agricultural scientists and much of it has been or is being tested in Burma. The inputs and marketing, discussed in separate sections, appear to be adequately provided for, at least in the initial phases. Marketing and storage will require continuing close attention.

Agriculture Corporation personnel have established production targets and adoption rates on acreage directly affected in the project as shown in Table 23. The project appraisal team has reviewed Agriculture Corporation experience and plans for inputs and outputs and considers them to be very realistic. Figure 3 shows experience with rice under the Whole Township program.

These rates of adoption are expected to lead to increases in production, value of production by Year Five, and total value for the five years as shown in Table 24. Value of total production for five years from fertilizer-supplied acreage in the project will increase by K 1,160 million.

FIGURE 3

Adoption of Technology (Paddy Production)



1. Recommended plant population per hectare.
2. Recommended HYV seed

Table 23

Estimated Adoption Rates and Direct Increase in Crop Production under the Project

(all data in thousands)

Crop	Total Acres			Year 5 Acreage			Year 5 Production			Cumulative total production increase by end of 5 years	
							Production	Increase over base			
	Int.	Ext.	Total	Int.	Ext.	Total	Baskets	Baskets	MT	Baskets	MT
Maize	328	45.2	373.2	105	24.4	129.4	7540	5480	137.0	15,000	375.0
Groundnut	176	212	388	50	71.2	121.2	7270	4040	45.9	11,000	125.0
Sesamum	148	164.2	312.2	40	54	94	930	690	16.9	2,000	49.1
Sunflower	90	25.4	115.4	30	14	44	2140	1700	24.7	4,500	65.5
Subtotal oilseed:	414	401.6	815.6	120	139.2	259.2			87.5		239.6
Total:	742	446.8	1188.8	225	163.6	388.6					

Int. - Intensive Townships (8)

Ext. - Extensive Townships (20)

TABLE 24

Estimated Production and Farm-Level Value (K million, $ million) of Directly Affected Acreage

Crop	Price	Increase over base in Year 5			Cumulative total increase over base through year 5		
	K Basket	(000) Baskets	Value K	Value $	(000) Baskets	Value K	Value $
Maize	20	5,480	109.6	15.2	15,000	300	41.7
Groundnut	40	4,040	161.6	22.4	11,000	440	61.1
Sesamum	120	690	82.8	11.5	2,000	240	33.3
Sunflower	40	1,700	68.0	9.4	4,500	180	25.0
Total:			422.0	58.61		1,160	161.1

b. Indirect Returns: Spread Effects

High-yielding production techniques for maize, sesame and sunflower, which are dependent on outside sources of nitrogen, are not expected to spread much beyond the area in which nitrogen and other fertilizer will be supplied under the project. In contrast, groundnuts and soybeans will supply their own nitrogen when inoculated with the proper viable rhizobium as part of this project. The project includes an output target to produce inoculum sufficient to inoculate the entire groundnut and soybean crop areas in the country, totaling 1.7 million acres, by Year Five. Use of improved seed will spread indirectly to a substantial number of farms beyond those directly benefiting from the project. Most, and perhaps all, of the groundnut and soybean acreage covered in the project will benefit from proper nitrogen fixing rhizobium by the end of the project.

Although improved seed normally would be used several years before being replaced and would be expanded several-fold, we have assumed only a 100,000 acre improved seed plus inoculum spread compared with 176,000 acres of intensive groundnut area receiving improved seed directly during the life of the project, mainly in the intensive townships. Improved seed along with inoculum is expected to cover 50% of current groundnut acreage and 50% of new groundnut acres and result in yields of over 50 baskets by Year Five of the project (5 million baskets total from 100,000 acres). Per-acre nutrient requirement for a 50 basket per acre crop is 6 pounds of P_2O_5 and 8 pounds of K_2O both of which should be available in most soils without adding fertilizer. The total increment would be about 3.75 million baskets a year by year five (42,500 MT).

The effect of provision of viable rhizobium inoculum of the correct type to an additional 1.5 million acres with present seed type would be to increase yields by a minimum of five to ten baskets. A five basket increase in yield on 1.5 million acres (or ten baskets on half that area) would add about 7.5 million baskets (85,000 MT) by Year 5. Together these two indirect effects will add about 11,250,000 baskets (127,500 MT) in Year 5,

Soybeans are to start slowly with initial work mainly on production trials and monitoring of utilization. Starting in Year Four, it is estimated that a total of 5,000 acres will be covered by the project. By Year Five a total of 20,000 acres should be covered by the project with yields averaging a minimum of 18 baskets (of 56 pounds). Production will increase by 2,300 MT in year four and 9,700 MT by year five. These combined less direct effects will add K 904 million to gross farm income over 5 years.

c. Combined Direct and Indirect Benefits

The combined direct and indirect benefits of the project, measured in terms of village level prices is expected to be approximately K2,066,046,000 ($287 million) as shown in Table 25.

Table 25

Summary of Direct and Indirect Production Increase and Farm Level Value

Item	(thousands) Fifth Year MT	Fifth Year K	5-Year Total MT	5-Year Total K	Value $ (millions) Fifth Year	5-Year Total
Maize	137	109,600	375	300,000	15.22	41.67
Groundnuts: Direct	(45.9)		(125)			
Spread	(127.5)		(250)			
Total Groundnut	173.4	610,368	375	1,320,000	84.77	183.33
Sesame	17	83,096	49.1	240,001	11.54	33.33
Sunflower	24.7	67,925	65.5	180,125	9.43	25.02
Soybean	9.7	20,952	12	25,920	2.91	3.60
Total:	361.8	891,911	876.6	2,066,046	123.87	286.95

Financial Values Used

Maize K 20/55 lb basket, K 800/MT

Groundnuts K 40/25 lb basket, K 3520/MT

Sesame K 120/54 lb basket, K 4888/MT

Sunflower K 40/32 lb basket, K2750/MT

Soybean K 55/56 lb basket, K 2160/MT

Exchange rate of K 7.2 = U.S. $1.00

Total costs of the project for purposes of economic analysis are estimated as follows:

	Value $ (millions)
Fertilizer	25.0
Machinery	5.0
T.A., Training and Evaluation	5.5
Contingency and Inflation	4.5
Other Project Costs	12.0
Total:	$52.0 million

1/ Includes $8.0 million budgeted by SRUB for local costs plus an additional $4.0 million estimate for additional project-related costs such as fuel, other energy needs, other construction costs and additional supplies and equipment.

Based on the above, the internal benefit/cost ratio of the project, without counting additional farm costs of harvesting and transporting the additional crops, would be:

$$\frac{\$286.95 \text{ million}}{\$\ 52.0 \text{ million}} = \$5.50 \text{ return per } \$1.00 \text{ spent}$$

Even assuming an average of 15% for cost of harvesting and transporting the increased maize and oilseed output to the closest village outlet, the benefit/cost ratio would be:

$$\frac{\$243.81 \text{ million}}{\$\ 52.0 \text{ million}} = \$4.70 \text{ return per } \$1.00 \text{ spent}$$

Either of these constitutes a very good return on investment. We have not attempted to discount the costs and benefits to present value,but both costs and returns occur over a five-year time period and discounts would have to be made to both the cost and benefits sides of the ratio.

3. Foreign Exchange Costs and Benefits

The maximum foreign exchange costs of the project have been estimated as follows:

Fertilizer Imports	$25.0 million (of which AID-financed is $15 million)
Machinery and Equipment	5.0 million
T.A. Training,and Evaluation	5.5 million
Contingency & Inflation	4.5 million
Indirect FX Costs	7.0 million 2/
Total:	$47.0 million

2/- Estimate includes other machinery and equipment, spare parts, supplies, energy,pesticides.

Based on present level extraction rates from village level processing, the project is expected to produce the following increase in products for local consumption or export, (MT and dollars are both in thousands):

	Increase over base			
	Year 5		5 Years Total	
	MT	Value US $	MT	Value US $
Maize	137	18,495	375	50,625
Groundnut	173.4		375	
Oil (28%)	48.55	33,985	105	73,500
Cake (37.5%)	65.03	14,631	140.62	31,640
Sesame	17		49.1	
Oil (37%)	6.29	4,403	18.17	12,719
Cake (61%)	10.37	2,333	29.95	6,739
Sunflower	24.7		65.5	
Oil (18%)	4.45	3,115	11.79	8,253
Cake (80%)	19.76	3,196	52.40	8,384
Soybeans	9.7	2,862	12	3,540
Totals:		$83,020		$195,400

Prices: Maize FOB $135/MT; Soybeans FOB $295/MT; Oils CIF $700/MT; Sunflower oilcake FOB $160/MT; and other oilcake FOB $225/MT.

The project will result in a foreign exchange saving/earning of U.S. $195.4 million for the five years with foreign exchange cost of $47.0 million. Thus, the net return on foreign exchange will be $148.4 million and the benefit/cost ratio, $\frac{\$195.4 \text{ million}}{\$\ 47.0 \text{ million}} = 4.16$

Considering direct effects only, i.e., excluding effects of inoculum and know-how on groundnuts and soybeans not supplied with fertilizer, the benefit/cost ratio would be $\frac{\$121.4 \text{ million}}{\$\ 47.0 \text{ million}} = 2.58$

4. Effects on Vegetable Oil Supply Per Capita

Over the five years, the project will provide a total increase in vegetable oil production of 135,000MT worth approximately $94.5 million using village level processing technology which leaves approximately ten percent residual oil. By Year Five (1985-86), the project will increase production by 59,000 MT per year of edible oil per capita (slightly more than 30 percent increase in per capita supply). For a further discussion of supply, price and demand for vegetable oil, oilcake and maize, refer to Annex E.

C. Social Soundness Analysis

1. Introduction

The Maize and Oilseed Production Project represents AID's first involvement in Burma's agriculture sector in almost twenty years during which period little socio-anthropological research has been done in the country. Almost nothing has been written on rural society in Burma which begins to describe the present socio-cultural setting for development and the rural villagers' receptivity for the kind of accelerated agricultural production program that the Government is now emphasizing. Complete and detailed farm family profiles do not exist. Accurate production, income, savings and consumption data are difficult to obtain. Despite these obstacles this social soundness analysis will attempt to describe the general socio-economic situation in the States/Divisions of Upper and Lower Burma that comprise the project target area. An attempt will be made to characterize the peasant farmer participant and beneficiary; particularly how he or she interacts with the village leadership structure and with various political and technical actors at the village tract and township levels. This social soundness analysis must be considered tentative and is only the first step toward understanding rural Burma and the potential for continued expansion of agricultural production activities.

Some attempt will be made to define the role of women in Burma's agricultural development. Emphasis will be made on the advantages of the Burmese political structure which seems to encourage an unusually high degree of villager participation in development activities.

The central issues to address from a viewpoint of social soundness of the project are: (a) whether the experience of the Whole Township rice program can be adopted for intensive maize and oilseeds production; (b) if so, whether sufficient social as well as economic incentives exist to induce wide farmer participation in the project; (c) what the spread effect will be in terms of maize and oilseeds production expansion within and outside the project area; and (d) who will benefit?

2. Socio-Cultural Feasibility

The project area includes 28 townships in Upper and Lower Burma. Farmer participants in these townships are already involved in some cash crop agriculture and are probably members of a village-level peasants' Agricultural or Cooperative Society. They will have some general awareness of, if not personal experience with, the high-yielding techniques and improved production levels in the Whole Township rice program.

In Burma, literacy is high (67% generally) and among most rural farm families someone can read and write Burmese. Communication and information dissemination by the central government successfully reaches down to the village level, and the high priority given to agriculture, production campaigns, and export drives has been widely publicized.

The most important single difference between the two project regions is water availability. While Upper Burma averages only 30 inches of rain per year, Lower Burma receives 100 inches annually. This accounts for variations in current cropping patterns as well as cultivation practices. (Table 26). The increase in maize and oilseeds production contemplated in the project will involve (a) encouraging farmers in Upper Burma to expand rainfed cultivation of maize and oilseeds through the use of new seed varieties, fertilizers, and improved cultural practices,making double- or triple-cropping possible; and (b) encouraging farmers in Lower Burma to undertake maize and oilseeds cultivation as a second crop using residual moisture following the paddy harvest.

Burma's rural population comprises roughly 78% of the total. Of an estimated current population of nearly 34 million, approximately 26 million people reside in rural areas. National per capita income is $150, slightly lower in rural areas. As a result of both continued population growth (at an official rate of 2.2% per year) and a series of land reform measures begun in 1948, the number of acres per farm family has dropped from a national average of 5.5 acres to an average of 4.8 acres. The average farm size in the target area is 6.4 acres (Table 27). However, the composition of the labor force has not changed significantly; nearly two-thirds of all employed persons continue to be categorized as agricultural workers (Table 28). In the absence of significant increases in off-farm employment opportunities, this reveals the importance of increasing yields, as well as acreages, both for direct consumption and as an income generator. Furthermore, unofficial estimates place rural un- and under-employment at more than 25%.* This suggests that except at times of transplanting and harvesting when labor is short, seasonal unemployment is very high, so that additional employment (and income) to be generated by the project will be possible.

a. Existing Farm Practices/Farm Management.

Agriculture continues to be the main occupation for the majority of Burma's population. The average farm size is small, yields per acre are low, family incomes are low, and staple food requirements tend to be homegrown. Nonetheless, Burmese farmers are not subsistence farmers; they are familiar with the relationship of inputs to increases in yields, they occasionally hire labor, and they are raising cash crops. In short, they view farming as an enterprise.

It is a widely held view (by the Government and many donors) that Burmese farmers have demonstrated their willingness to adopt new superior varieties, new inputs, and new cultural practices when their value has been demonstrated. Failure to improve yields (outside of paddy production) is attributed more to insufficient and erratic supplies of essential inputs, including improved seed, fertilizers, insecticides and extension personnel, than to some inherent resistance to their use.

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* Millard Burr, "Aspects of Burmese Development, 1970-1979," Unpublished manuscript, Copyrighted 1979, Chapter III.

Other constraints include too few and inadequate farm implements and lack of irrigation. Animal power (bullock or buffalo) is relied upon for land preparation and cultivation. Four basic, locally-manufactured implements, all animal-drawn, are used: a wood turning plow, a harrow, a cultivators, and a two-wheeled cart. Planting, seeding, fertilizing, spraying and harvesting tends to be done by hand labor.

The Burmese farmer has become accustomed to sharing farm management decisions with the Government. For many industrial and commercial crops, the Government prepares annual production targets aimed at attaining self-sufficiency in food, producing raw materials for agro-allied industries, and producing exports. After discussions and review at the state, township, village tract and village levels, individual farmers are assigned specific acreages or production quotas and provided essential inputs and services by government extension agents and cooperative societies. For crops with controlled prices, such as paddy and maize, the farmer is required to sell specific quantities or percentages of the harvest to the Government at the controlled prices. Oilseeds at present are sold at a "free-market" price to cooperative or private traders, although effective quota systems operate in conjunction with the cooperatives. Cultural practices, including decisions regarding crop production and harvesting, are generally left to the farmer. Government farm management assistance, including water management, is handled by the Agriculture Corporation's Extension, Irrigation, and Mechanization Divisions, in collaboration with the township and village People's Councils and the township and village tract Agricultural Cooperative Societies, to which heads of farm households are expected to belong.

b. The HYV Paddy Production Experience.

In order to hasten diffusion of high yielding varieties of rice, a selective-concentration strategy was devised by the Burmese. Its five components include (1) promotion of a correct and proven new technology which includes new varieties and improved cultural practices; (2) guidance and coordination from the Burmese Socialist Program Party (BSPP) down through elected local officials who have the authority to coordinate the activities of various governmental agencies; (3) selectivity and concentration on the provision of appropriate HYVs to townships with high potential by extension personnel and management who are carefully selected for participation; (4) mass participation by non-farmers from urban areas during peak labor periods (transplantation and harvest), as well as carefully timed participation by the farmer; and (5) emulation and competition fostered by awards to producers with the highest yields.

Figure 4 illustrates the administrative structure established for planning, guiding and implementing the paddy program which is to be adopted for promotion of maize and oilseeds. While the BSPP provides overall policy guidance, and the Agriculture Corporation provides technical inputs and services, elective bodies (People's Councils) at the township, village tract, and village levels implement and monitor the program.

Available evidence shows that farmer acceptance of new technology using the Whole Township approach has been high. In fact,it has exceeded expectations. This is attributed to a combination of factors, including fundamentally the profitability to the participating farmers and farm families as expressed in increased real income, and the mix of social and peer pressures encouraging participation. In a system which is organized to promote mass cooperation, the village and village tract People's Councils exercise a powerful influence. This does not mean that farmers are coerced into cooperation, but agreeing to go along with the recommended innovations is a path which gains acceptance and which, thus far, has proved economically sound.

In Burma, it should also be pointed out, all land is owned by the State and only usufructual rights belong to the peasant/farmer. These rights cannot be passed on to legal heirs without the consent of the Village People's Council which, in theory, can redistribute the land to an entirely different family when a farmer dies. In practice, it is understood that this drastic measure is seldom invoked, but one would take at least some pains to avoid offending the leadership of the village.

Given the overall success of the Whole Township paddy program, and given the farm-level economic benefits expected for expanded maize and oilseed production, it is therefore reasonable to assume that the selective-concentration, Whole Township system will be socio-culturally feasible when applied to maize and oilseed crops. Although the somewhat less advanced state of technology will introduce some element of risk, all of the project crops are recognized for their importance and oilseeds, in particular, for their place in the Burmese diet via edible oils.

The challenge for the Government is to maintain the high degree of enthusiasm now evident, to preserve the package of incentives required for the peasant/farmer to take risks, and to be both responsive and flexible in handling implementation problems and in modifying the strategy as appropriate.

3. Diffusion of Innovation: Spread Effects

The established Burmese approach to development planning entails centralized policy-making and resource allocation coupled with peripheral and local decision-making, implementation, and monitoring. Since the central level, including the Ministry of Agriculture and Forests and, one would assume, even higher levels of government and state, is committed to the program, the political/administrative atmosphere should be quite favorable. Elected local officials will presumably endorse the program to farmers and encourage their cooperation. Furthermore, as discussed above, through production loans and other government programs which tie the provision of inputs and services to production targets, the SRUB has powerful incentives for farmer participation.

Diffusion of innovations will emanate principally from an action/research program on "high technology sites" in the project's intensive townships, involving field-testing of research results from international institutions as well as the Agricultural Research Institute in Yezin. On the high

technology sites, farmer cooperators, extension agents, local administrative and BSPP representatives will learn more about implementation constraints, new (but not necessarily mechanized) cultural practices, proper application techniques for fertilizer and pesticides and the efficient use of water for irrigation. On-farm research emphasis is important because much less is known about the production technology of maize and oilseeds than of paddy.

The maize and oilseeds production program is based on successful experience with what the Burmese call a selective - concentration system of extension. This system has been described in the preceding section and is illustrated by Figure 5. The SRUB developed this system as a result of unsuccessful attempts to diffuse HYV's beginning as early as 1966. At the suggestion of the IBRD, the Training and Visit (T&V) system of extension had been introduced in Burma as the extension method for introducing the HYV's new production technology. However, under Burmese conditions, the T&V system did not assure adequate technological diffusion. Therefore, the new selective-concentration approach was developed in conjunction with the HYV paddy program in the mid-1970's.

Based on rapid expansion of the paddy production program, there is every reason to believe that diffusion of both the new varieties and improved cultural practices will be just as rapid under the maize and oilseeds production project. However, the number of extension personnel may determine how rapidly diffusion can occur simultaneously with continued SRUB emphasis on the paddy program. As the intensive areas are developed and operating well, the maize and oilseeds program will be expanded into the extensive areas, where it is believed that the use of some fertilizer and improved seed (without full extension services) can still have significant effects on yields.

The Maize and Oilseeds Production project will have both direct and indirect spread effects in terms of expanded adoption of new techniques and inputs by cooperating farmers. Some 200,000 farm families are expected to participate directly in intensive and extensive coverage townships. The spread effect will cover an estimated 400 - 750,000 additional farmers in other townships as they gradually adopt improved groundnut and soybean cultivation practices and rhizobium inoculum on up to 1.6 million additional acres.

Estimated Number of Farm Family Beneficiaries*

Direct:	Producers in 28 participating townships:	200,000 farm families
Indirect:	(1) Groundnut and soybean producers supplied with improved seed and inoculum	60,000 farm families
	(2) Groundnut growers supplied with project produced inoculum only	400-750,000 farm families
	Total Beneficiaries:	660-1,010,000 farm families

* At an average of six people per family, the total farm producer beneficiaries would be 3,960,000 to 6,060,000.

4. Incidence of Benefits

a. Direct Benefits

As summarized above, direct beneficiaries of the project will be the farmers and farm families in the 28 intensive and extensive townships selected for participation. Some 200,000 participating farm families will benefit immediately from the provision of improved seeds, inputs and extension services. Wide acceptance of the new production packages should have a multiplier effect and translate directly into increased yields, more rural employment (from double and triple cropping in irrigated areas), and increased rural incomes. Just how much will farmer participants benefit?

The farm-level economic analysis shows clearly that farmers who participate in HYV programs generally will make a larger profit than by remaining with the traditional varieties and cultivation practices. The ratio of marginal return to marginal cost for a farm family which cultivates two acres of HYV paddy, for example, is 5:5 to 1 or a net profit of K 360. Those who produce paddy on "high technology sites", using labor intensive weeding, spacing and some improved mechanization, are estimated to gain K 908 net of expenses. With maize and oilseeds production, the profit margin increases markedly.

Groundnut and sesamum, according to the economic analysis, show the highest marginal revenue versus marginal cost net return, at 19:1 and 16:1, respectively. Translated into real profit terms, a farm family that plants two acres of groundnuts, using the intensive package, can expect to gain K 2,048, on five acres K 5,674, and on ten acres up to K 14,185 in profit. (The average planting area for oilseeds is expected to be about two acres per farm family.) HYV sesamum production should yield K 2,112 per two acre plot, net of expenses.

The profit possibilities should be a powerful incentive to participate in the program -- both in the intensive and extensive townships. The most obvious constraint to rapid expansion of maize and oilseeds production -- and thus, rural incomes -- will be the SRUB's ability to provide extension services, inputs and credit in a timely manner. In the case of oilseeds production, the marketing mechanism must be as free as possible to allow the farmer a choice as to where to sell and at what price. There is some evidence that, although oilseeds, unlike paddy and maize, are not sold at a controlled price, some local cooperatives which are charged with buying oilseeds production have been setting de facto quotas. More study should be made on this apparent problem.

Other beneficiaries from this program will be those employed at the seed multiplication farms and seed processing centers, and the additional employees eventually required at expanded oil extraction facilities. Finally, trainees at all levels, from Agriculture Corporation officials to researchers and extension personnel to local officials and farmers, will benefit directly.

b. Indirect Social Benefits to the Nation

Farther-reaching and longer-term social benefits will accrue to the Burmese nation from successful expansion of maize and oilseed production. On the individual level, these include: (1) greater availability of edible oil (estimated at 30% or about 2.2 lbs. per capita by the fifth year of the project) leading to improved nutrition and therefore reduced morbidity and mortality, especially among infants, young children, and pregnant and lactating women; and (2) reduced un- and under-employment and higher incomes. In the aggregate, as detailed in the macro-economic analysis, longer-term benefits also include: (3) edible oils import substitution and subsequent foreign exchange savings; (4) greater exports of maize and oilseed cake; and (5) an expanded livestock industry. Finally, successful adaptation of the HYV selective-concentration extension system to maize and oilseeds will expand the local participation element in Burmese development. Although policy direction, inputs and services originate from the central government, planning and implementation are a function of local participation of both farmers and elected officials.

5. Role of Women in Agriculture

This social analysis will not attempt to define the role of women in Burma's development nor in the agriculture sector. Sufficient data and analyses do not exist to paint a complete and accurate composite of the rural woman. We do know, though, that Burmese women are independent and accustomed to an unusually high degree of freedom compared to some other Asian nations. Even when married, they carry their dowry and maiden name with them throughout life. In today's Burma the literacy rate is almost 70 percent and among women generally is only slightly lower. Women are generally allowed to participate in every sector of the society and are encouraged, for example, to compete for regional college and university seats. Women now account for about fifty percent of university graduates in Burma.

In agriculture, Burmese women play a significant role both in direct production and in making basic farm management decisions. Household budgeting, adoption of new cash crop technologies, dealing with Government agency representatives, and actual field work and marketing of crops, are all parts of the role women play. At the farm level, women will exert an important influence in the decision of the average farm family to participate in the maize and oilseeds program.

Recently, women have begun to make up as high as sixty percent of the enrollment in agriculture colleges and institutions. The Agriculture Institute in Yezin accepted 250 women out of 400 incoming first-year agriculture students in 1980. It is estimated that the Government can offer employment to only 15-20 percent of women agriculture graduates in its various agriculture programs.

FIGURE 4

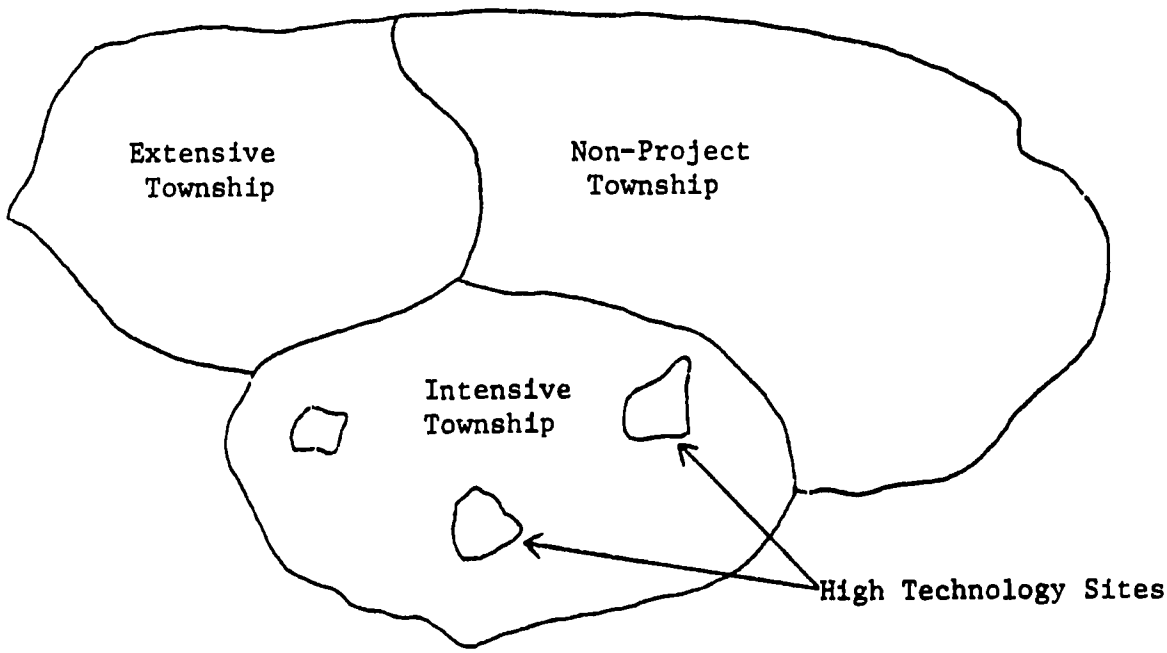
AGRICULTURE PRODUCTION ADMINISTRATIVE STRUCTURE

Organization Levels	Technical Inputs/Services	Implementation/Monitoring	Policy/Coordination
Central	- Ministry of Agriculture/Forests - Agriculture Corporation	Central People's Council	Burma Socialist Program Party
Divisions/States	- Agric. Corp. Division Manager	Division People's Council	Division Party Unit
Townships (15-20 Village Tracts)	- Agric. Corp. Township Manager responsible for average of 7 production camps (one Central camp and 6 sub-camps)	Township People's Council Chairman + 6 Executive Committee Members.	Township Party Unit
Village Tracts (5-10 Villages)	- Agriculture Production Camp - average of 9 extension agents - serve 2-3 village tracts	Village Tract People's Council Chairman + 6 Executive Committee Members	Village Tract Party Section Peasants Association Workers Association Youth Organization
Villages	- Extension Agents		Village Party Cell.

FIGURE 5

LEVELS OF PROJECT EMPHASIS

Extensive - Intensive - High Technology Sites



Non-Project Township is one where the project will not be intentionally implemented.

Extensive Township is one where the particular crop of emphasis has high potential for successful cultivation. Cultivated areas would receive inputs as available and normal extension services. Technologies promoted would be those presently available.

Intensive Township is one in which those areas of the township that have high potential for the crop emphasized would receive all inputs, technical services from production camps, training for farmers, etc. Initially, technologies promoted would be those presently available. New technologies would be provided as they became available.

High Technology Sites are small areas, perhaps a block of 8 - 10 farm units, where newly developed technology would be farm tested and proven using on-farm trials. Successful technology packages developed on these sites would then be moved to other parts of the intensive townships and when feasible to the extensive townships.

Table 26

CROP ACREAGE - 1974/75 (000)

	Riceland Acreage	Other Crop Acreage	Total	Rice as % of Total
UPPER BURMA				
Sagaing	1,306	2,013	3,319	40
Magwe	467	1,923	2,390	20
Mandalay	761	2,470	3,231	24
TOTAL	2,534	6,406	8,940	28%
LOWER BURMA				
Pegu	2,301	528	2,829	81
Irrawaddy	3,318	520	3,838	86
Rangoon	1,296	52	1,348	96
TOTAL	6,915	1,100	8,015	86%

Source: SRUB, Statistical Yearbook, 1975.

Table 27

RURAL POPULATION AND CULTIVATED LAND (000)

(UPPER AND LOWER BURMA, 1973)

	Rural Pop'n	% Rural	Farm Families	Cultivated Acres	Acres/ Family
UPPER BURMA					
Sagaing	2,713	87	493	3,319	6.7
Magwe	2,212	84	402	2,390	5.9
Mandalay	2,692	73	490	3,231	6.6
TOTAL	7,617	81	1,385	8,940	6.5
LOWER BURMA					
Pegu	2,573	81	468	2,829	6.0
Irrawaddy	3,491	84	635	3,838	6.0
Rangoon	956	30	174	1,348	7.7
TOTAL	7,020	67	1,277	8,015	6.3

Source: SRUB, Statistical Yearbook, 1975.

Table 28

LABOR FORCE COMPOSITION

(1965 - 1978)

	1965	1970	1975	1978
Agriculture	64.8	66.7	65.8	65.0
Livestock and Fisheries	1.5	1.6	1.3	1.3
Forestry	0.3	1.6	1.2	1.2
Social Services	5.1	1.3	2.0	2.0
Other	28.3	28.8	29.7	30.5
TOTAL	100.0	100.0	100.0	100.0

Source: SRUB, Ministry of Planning and Finance, 1978.

IV. FINANCIAL PLAN

A. Project Cost Summary

The total project cost is estimated at $48.0 million. The AID contribution is $30.0 million in grant funds, and the SRUB contribution is $18.0 million, equivalent to 62.5% and 37.5%, respectively, of total project costs.

Summaries of the AID dollar commitments and the SRUB foreign exchange and Kyat commitments are shown in Table 29. Of the individual components in the project, fertilizer procurements will total $25.0 million, (52% of total costs) consisting of $15.0 million, or 60%, from AID funds and 40% from SRUB funds in the form of fertilizer procured from foreign exchange. Remaining expenditures are divided nearly equally among technical assistance, training, equipment, and local costs. The latter are to be covered entirely by the SRUB.

Budget detail on all budget items is contained in Annex B. In general, it should be noted that inflation factors have already been built into fertilizer and equipment procurement costs (on a CIF Rangoon basis). Thus, inflation for the AID grant portion of the budget is listed separately (at 15%) for only the technical assistance and training budget items. This includes inflation on the amounts budgeted for overhead/ campus backstop costs of the university contractor selected for the project.

B. Recurrent Costs

This project is incorporated into a major initiative of the Government of the SRUB which will continue after the project ends. Fertilizer requirements for maize and oilseed crops will continue after the project ends. To the degree that domestic production is insufficient to meet demand, or that non-urea fertilizer is required, imports on a medium to large scale will continue to be needed. However, regardless of the future availability of fertilizer from AID or from other donors, the highly favorable foreign exchange effects of this project will strengthen the SRUB's ability to meet costs of future fertilizer and other import requirements as compared with its ability to do so in the absence of the project. In addition, as mentioned earlier, under the project AID will provide technology in the use of rhizobium as a complete substitute for urea on groundnuts and soybean, leading to a substantial reduction of the amount of urea Burma will need in the future compared with requirements in the absence of this project.

Table 29

,ST ESTIMATE AND FINANCIAL PLAN

(US $'000)

Category	AID FX	AID LC	SRUB FX	SRUB LC	Total
Technical Assistance 1/	2,400	-	-	-	2,400
Participant Training 2/	3,000	-	-	-	3,000
Fertilizer 3/	15,000	-	10,000	-	15,000
Equipment 3/	5,000	-	-	-	5,000
Local Costs 4/	-	-	-	8,000	8,000
Evaluation	100	-	-	-	100
Inflation & Contingency Reserve 5/	4,500	-	-	-	4,500
Total:	30,000	-	10,000	8,000	48,000

Notes:
1/ Includes all dollar costs of short-term and long-term Technical Assistance plus a portion of contract overhead.
2/ Includes all dollar costs of PhD, MS and short-term training plus a portion of contract overhead.
3/ On CIF Rangoon basis. Inflation has been included
4/ Local costs will be paid in local currency; includes in-country fertilizer handling and distribution, seed farm construction, training support and project operating costs.
5/ Includes $3,600,000 contingency reserve that may be applied to any FX line item by mutual agreement, and $810,000 inflation reserve for Technical Assistance and Training (inflation has been calculated separately for Fertilizer and Equipment in the appropriate line items).

Table 30

AID AND SRUB FINANCED PROJECTION OF EXPENDITURES BY U.S. FISCAL YEARS ($'000)

	FY 82		FY 83		FY 84		FY 85		FY 86		Totals
	AID	SRUB	AID	SRUB	AID	SRUB	AID	SRUB	AID	SRUB	
Technical Assistance	200	-	480	-	700	-	650	-	370	-	2,400
Participant Training	300	-	600	-	600	-	600	-	900**	-	3,000
Fertilizer	3,720	680	3,820	1,980	3,720	3,080	3,720	4,280	-	-	25,000
Equipment	2,500	-	2,500	-	-	-	-	-	-	-	5,000
Local Costs	-	800	-	2,500	-	2,500	-	1,100	-	1,100	8,000
Evaluation	-	-	-	-	50	-	-	-	50	-	100
Inflation & Contingency Reserve	875	-	1,062	-	1,095	-	1,088	-	380	-	4,500
Total:	7,595	1,480	8,462	4,480	6,165	5,580	6,058	5,380	1,700	1,100	48,000

* -"Expenditures" for purposes of this table means estimated commitments needed pursuant to issued sub-obligating documents, not disbursements.

** - Includes $300,000 for MS/PhD candidates whose training may extend beyond FY 86.

V. IMPLEMENTATION PLANNING

A. Implementation Schedule

A five-year project implementation span is planned, including four maize and oilseeds crop years. The project is scheduled to begin in 10/81 with an estimated Project Assistance Completion Date (PACD) to allow for completion of PhD training lasting as many as two additional years beyond the completion date for the rest of the project (10/86).

Year One of the project will involve key start-up activities involving selection of the long-term university contractor; selection and assignment of trainees for study beginning in the 1982-83 U.S. academic year; initiation of immediate short-term training for Extension Division staff; procurement orders for most of the agricultural equipment required in the project; and procurement orders for fertilizer. Given the necessity to complete these steps on schedule, an interim AID/Burma staffing proposal is included in PART V.C., Administrative Arrangements, to cover project coordination needs preceding the arrival of the contract team and the arrival of the permanent direct-hire Agricultural Development Officer (funded outside the project).

For ease of presentation, the principal steps in implementation, concentrating on Year One start-up, are listed as follows under six separate headings. For fertilizer and equipment procurement schedules, see PART V.B.2.

1. AID Actions Required

7/1/81 - Project Paper arrives in AID/W for technical review.

7/30/81 - Project is approved by AID/Asia Bureau Project Advisory Committee.

7/31/81 - Start of Congressional Notification period and AID/Rangoon advises SRUB of Asia Bureau Project Advisory Committee approval and that authorization of project is in preparation. Text of draft authorization is cabled to field.

8/15/81 - Project is authorized and AID/Rangoon is authorized to negotiate grant agreement.

8/17-8/20/81 - TDY of RLA Muntsinger to prepare the negotiating draft of the Project Grant Agreement based on the authorization language.

8/20/81-9/15/81 - As early in this period as possible, but no later than 9/9/81, project agreement negotiations NTE one week begin in Rangoon. RLA, SER/COM procurement specialist, and TDY USDH Agricultural Officer to be present at the negotiations.

9/1/81-9/30/81 - (a) Draft agreement text as negotiated is reviewed for approval, with signing to take place early in FY-82 when funds are available. (b) PIO/C's and tenders for fertilizer are completely prepared and held.

10/5/81-12/5/81 -When FY-82 funds become available, FY-82 contribution is allotted to AID/Rangoon, AID/Rangoon is authorized to sign Project Grant Agreement, and PGA is signed. If PGA is signed before end of October, following additional actions are taken immediately:

10/81 - Previously-prepared PIO/C's/tenders for fertilizer are issued as soon as CPs, if any, are met.

10/81-11/81 - PIO/T/scope of work for technical assistance is issued.

11/1/81 - Fertilizer tender advertised in U.S.

1/30/82 - Last date for fertilizer shipment from USA until May 1982.

10/82 - PGA amended to add $10.0 million of FY-83 funding. If PGA is not signed until November or December 1981, the first year fertilizer procurement will be postponed. The SRUB will advance additional fertilizer to the project from its own stocks and will be reimbursed with AID-financed stocks at a later date.

10/83 - Project Grant Agreement Amended to provide balance of funds ($10 million - $15 million). (May be followed by a fourth obligation in 10/84 if FY-84 funds insufficient).

10/82)
10/83 } Annual Project Evaluation Summaries completed
10/85)

10/84)
10/86) Major internal evaluations

10/87 - Earliest date for total Project Impact Evaluation

IMPLEMENTATION SCHEDULE

2. SRUB START-UP, MANAGEMENT AND STAFFING ACTIONS

10/5/81-10/15/81 - Project Grant Agreement signed.

10/15/81-10/30/81 - SRUB Project Director selected within Agriculture Corporation and assigned to project.

11/30/81 - Agriculture Corporation technical project team members selected and assigned to project,

10/81 - Recruitment and training of field staff begin

10/81 - Annual Fertilizer Procurement and Distribution Plan update completed.

1/82 - Seed Farm Development and Seed Distribution Plan completed.

1/82 - Joint SRUB/AID review of contractor proposals and of fertilizer/ shipping awards in USA.

4/82 - Agriculture Corporation field staff trained and in place in Intensive Townships.

3. CONTRACTOR START-UP

10/1/81 - PIO/T prepared for long-term and short-term TA, including responsibility for coordination and implementation of all participant training component activities as well as coordination and processing of orders for agricultural machinery and equipment. (AID-Direct Contract). PIO/T to be issued o/a 10/15/81.

10/15/81 - Request for Proposal issued for competitive bidding in U.S.

1/15/82 - Receipt and review of technical proposals, including site visits to university locations. (Anticipate SRUB participation in selection process).

2/15/82 - Contractor selection and award

4/1/82 - Arrival of first long-term advisor(s) including team Leader/ Chief of Party

NOTE: Schedule may be accelerated but should not be delayed.

4. PARTICIPANT TRAINING (JOINT AID/SRUB ACTIONS)

Year One* -PhD and MS candidates selected/placed for U.S. academic year beginning September 1982:

10/81 (A) priority disciplines determined with SRUB
1/82 (B) competitive selection completed by SRUB
3/82 (C) placement arranged by contractor
7/82 (D) English language preparation completed, when necessary
8/82 (E) arrival in U.S.

Years Two and Three

Similar procedure as Year One for further PhD/MS training for U.S. academic years beginning September 1983, 1984.

On-going

Short-term training scheduled periodically according to need and availability of candidates.

*NOTE: It may be desirable that Year One steps be completed by AID/W and AID/Burma staff prior to signing of contract and arrival of contract personnel scheduled o/a 4/1/82. This procedure would get some long-term training under way early, but would have the disadvantage that as the contracting University may not be known, the contracting University may not be able to provide extra campus support beyond normal academic course-work. After the project is signed, it will be decided by agreement between the AID Office in Rangoon and the SRUB representatives whether to have initiation of long-term training precede or follow the selection of the University contractor. Some short-term training may precede the contractor selection.

5. SEED FARMS ESTABLISHMENT (SRUB ACTIONS)

10/81- Agriculture Corporation seed farm staff selected and undergoing local training.

3/82 - Sites selected and preliminary design/layout completed.

4/82 - Equipment procurement process begins

8/82 - Plans for construction of facilities (incl. irrigation) and for equipment installation completed.

3/83 - Construction of facilities complete and staff in place.

2/83-7/83- Equipment arrives from U.S.

10/83 -Equipment installed and working.

10/83 -Seed farms fully operational

B. CONTRACTING AND PROCUREMENT PLAN

1. Technical Assistance Contract

An AID Direct contract is proposed which will entail all technical assistance and training responsibilities in the project, coordination of all projected-related procurement of agricultural equipment, and other responsibilities to be detailed in a scope of work for the contract.

Host country contracting (other than for fertilizer) would be impractical for this project and AID has been specifically requested to handle the contracting arrangements. This is common practice with other international donors. Having AID negotiate the contract should not affect the working relationships and professional responsibilities between the Agriculture Corporation and the contractor.

The preferred method of contracting will be competitive bidding open to private universities, university consortia, or technical consulting firms. Regardless of which institution receives the contract, it is likely that the required expertise will be found in U.S. agricultural universities. Given the large participant training responsibilities under the contract, it may be preferable to have a university for the institutional backup capacity which will be needed in the U.S.

Local cost support for the contractor financed by the SRUB from SRUB local currency funds, will include office space, equipment and supplies; secretarial and administrative staff; vehicles, fuel and drivers for long-term project personnel; and in-country surface travel. Air travel and per diem costs will be paid from project dollar funds according to actual costs and standard AID rates.

If a PIO/T for contractual services is prepared in advance, an RFP soliciting competitive bids should be issued as soon as possible after funds are available and the project Grant Agreement is signed. If the implementation schedule in Part V.A. is adhered to, technical review of bids and visits to U.S. universities could occur as early as January, 1982 including participation by officials of the Agriculture Corporation and other appropriate SRUB agencies. This is highly desirable for the SRUB to have a direct involvement in contractor selection. If the schedule is kept, the first long-term contract specialists could arrive in country by April, 1982.

2. Procurement Plan: Fertilizer and Equipment

AID grant-financed purchases under this project will include approximately $15.0 million worth of fertilizer and approximately $5.0 million of agricultural equipment and machinery. All procurements will be accomplished in accordance with AID regulations and good commercial practice. An outline of the procedures to be followed for each type of commodity is given below. Common to both types are:

- Source of commodities - The authorized source and origin of all commodities will be AID geographic code 000 (U.S.A.)

- Source of transportation services - Ocean transportation services will be restricted to code 000 (U.S.) unless A.I.D. Office of Commodity Management (SER/COM) determines that adequate U.S. flag service is unavailable, in which case AID will allow for the financing of ocean transportation on Code 899 and host country vessels, as per the transportation waiver included in this project paper.

- Marking - AID's marking regulations will be observed in accordance with the Foreign Assistance Act requirement that commodities be identified to show that the project is financed by the U.S. government.

a. Fertilizer

Procedures for the procurement of fertilizer have been discussed by representatives of SER/COM with the SRUB represented by the Procurement and Distribution Division of the Agriculture Corporation. It is the desire of both parties to establish a procurement process which will observe AID requirements as well as the procurement regulations of the SRUB.

Two different options were discussed and agreement was reached on the following points:

Option I - Host country procurement

- AID/W to review and approve the IFB and the charter party prior to the start of the procurement process;

- The SRUB to take responsibility for the procurement, and will tender for the commodity on an FOB basis;

- AID/W to arrange for publication of the advertisement for fertilizer when requested to do so by the SRUB;

- The SRUB to distribute the IFB through its Embassy in Washington, D.C.. and would also take responsibility for issuing the freight tender;

- The bid opening to take place in Washington;

- The evaluations of offers and marrying of freight offers to commodity awards to be done jointly by AID/W and the SRUB representative;

- Award notices to be issued by SRUB representative in Washington;

- SRUB to take responsibility for movement of fertilizer from port to township warehouses.

Option II - AID procurement

- SRUB to approve fertilizer and bagging specifications before the start of the procurement process;

- AID/W to take responsibility for the procurement and to tender for the commodity on an FOB basis;

- AID/W to arrange for publication of the advertisement for fertilizer;

- AID/W to distribute the IFB through the Office of Commodity Management (SER/COM) and to issue freight tender;

- The bid opening to take place in Washington;

- The evaluation of offers and marrying of freight offers to commodity awards to be done by AID/W;

- Award notices to be issued by AID/W;

- Payment to be made by AID direct letter of commitment;

- SRUB to take responsibility for movement of fertilizer from port to township warehouses.

Because of the critical timing of the fertilizer procurement and other administrative constraints, it was the SRUB's strong preference to use the option of having AID take responsibility for the purchase of the fertilizer (Option II). Under either option the timing of the procurement steps would be as follows:

- day 1 - Advertising requested.
- day 15 - Ads published in the Commerce Business Daily and the AID-financed Export Opportunities Bulletin.
  The IFBs are issued in Washington, D.C.
- day 60 - Bid opening and evaluation of offers takes place in Washington. Freight tender issued upon selection of lowest responsive offers.
- day 65 - Commodity and freight award notices issued in Washington.
- day 72 - Performance bonds from selected supplies received in Washington.
- day 75 - Letters of commitment requested.
- day 85 - Letters of commitment issued by AID/W.
- day 115 - Fertilizer loaded at port of exit.
- day 150 - Fertilizer arrives in Rangoon.
- day 180 - Fertilizer offloaded and delivered to township warehouses.

The SRUB may also choose to utilize Burma Five Star Lines for up to 50% of the cargo provided that such transportation costs are financed by the SRUB. In this case, the portion of the cargo for which transport costs are paid by the SRUB may be carried on any available and eligible code 935 vessel, regardless of cost or other considerations. The remainder of the fertilizer, which must equal at least 50% of the total cargo, would still have to be transported on U.S. vessels, if available.

The proposed AID-financed fertilizer procurement schedule is as follows:

Year of arrival in country	Amount	Type		Approximate CIF cost Per MT*		Total Cost
1982 or 1983	10,000 MT	Urea	x	$382	=	$ 3,820,000
1983	10,000 MT	TSP	x	$372	=	3,720,000
1984	10,000 MT	TSP	x	$372	=	3,720,000
1985	10,000 MT	TSP	x	$372	=	3,720,000
				Total:		14,980,000

The fertilizer should be delivered to the township warehouses before the start of the monsoon season which is approximately May 15.

*Note: Price based on average cost estimates for urea, TSP and MOP explained in budget section.

An additional constraint is that the fertilizer cannot be shipped out of the U.S. from the end of January until the end of May. Given the 180-day procurement cycle discussed above, the procurement actions should ideally start around September 1 but no later than the latter part of October. Since the project may not be obligated in time to meet this deadline for the 1982 delivery, purchase of the 10,000 MT's of urea listed for this year may be moved back to 1983. In this case, the Agriculture Corporation has agreed to meet all project fertilizer needs for the 1982-83 crop year (approximately 6,000 MT of urea, 3,000 MT of TSP and 1,000 MT of MOP).

If the procurement begins on or about October 15, delivery to township warehouses should take place by on or about April 15, thus allowing for a 30-day margin of error before the rainy season begins. It should be noted that adequate warehouse space is available to ensure that the fertilizer would be protected even if deliveries were delayed past May 15.

b. Agricultural Equipment

Procedures for the procurement of the agricultural equipment have been discussed by representatives of SER/COM and the Agriculture Corporation. Because of the size and complexity of this procurement, the SRUB has expressed its preference that responsibility for procurement be retained by the prime contractor and that actual purchases be transacted through a procurement service

agent (PSA). The procedures for this procurement are as follows:

- SRUB reviews and approves the final equipment list;

- Contractor completes the equipment specifications in detail, ensuring that they are in a form that can be tendered;

*- AID and the SRUB approve final commodity specifications; and

- Contractor appoints PSA, subject to AID/W concurrence, to handle all procurement activities.

Since the expected fee for the PSA (procurement agent) will not exceed $100,000 for any contract, the agent can be selected through an informal solicitation of offers. (AID will furnish the contractor with a list of available PSAs). The contractor will, with AID assistance, evaluate the proposals and negotiate a contract, including the scope of work and amount of fee, with the chosen firm. The contract must be approved by AID before the procurement process can begin. Once the contract has been signed the PSA will undertake the following tasks:

- Issue and advertise commodity specifications;

- Prepare IFBs and/or RFPs; and

- Evaluate bids and submit award recommendations to the contractor.

The contractor, in conjunction with AID/W, will be responsible for approving the award recommendations. After selection of suppliers the PSA will take the following actions:

- Issue purchase orders;

- Expedite deliveries to ports of exit;

- Inspect and consolidate equipment shipments;

- Arrange freight forwarding and insurance, process insurance.

- Arrange for flow of documents and information to the buyer; and

- Arrange for payment of commodities.

The SRUB will be responsible for Burmese customs clearance and transport of commodities to project sites, as well as for payment of any and all duties, fees, taxes, handling charges, or other levies.

* Requirement for SRUB approval of final equipment specifications may be waived, if the SRUB is satisfied that all issues have been resolved after review and approval of final equipment list. Elimination of this step would shorten the procurement cycle by about 60 days.

The equipment list for the project is contained in Annex B.
The timing of the procurement steps for the purchase of this equipment will be as follows.

- day 1 - Contractor begins work on commodity specifications and PSA selection process.
- day 60 - Contractor finalizes equipment specifications and appoints PSA to handle procurement.
- day 120 - Host government approves equipment specifications; PSA requests publication of advertisement and prepares IFB.
- day 135 - Advertisement is published and PSA issues IFB.
- day 185 - Bid closing deadline.
- day 195 - Evaluation and recommendations for award submitted to contractor and AID.
- day 225 - Recommendations approved and PSA issues purchase orders.

Because the groups of equipment are in many cases unrelated, have different lead times and are needed at different times in the project, it is anticipated that several separate procurements will take place, each following the steps outlined above.

Immediately upon contractor selection and award, work will begin on procurement of items which are most urgently needed. The contractor within 60 days of award should complete equipment specifications and appoint a PSA to handle procurement of items in groups A.1, C and E (see Annex B). Similarly, specifications and PSA selection should be completed within 120 days for groups A.2 and D and 180 days for group B.

Given the different lead times required for the commodities in each group (A.1 - 180 days, A.2 - 45 days, B - 45 days, C - 45 days, D - 90 days and E - 180 days), the staggered procurement schedule, and estimating 45 days for shipping, the estimated time from contractor selection and award (day 1) until delivery of goods to Rangoon would be as follows for the various groups:

A.1	-	450 days
A.2	-	375 days
B	-	435 days
C	-	315 days
D	-	420 days
E	-	450 days

Note: In equipment group B, only 50 electric pumps and 50 diesel pumps will be ordered in the first procurement. Order of the remaining 400 pumps will depend on evaluation of the field use of the first 100 pumps.

C. ADMINISTRATIVE ARRANGEMENTS

1. Government of the Socialist Republic of Burma (SRUB)

Principal coordinating and budgetary responsibility for the project will be with the Ministry of Planning and Finance, and in particular with the Director-General of the Foreign Economic Relations Department. Overall responsibility for managing and implementing the project rests with the Ministry of Agriculture and Forests (MAF) which consists of nine Departments and five Corporations (Figure 6). The Agriculture Corporation (AC), under its Managing Director, will be directly responsible for the project and will coordinate as necessary with other Departments and Corporations within the MAF as well as other government Ministries.

The organizational structure of the Agriculture Corporation is depicted in Figure 7. Because the project calls for a multi-disciplinary team of specialists and counterparts to accomplish objectives involving several divisions with the AC, the Project Team will formally report to the Managing Director. However, operational coordination and guidance will be with the General Managers and Deputy General Managers of the principal divisions engaged in the project, which will primarily be the Planning and Projects Division, the Extension Division, the Agricultural Research Institute (located at Yezin), and the Procurement Division. The latter is responsible for fertilizer procurements undertaken by the AC.

2. AID Office in Burma

The AID Office in Burma (AID) will assist the SRUB in project implementation to the extent desired and feasible, monitor the project, provide necessary AID approvals, participate in evaluations, and perform all functions generally associated with an AID monitoring role. Project coordination and monitoring functions within AID/Rangoon, including monitoring of the contractor's performance, will be delegated to a direct-hire Agricultural Development Officer, supported by sufficient professional and local administrative staff for purposes of this project as well as all future projects and general AID objectives related to the agricultural sector. Sufficient means no less than one FN agricultural commodity specialist, on an FNDH or FN Contract basis.

Upon authorization of the project, AID will establish the Agricultural Development Officer (ADO) position and request MODE clearance for assignment to Burma. Realistically, it may be impractical for the ADO to be on board prior to the first part of 1982. In view of the lead time which will be required to reassign a qualified AID employee, plus consideration of a possible Burmese language training requirement, and given the critical start-up steps which must be accomplished smoothly during the first year of the project, if an ADO cannot be assigned by the signing date AID/Rangoon will request the short-term services of an experienced individual to manage such start-up activities during the first six months of the project

(October 1981 - March 1982). This may be arranged by TDY, PSC, IQC, PASA or any suitable arrangement determined in consultation with AID/ Washington. As the long-term AID-financed advisors to be assigned to the Project Team under the technical assistance contract will also not arrive in country until at least March 1982, it is all the more vital to have a strong interim project manager to establish project momentum, to take necessary actions, and to provide continuity between the time of project negotiation and agreement and the arrival of permanent personnel.

3. Project Team

The Project Team for the Maize and Oilseeds Production project will consist of up to six (6) representataives equally balanced between the AC and USAID. Each side will assign technical specialists to the Project Team who will work in professional counterpart relationships to implement different aspects of the project. One specialist from each side will be designated as team leader responsible for overall management and administration of the project in addition to technical responsibilities. Three principal objectives of designing the Project Team in this way are (a) the guaranteeing of a practical means for integrating the skill and expertise of the AID team members in the project, (b) the strengthening of internal coordination and institutional capacity within the AC, and (c) developing an organizational structure which will assure continuity in project management following the departure of the AID advisors. Proposed position descriptions of the long-term AID advisors are contained in Part III. 10, Technical Assistance.

As part of its local cost contribution to the project, the AC will arrange for office space, equipment, support staff, and transportation for the Project Team. In this way adequate support will be provided and the Project Team will be more visibly identified as the AC unit responsible for maize and oilseed production. These costs are more fully detailed in the project budget.

The contracting plan calls for an AID-Direct contract and will include technical assistance, training and functions related to procurement of equipment required by the project. After the AID team is assembled, they will assume direct responsibilities for the project with back-up support as needed from the ADO. It is anticipated that the AID team members will be assigned to Burma no earlier than April 1982. Therefore, the Project Team per se will not be organized until that time. Nevertheless, in the interim period the AC may determine who is to be assigned to the team from its side and these individuals will begin to coordinate with AID/Rangoon on key actions which must be accomplished.

4. Field Implementation

The crucial link in project administrative arrangements is at the field level. This will be accomplished via three principal contact points through which Project Team members will have on-going access to field activities.

First, at the township level in each of the townships involved in the project, the AC Township Managers (Extension Division) will assign and supervise at least one Project Coordinator and as many additional extension staff as required to carry out the Maize and Oilseeds Production project in their township. They will be selected based on leadership and technical abilities, particularly in the specific crop chosen for emphasis in the township. Among their key responsibilities will be supervision of research and demonstration activity at high technology sites within the township, monitoring functions concerned with fertilizer use based on the recommended application rate per acre, introduction of other inputs including pest management, machinery and equipment, and rhyzobium inoculum (for groundnut), and participation in data collection and evaluation of results in yields and production increases achieved in the township.

Note: Given the important role of the township-level Project Coordinators, it is expected that these individuals will receive specialized non-degree training of 3-6 months duration at major crop research centers in the March-September period of 1982, in time to return to Burma by the beginning of the 1982-83 winter crop season.

The second contact point follows the same channel through AC Township Managers to seed farm managers at the four project seed farms. Design, construction, equipment installation and other preparation of the seed farms before they become fully operational will require frequent visits by Project Team members and other short-term consultants. Moreover, special attention in the project is given to training and management aspects of seed development activities.

The third field-level contact point is the central facility of the Agricultural Research Institute at Yezin. Project personnel will coordinate as necessary with activities at Yezin particularly as this relates to strengthening research and extension capabilities focused on maize and oilseeds.

A graphic description of the administrative organization of the project is given in Figure 8.

FIGURE 6

MINISTRY OF AGRICULTURE AND FORESTS

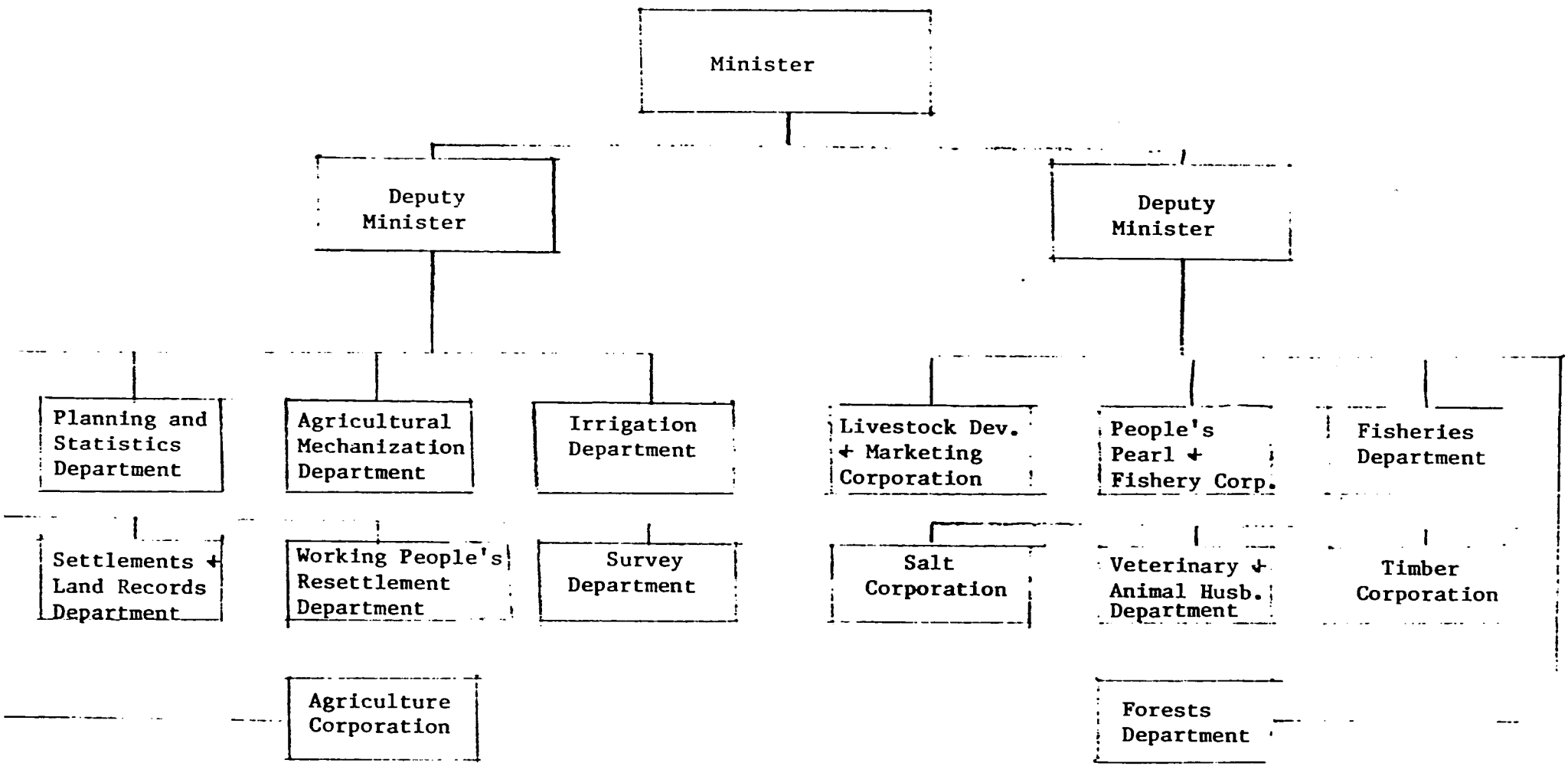
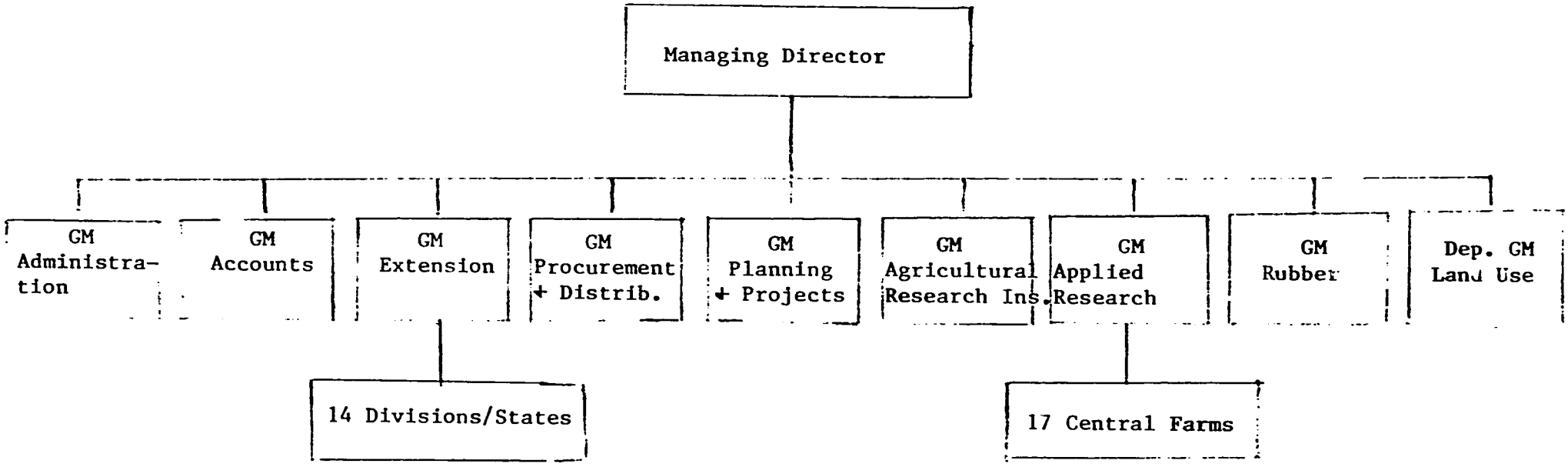


FIGURE 7

AGRICULTURE CORPORATION



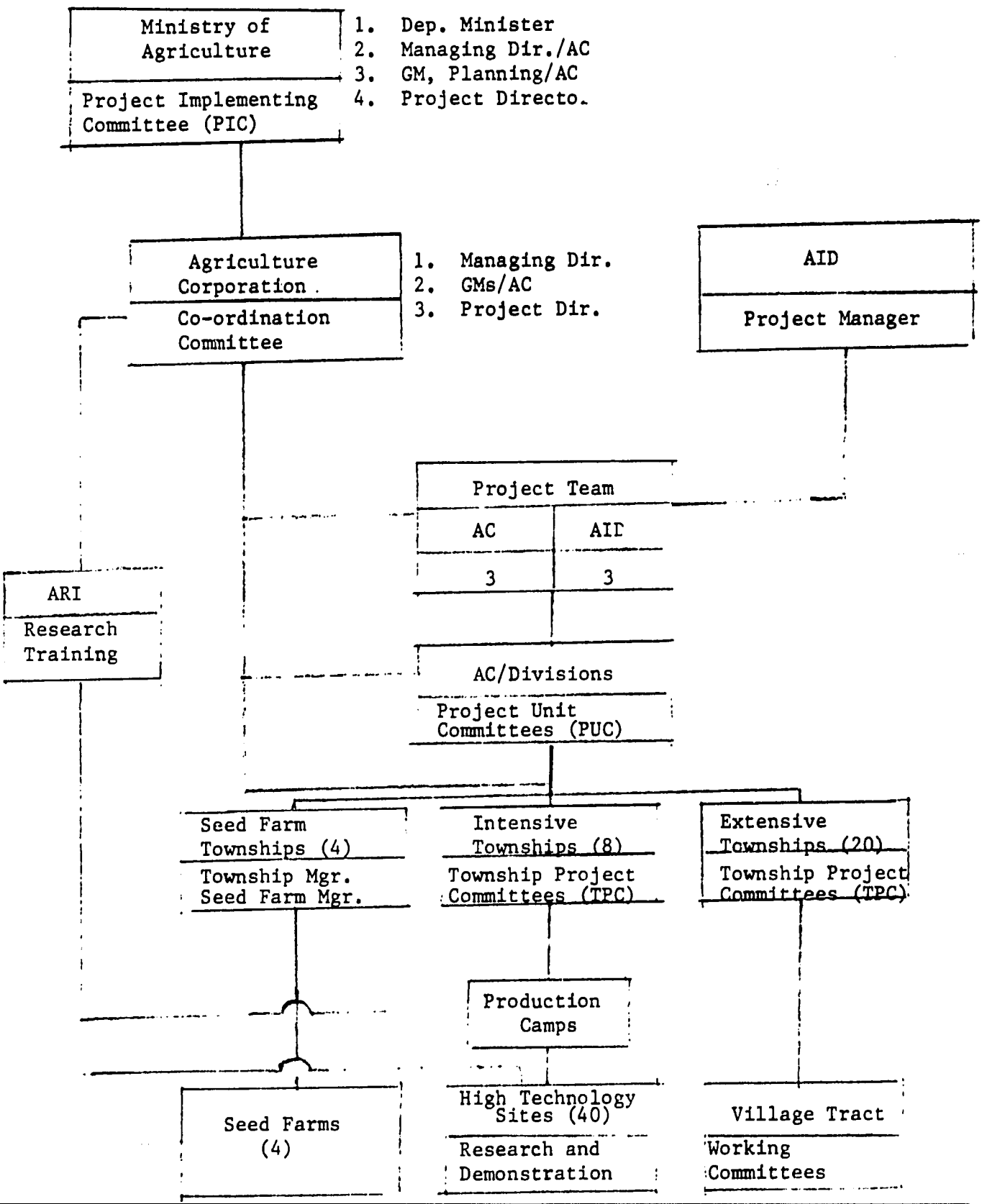
Total Extension Personnel (1/81)

Township Managers = 189
Dep. Township Managers = 419
Village Tract Managers = 902
Village Managers = 5220

GM = General Manager

FIGURE 8

OILSEED + MAIZE PROJECT ORGANIZATION



D. EVALUATION ARRANGEMENTS

The evaluation plan for the Maize and Oilseeds Production Project will include several evaluative activities undertaken jointly by AID and the SRUB. The Agriculture Corporation and AID/Burma intend to conduct: (1) annual project evaluations (PES) starting in 10/82; (2) major project evaluations in 10/84 and 10/86; and (3) an Impact Evaluation in 1987-88. The annual PES exercise will allow the AID/Burma and Agriculture Corporation project management team to assess project progress, and on a regularly scheduled basis to make necessary adjustments in project implementation strategy.

The major internal evaluation scheduled for 10/84 will be important in determining for the SRUB whether (and in what form) AID might be requested to provide assistance for a Phase II project in maize and oilseeds production and/or new priority crops such as pulses, cereal grains or legumes. The major internal evaluation planned for 10/86 will serve as an end-of-project analysis and be of use in SRUB and AID/Burma forward planning and agriculture sector project selection.

Part of the evaluation process will be the strengthening of a management information capability within the Ministry of Agriculture and Forests and within the Agriculture Corporation. It is the intent of the Agriculture Corporation to develop an agronomic modeling capacity demonstrating appropriate cropping mixes at regional, state/division, township and sub-township levels. The project will provide some participant training and short-term technical assistance for this purpose.

The gradual establishment of a sound agriculture data base can provide the demographic, income, production and other information that will be required for an Impact Evaluation scheduled, at the earliest, for 1987.

Project funds will be used to cover costs of U.S. and Burmese consultants required to carry out the major internal evaluations scheduled for 10/84 and 10/86. It is estimated that up to $100,000 in A.I.D. grant funds as well as SRUB-funded local costs will be required for this purpose. Some technical assistance and guidance will be required from AID/Washington offices such as PPC/Evaluation and ASIA/Development Programs to define the scope of the evaluations and recruit qualified evaluation team members.

E. CONDITIONS, PRECEDENT, COVENANTS, WAIVERS, STATUS OF NEGOTIATIONS

Conditions Precedent

- To initial disbursement: designation of representatives

Covenants

AID/Rangoon plans to seek the following covenants in the agreement:

- Assurance of provision of sufficient existing and incremental budgetary and staff support to accomplish the project (including field-level extension personnel, seed farm personnel, and other project counterpart personnel).

- Agreement to make sites available for four seed farms, to design and construct all necessary facilities for the farms in a timely manner, and to install and maintain properly AID-financed equipment for the farms.

- Assurance of operation of a field level monitoring system, satisfactory to the AID Office in Burma, which insures that during the project, fertilizer from both AID and SRUB financing totalling not less than $25 million in value is properly applied to acreage and crops in the project townships.

- Agreement to budget and pay, in a timely manner, sufficient funds to cover any and all duties, taxes, charges, handling costs, or other fiscal levies which may be imposed by the Cooperating Country on AID-financed commodities, and/or to assure that such commodities are exempt from such costs.

- Assurance to process and clear expeditiously and to store and distribute properly all goods financed under the Grant.

- Agreement to afford A.I.D. representatives the opportunity at all reasonable times to inspect the Project and the utilization of goods and services financed under the Grant.

The draft authorization (attached as Annex H) includes language covering five of these six planned covenants, plus the phrase "such other covenants as AID may deem advisable" (see Revised HB 3, Chapter 5A, para 6) to cover the possible need for a sixth covenant on the seed farms. The authorization text is phrased in a more general way than shown above, in order that only essential AID concerns are satisfied in the authorization itself, per HB3 guidance. AID/Rangoon intends that all six points, using the more specific language above, will be contained in the PGA insofar as is possible. However, it would not be desirable to include the detailed language verbatim in the authorization, as the exact language may have to be modified during negotiations on the PGA.

Waivers

The draft authorization (Annex H) provides that all goods and services financed under the project except ocean shipping shall have their source and origin in either the United States or in the Cooperating Country, except as AID may otherwise agree in writing, and except as follows:

- ocean shipping shall be procured in the U.S. only, except as AID may otherwise agree in writing;

- training services may be procured in third countries as well as in the United States, in accordance with the provisions of AID HB 10;

- the U.S. contractor(s) selected to provide the technical assistance may elect to obtain the services of third-country technicians if necessary. The contractor may find that certain types of expertise in tropical agriculture (for example sesamum or groundnut) can best come from international research center personnel or from third-country national consultants. This flexibility should be provided in the contract.

AID/W is requested to prepare any technical waivers needed to permit the signing of the proposed authorization language.

Status of Negotiations

General SRUB approval for AID to formulate projects in the agricultural sector in cooperation with SRUB authorities was received in December 1980. Immediately thereafter an AID agricultural sector review and project identification team visited Burma for four weeks in January/February 1981. That team reviewed the entire agricultural sector, the activities of other donors, and several draft SRUB proposals, in light of AID areas of expertise and comparative advantage, and concluded that the Maize and Oilseeds Production Project was the most appropriate way in which AID could assist Burma in its agricultural development at this time.

Following that mission, the SRUB reviewed the Project Identification Document at high levels and authorized further discussions of the project with AID with a view toward the preparation of this detailed Project Paper.

This PP is the result of more than three weeks of intensive discussions at the technical level between AID and the Agriculture Corporation. It refelects a set of shared expectations about the project between officials who would be implementing the project on both sides. In addition, the Agriculture Corporation has been given a copy of this document for review. Any suggestions made and agreed to for further changes will be cabled to AID/W for retyping of the appropriate pages to be done either before or after the APAC review (depending on the nature of any changes). It is expected that, if the project is approved by both sides, this document will serve not only as an AID approval document but also as a joint guide to project implementation.

The status of negotiations on the project is as follows: As shown in the implementation plan (Part VA), AID authorization of the project is sought at this time. APAC approval is needed by the end of July and project authorization (following Congressional Notification) is needed by o/a August 15. Once the text of the draft authorization language is known, AID/Rangoon, with the assistance of the Regional Legal Advisor, will prepare the draft language for the Project Grant Agreement and will begin initial discussions on the agreement with the SRUB authorities. Following formal project authorization in August, the project would be offered by letter and negotiations would be conducted. It is expected that an authorized, negotiated Project Grant Agreement will be ready for final presentation to the SRUB approving authorities by no later than September 15. Approval will then be sought for (a) the signing of the negotiated agreement (to take place as soon in FY-1982 as funds are available) and (b) for a formal SRUB letter of request for the grant, if not previously provided.

The project meets important SRUB agricultural priorities, is based upon a SRUB request, and has a high economic rate of return. General issues were resolved in the 1980 negotiations on our other project, and the SRUB has considerable experience in negotiating agricultural project agreements with other donors. For these reasons, if the schedule proposed above is adhered to, we see no difficulties in negotiating this project in a form that is acceptable both to AID and to the Government of the SRUB.

ANNEX A

BURMA MAIZE AND OILSEEDS PRODUCTION PROJECT

PROJECT TOWNSHIPS, ACREAGE BY CROP AND FERTILIZER REQUIREMENTS
CROP YEARS 82-83, 83-84, 84-85, 85-86
(PROJECT YEARS 2, 3, 4, 5)

INTENSIVE TOWNSHIPS (8)

TABLE A.1

			ACREAGE (000)					FERTILIZER (MT)			COST ($US MILLION)			
CROP	TOWNSHIP	DIVISION	82-83	83-84	84-85	85-86	TOTAL	UREA	TSP	MOP	UREA	TSP	MOP	TOTAL
Maize	Zalun	Irrawaddy	12.0	15.0	18.0	20.0	65.0	3309	1655	828	$1.0	$ .6	$.2	$1.8
"	Taze	Sagaing	20.0	25.0	28.0	30.0	103.0	5244	2622	1311	1.6	1.0	.4	3.0
"	Lewe	Mandalay	10.0	15.0	20.0	25.0	70.0	3564	1782	891	1.2	.6	.3	2.1
"	Pyinmana	Mandalay	15.0	20.0	25.0	30.0	90.0	4581	2290	1145	1.4	.8	.3	2.5
Total Maize			57.0	75.0	91.0	105.0	328.0	16698	8349	4175	5.2	3.0	1.2	9.4
Groundnut	Daik-U	Pegu	22.5	25.0	27.5	30.0	105.0	2673	2673	-	.8	1.0	-	1.8
"	Yandoom	Irrawaddy	15.0	17.0	19.0	20.0	71.0	1807	1807	-	.7	.6	-	1.3
Sesamum	Moulmeingyun	Irrawaddy	34.0	36.0	38.0	40.0	148.0	5651	3767	-	1.8	1.4	-	3.2
Sunflower	Yamethin	Mandalay	15.0	20.0	25.0	30.0	90.0	3436	2291	-	1.1	.8	-	1.9
Total Oilseed			86.5	98.0	109.5	120.0	414.0	13567	10538	-	4.4	3.8	-	8.2
TOTALS			143.5	173.0	200.5	225.0	742.0	30265	18887	4175	11.5	7.0	1.0	19.5

NOTES:

1. Recommended application (dosage) for intensive townships calculated as follows:

	UREA	TSP	MOP	
Maize	112	56	28	Lbs per acre (2200 lbs. = 1 MT)
Groundnut	56	56	-	
Sesamum	84	56	-	
Sunflower	84	56	-	

2. Prices CIF landed in Rangoon Port calculated at (Ave. Estimated cost, 1981-85)

UREA	$382/MT
TSP	$372/MT
MOP	$240/MT

3. Tables A.1 and A.2 are illustrative. While all 28 townships will be included in the project, acreage coverage in the extensive townships will have to be reduced to a level requiring total fertilizer expenditures not exceeding a grand total of $25 million. This is discussed further in Annex B.4.

PROJECT TOWNSHIPS, ACREAGE BY CROP AND FERTILIZER REQUIREMENTS
CROP YEARS 82-83, 83-84, 85-86, 86-87
(PROJECT YEARS 2, 3, 4, 5)

II. EXTENSIVE TOWNSHIPS (20)

TABLE A.2

CROP	TOWNSHIP	DIVISION	ACREAGE (000) 82-83	83-84	84-85	85-86	TOTAL	FERTILIZER (MT) UREA	TSP	MOP	COST ($US MILLION) UREA	TSP	MOP	TOTAL
Maize	Letpadan	Pegu	-	-	-	3.2	3.2	123	41	-	$.047	$.015	-	$.062
"	Ma-Ubin	Irrawaddy	-	.	-	3.2	3.2	123	41	-	.047	.015	-	.062
"	Kanbalu	Sagaing	-	9.6	11.2	12.0	32.8	1252	417	-	.478	.158	-	.634
"	Tatkon	Mandalay	-	-	-	6.0	6.0	229	76	-	.087	.028	-	.115
Total Maize			-	9.6	11.2	24.4	45.2	1726	575	-	.659	.214	-	.873
Groundnut	Kyauktaga	Pegu	3.2	4.0	4.0	4.0	15.2	193	387	-	.074	.144	-	.218
"	Tatkon	Mandalay	-	-	6.0	6.0	12.0	153	305	-	.058	.113	-	.171
"	Singu	Mandalay	-	6.8	6.8	6.8	20.4	260	519	-	.099	.193	-	.292
"	Myaung	Sagaing	-	10.0	10.0	10.0	30.0	382	764	-	.146	.284	-	.430
"	Magwe	Magwe	30.0	30.0	30.0	30.0	120.0	1527	3054	-	.583	1.136	-	1.719
"	Natmauk	Magwe	-	-	-	14.4	14.4	183	367	-	.071	.137	-	.208
Total Groundnut			33.2	50.8	56.8	71.2	212.0	2698	5396	-	1.031	2.007	-	3.038
Sesamum	Ma-Ubin	Irrawaddy	-	-	6.0	8.0	14.0	356	178	-	.136	.066	-	.202
"	Kyaunggon	Irrawaddy	-	-	3.2	4.0	7.2	183	92	-	.070	.034	-	.104
"	Wakema	Irrawaddy	12.0	14.0	15.0	16.0	57.0	1451	726	-	.554	.270	-	.824
"	Okpo	Pegu	-	8.0	8.0	8.0	24.0	611	305	-	.233	.113	-	.346
"	Henzada	Irrawaddy	-	-	3.0	4.0	7.0	178	89	-	.068	.033	-	.101
"	Myittha	Mandalay	3.0	4.0	4.0	4.0	15.0	382	191	-	.146	.072	-	.218
"	Kyaukse	Mandalay	10.0	10.0	10.0	10.0	40.0	1018	509	-	.389	.189	-	.578
Total Sesamum			25.0	36.0	49.2	54.0	164.2	4179	2090	-	1.596	.777	-	2.373
Sunflower	Kyauktaga	Pegu	-	-	5.0	6.0	11.0	280	140	-	.107	.052	-	.159
"	Budalin	Sagaing	-	-	-	4.0	4.0	102	51	-	.039	.019	-	.058
"	Pyawbwe	Mandalay	-	2.8	3.6	4.0	10.4	265	132	-	.101	.049	-	.150
Total Sunflower			-	2.8	8.6	14.0	25.4	647	323	-	.247	.120	-	.367
T O T A L S			58.2	99.2	125.8	163.6	446.8	9250	8384	-	$3.533	$3.118	-	$6.651

NOTES: 1. Recommended application (dosage) for extensive townships calculated as follows:

	UREA	TSP	MOP
Maize	84	28	-
Groundnut	28	56	-
Sesamum	56	28	-
Sunflower	56	28	-

lbs per acre (2000 lbs = 1 MT)

2. Prices CIF landed in Rangoon Port calculated at: (Ave. estimated cost, 1981-1985)

UREA	$382/MT
TSP	$372/MT
MOP	$240/MT

ANNEX B

BUDGET DETAIL/COST ASSUMPTIONS

TABLE B.1

TECHNICAL ASSISTANCE BUDGET

1. Long-term Specialists (13 person years):

Estimated on the basis of two-year assignments as follows: Two specialists are budgeted to continue for a second two-year assignment and a final one-half year period at the end of the 4½ year contract.

Year One (Illustrative)

Posting:	
Travel of family (4 persons)	$6,000
Unaccompanied baggage	1,000
Household effects and personally owned vehicle (HHE & POV)	10,000
Temporary lodging	2,400
Housing and Utilities (6,000 + 7,000)	13,000
School allowance	4,500
In-country travel	1,000
Recuperation leave (R&R)	5,000
Salary (average)	40,000
Fringe benefits (40%)	16,000
Post differential (25% of salary)	10,000
Sub-total - Year One	$108,900

Year Two (Illustrative)

Departure from Post:	
Travel of family	$ 6,000
Unaccompanied baggage	1,000
Household effects and personally owned vehicle (HHE & POV)	10,000
Temporary lodging	2,400
Housing and Utilities	13,000
School allowance	4,500
In-country travel	1,000
Salary	40,000
Fringe benefits (40%)	16,000
Post Differential	10,000
Sub-total - Year Two	$103,900

Total Budget for Two-year Assignment	=	$212,800
Six (6) two-year assignments	=	1,276,800
Two (2) one-half year assignment	=	103,900
Total Long-term specialists budget	=	$1,380,700

2. Short-term Specialists (Illustrative for 50 person months)

Calculated on the basis of 30-day months. Cost of one month estimated as follows:

International Travel	$3,000
Per diem (30 days x $60)	1,800
In-country Air Travel	300
Salary (26 days x $210)	5,460
Supplies	250
Sub-total	$10,810

Total Short-term Budget

Fifty (50) one-month assignments	$540,500

3. Total Technical Assistance budget without overhead/campus backstop	=	$1,921,200
4. University overhead/campus backstop (estimate)	=	478,800
5. Total Technical Assistance Budget	=	2,400,000

TABLE B. 2

PARTICIPANT TRAINING BUDGET

1. Long-term overseas training

MS/PhD degrees (4 years) and MS degrees (2 years) calculated as follows:

Expense	PhD U.S. (4 Years)	MS U.S. (2 Years)	MS Other (2 Years) IRRI, etc.
Tuition			
Minimum/yr $2,100	$ 8,400	$ 4,200	$ 4,200
Maximum/yr $5,400	21,600	10,200	6,200
Orientation in D.C.	2,250	2,250	
Stipend (U.S.)			
Minimum/mo. $600	28,800	14,400	10,000
Maximum/mo. $1200	57,600	28,800	20,000
International Travel	3,000	3,000	2,500
Books & Supplies			
$625/year	2,500	1,300	1,300
Insurance	3,000	1,500	
Term Break			
Programs (per diem, travel): $3,500 each 2 years x 2	7,000	3,500	
Total			
Minimum	$55,000	30,000	20,000
Maximum	$97,000	51,000	30,000
Average	$85,000	$42,500	$25,000

Budget

11 MS/PhD degrees @ $85,000	=	$935,000
25 MS degrees @ $42,500*	=	1,065,000
Total budget	=	2,000,000

*NOTE: Calculated at high figure. If some MS training occurs in other countries at lower cost, budget will be slightly lower.

2. Short-term overseas training

Calculated at average cost of $8,000 per trainee. Shorter courses (3-6 months) in U.S. will cost an estimated $6,000 - $10,000 per trainee. Longer courses (6 months) in developing countries will cost an estimated $8 ,000 per trainee. (All costs plus international travel included).

Budget

70 trainees x $8,000	=	$ 560,000

3. Total Participant Training budget without overhead/campus backstop	=	$2,560,000
4. Total university overhead/campus backstop (estimate)	=	440,000
5. Total Participant Training Budget	=	3,000,000

TABLE B.3

AGRICULTURAL EQUIPMENT AND MACHINERY BUDGET

Equipment and machinery costs are detailed in the following sub-tables:

Category		Table		Amount (U.S.$)
A.1	Seed Processing Equipment	B.3.a		1,274,760
A.2	Other Seed Farm Equipment	B.3.b		1,274,200
B	Intensive Townships Equipment	B.3.c		1,036,480
C	High Technology Sites Equipment	B.3.d		81,000
D	Agricultural Research Institute	B.3.e		90,010
E	Rhyzobium Inoculant Production	B.3.f		250,000
			Sub total:	4,006,450
	Add 15% (spare parts)			600,968
			Sub total:	4,607,418
	Add in procurement cost			392,582
			Total:	5,000,000

All equipment costs are calculated to account for two-year inflation (orders will be placed within the first two years of the project). All costs are also calculated at CIF Rangoon prices.

TABLE B.3.a

Category A.1: SEED PROCESSING EQUIPMENT

Item No.	Description	Foundation Maize (1) &	Foundation Oilseed (2)	Certified Maize (3)	Certified Oilseed (4)	Est. U.S. $ Cost Unit Cost	Est. U.S. $ Cost Total Cost
1	Dryer burner/fan	2		8	8	6,000	108,000
2	Air-Screen cleaner (crop seed)	1		1	1	32,000	96,000
3	Elevator assembly	1		3	3	2,800	19,600
4	Vibrator spout	2		5	5	1,100	13,200
5	Warehouse platform scale	1		1	1	3,000	9,000
6	Bag conveyor	1		1	1	2,300	6,900
7	Scale, platform	1		2	2	500	2,500
8	Dehumidifier (1/200 m^3 storage)	6		22	22	2,500	125,000
9	Conveyor	1		1	1	1,400	4,200
10	Conveyor	2		2	2	1,300	7,800
11	Vacuum cleaner	1		1	1	900	2,700
12	Blower	1		1	1	400	1,200
13	Step-down ladder	4		8	8	600	12,000
14	Bag truck, hand	3		6	6	400	6,000
15	Bagging-weighing-sewing system	1		1	1	13,000	39,000
16	Bag cleaner	1		1	1	2,300	6,900
17	Bag holder	4		10	10	100	2,400
18	Aerosol generator	1		1	1	900	2,700

SEED PROCESSING EQUIPMENT

Item No.	Description	Foundation Maize (1) & Foundation Oilseed (2)	Certified Maize (3)	Certified Oilseed (4)	Est. U.S. $ Cost Unit Cost	Est. U.S. $ Cost Total Cost
19	Filter masks	25 boxes	25 boxes	25 boxes	40	3,000
20	Spring return twister	2	2	2	600	3,600
21	Bag closer	1	2	2	1,900	11,400
22	Balance, torsion analytical	1	2	2	600	3,000
23	Gram scale (3.200 g)	1	4	4	100	900
24	Moisture tester, portable	3	10	10	400	9,200
25	Hygrothermograph	2	8	8	900	16,200
26	Sling psychrometer	1	2	2	100	500
27	Forceps, Flat Point	6	12	12	10	300
28	Triers	2	3	3	50	400
29	Seed Moisture Tester, die electric	1	1	1	1,100	3,300
30	Heated-air oven	1	1	1	1,100	3,000
31	Seed Divider (sample splitter)	1	1	1	600	1,800
32	Deadlock tag fasteners	30 boxes	30 boxes	30 boxes	30	2,700
33	Sprayer, knapsack	2	2	2	200	1,200
34	Elevator assembly	4	10	10	2,100	50,400
35	Gravity separator (crop seed)	1	1	1	10,000	30,000
36	Hand testing screens (set)	1	1	1	3,000	9,000

SEED PROCESSING EQUIPMENT

Item No.	Description	Foundation Maize (1) & Foundation Oilseed (2)	Certified Maize (3)	Certified Oilseed (4)	Est. U.S. $ cost Unit Cost	Total Cost
37	Dazor magnifier and light	2	6	6	300	4,200
38	Dessicator	3	3	3	200	1,800
39	Dust fan	3	6	6	600	9,000
40	Truck, 6 MT Hydraulic bed	1	3	3	25,000	175,000
41	Fork lift	1	3	3	15,000	105,000
42	Seed sample/germination pans	100	500	500	4	4,400
43	Floor brush	4	6	6	30	480
44	Pickup truck w/winches	2	3	3	7,000	56,000
45	Grain scoops	3	6	6	30	450
46	Treater	1	1	1	4,100	12,300
47	Seed Staining System	1	1	1	5,000	15,000
48	Chemical Dust respirator	-	6	6	20	240
49	Gas mask	-	2	2	400	1,600
50	Test weight apparatus	-	1	1	600	1,200
51	Bagger-weigher	-	1	1	2,000	4,000
52	Germinator	-	2	2	700	1,400
53	Blower, seed sample	-	1	1	50	100
54	Spiral Separator, double	-	1	1	1,000	2,000
55	Microscope, stereo	-	2	2	700	1,400

SEED PROCESSING EQUIPMENT

Item No.	Description	Foundation Maize (1) & Foundation Oilseed (2)	Certified Maize (3)	Certified Oilseed (4)	Est. U.S. $ Cost Unit Cost	Est. U.S. $ Cost Total Cost
56	Scale, bulk portable	-	2	2	1,600	6,400
57	Forceps, sharp point	6	12	12	10	300
58	Tag Printer	1	2	2	750	3,750
59	Drying/Storage bin assembly	-	2	2	10,000	50,000
60	Conveyor, tubular	-	1	1	4,000	8,000
61	Bin Thermometer	-	1	1	100	200
62	Trier, deep bin	-	1	1	170	340
63	Conveyor, Drag	-	2	2	1,200	4,800
64	Conveyor, flat belt	-	2	2	1,400	5,600
65	Ear corn conveyor, portable	-	3	-	1,200	3,600
66	Corn sheller	-	1	-	10,400	20,800
67	Ear corn sorting belt	-	1	-	4,000	8,000
68	Peanut cleaner	-	-	1	19,000	38,000
69	Pneumatic separator	-	2	2	6,000	24,000
70	Trailer, 4-wheel flatbed	-	6	4	3,000	30,000
71	Purity workboard	-	2	2	100	400
72	Air conditioning/refrigerator units	3	12	12	2,000	54,000
73	Air Compressor	-	2	2	1,000	6,000
					Total Cost:	$1,274,760

TABLE B.3.b

Category A.2: OTHER SEED FARM EQUIPMENT

Item No.	Description	Foundation Maize & (1)	Foundation Oilseed (2)	Certified Maize (3)	Certified Oilseed (4)	Est U.S. $ Cost Unit Cost	Est U.S. $ Cost Total Cost
74	4-T Chain hoist w/I Beam Support	1	1	-	-	500	1,000
75	8 T chain hoist w/I beam support	-		2	1	700	1,400
76	Oxy-cetylane Welder w/authorized welding tips	1	1	1	1	1,200	4,800
77	Electric welder, hoods, cables, rods	1	1	1	1	600	2,400
78	Soldering Heating Torch	1	1	1	1	100	400
79	Air Jacks	1	1	2	1	200	1,000
80	Vise	1	1	2	1	100	500
81	Motor cradle jack	1	1	1	1	300	1,200
82	Air Compressor	1	1	1	1	1,500	6,000
83	Anvil	1	1	1	1	100	400
84	Metal benders Flat Rod Sheet	1	1	1	1	200	800
85	Drill Press	1	1	1	1	400	1,600
86	Heating forge	1	1	1	1	400	1,600
87	Log chains (sets)	1	1	1	1	150	600
88	Lug wrenches, tire	1	1	2	2	50	300
89	Pivot stand for tire work	1	1	1	1	400	1,600
90	Tire tools (set)	1	1	3	2	100	700

OTHER SEED FARM EQUIPMENT

Item No.	Description	Foundation Maize (1) & Foundation Oilseed (2)		Certified Maize (3)	Certified Oilseed (4)	Est U.S. $ Cost Unit Cost	Est U.S. $ Cost Total Cost
91	Wheel Pullers (set)	1	1	2	2	100	600
92	Tool wrench sets	1	1	2	2	500	3,000
93	House Jacks, 5T	1	1	4	2	150	1,200
94	Engine Analyzers	1	1	1	1	2,500	10,000
95	Timing Lights	1	1	2	2	50	300
96	Hacksaw, Electric	1	1	1	1	600	2,400
97	Mallets (set)	1	1	3	2	50	350
98	Hammers (set)	1	1	3	2	50	350
99	Booster High Pressure Irrigation Pump and Gun Engine	2	1	10	1	4,500	63,000
100	High Pressure Alum. Pipe, 5"	1200 ft	12000 ft	6000 ft	12000 ft	300/100	36,000
101	Crawler Tractor (D-8 Capacity) with blade, bucket, root plow	-	-	4	4	56,000	112,000
102	Tool Cabinet, Console	1	1	2	2	500	3,000
103	Land Leveler, 40 ft x 10 ft		1	1	1	10,000	30,000
104	V-Ditcher, Hydraulic Control for 2000 GPM Ditch size	-	1	1	1	8,000	24,000
105	Diesel Auxiliary Generator, 60 KW	-	1	2	1	10,000	40,000
106	Generators, 5 KW elec.,220v, 60 cycle	-	2	3	3	1,000	8,000

OTHER SEED FARM EQUIPMENT

Item No.	Description	Foundation Maize (1)	& Foundation Oilseed (2)	Certified Maize (3)	Certified Oilseed (4)	Est U.S. $ Cost Unit Cost	Total Cost
107	Category 2, 3-pt. hitch Diesel Field Tractor, 52 h.p.	1	1	6	2	20,000	200,000
108	4-Row plate Integral Flex planter	1	1	6	2	6,000	60,000
109	2-Row cone planter		1	-	2	4,000	12,000
110	4-Row tool bar cultivator	1	1	6	2	1,500	15,000
111	4-Row 3 point gang rotary hoe	1	1	6	2	1,200	12,000
112	9-ft disc harrow	1	1	6	2	2,200	22,000
113	Front end loader	1	1	1	1	3,500	14,000
114	2-disc Disc Breaker for tractor	1	1	1	1	1,400	2,800
115	Groundnut Lifter-Inverter	-	1	-	1	5,000	10,000
116	Rear blade 6' for 52 h.p. tractor	1	1	1	1	500	2,000
117	Heavy duty 5' shredder	1	1	4	2	1,000	8,000
118	6-ft Straddle Border disc	1	1	2	1	800	4,000
119	Category 2, 3 pthitch 90 h.p. diesel field tractor	1	1	6	2	25,000	250,000
120	4-disc, disc breaker	1	1	6	2	2,100	21,000
121	11 ft Disc Harrow	1	1	6	2	3,000	30,000
122	8 ft Straddle Border Disc	1	1	4	2	1,100	8,800
123	Clod Buster for 4 disc breaker	1	1	6	2	500	5,000

OTHER SEED FARM EQUIPMENT

Item No.	Description	Foundation Maize (1) &	Foundation Oilseed (2)	Certified Maize (3)	Certified Oilseed (4)	Est U.S. $ Cost Unit Cost	Est U.S. $ Cost Total Cost
124	16 ft. Spike Tooth Harrow	1	1	4	1	1,100	7,700
125	40-Bushel grain wagon	2	2	8	4	1,400	22,400
126	Gravity Flow Fertilizer Distributors	1	1	6	2	900	9,000
127	Field Boom sprayer with centrifugal pump Trailer type, 200 gal tank	1	1	4	2	3,500	28,000
128	Industrial Front End 52 h.p. diesel tractor with Front-End loader and Rear Blade	-	-	1	1	25,000	50,000
129	Combine, self propelled combine with corn headers - 2 row and header for sunflower	-	-	2	1	40,000	120,000
						Total cost:	$1,274,200

TABLE B.3.c

Category B: EQUIPMENT LIST FOR INTENSIVE TOWNSHIPS
AGRICULTURE CORPORATION, RANGOON

Item No.	Description	Maize (4)	Ground Nut (2)	Sesamum (1)	Sunflower (1)	Est. U.S. $ Cost Unit Cost	Est. U.S. $ Cost Total Cost
1.	Audio-visual	4	2	1	1	5,000	40,000
2.	Calculator	20	10	5	5	200	8,000
3.	Calculator	10	5	3	3	80	1,680
4.	Typewriters, wide carriage	8	4	2	2	300	4,800
5.	PA System	4	2	1	1	800	6,400
6.	Misc. Research Equipm. (Balances, etc.)	4	2	1	1	10,000	80,000
7.	Weighing scales, Platform scales	8	4	2	2	2,000	32,000
8.	Levels, Transits	4	2	1	1	800	6,400
9.	Surveying Equipm. (Misc.)	4	2	1	1	1,000	8,000
10.	Micro Computer		1			15,000	15,000
11.	Mimeograph machines		3			600	1,800
12.	Photo Copier		2			3,000	6,000
13.	Lift pumps, 5 HP electric (3-phase 220 V. 60 cycle) and/or 10 HP diesel pumps		500			1,600	800,000
14.	PH meters, AC/DC rechargeable		40			500	20,000
15.	Pesticide handling kits, spring platform scale, three mixing buckets, funnel strainer, sealed bottles measuring cup and plastic cylinder, plastic spoons, rubber gloves and aprons, mask	80	40	20	20	40	6,400
						TOTAL	1,036,480

TABLE B.3.d

Category C: EQUIPMENT LIST FOR HIGH TECHNOLOGY SITES (40 sites)

Item No.	Description	Quantity per Site	Est. U.S. $ Cost Unit Cost	Total Cost
1.	3-gallon hand sprayer equippped with multiple nozzle boom, tip strainer, fan and hollow cone tips	2	60	4,800
2.	Metal beam and shank 6-inch replaceable shear turning plow	1	50	2,000
3.	Pesticide handling kits spring platform scales, three mixing buckets, 100 plastic bags with ties, funnel, funnel strainer, sealed bottles measuring cup and plastic cylinder, plastic spoons, rubber gloves and aprons, mask	2	60	4,800
4.	ULV Hand sprayer	1	40	1,600
5.	Auxiliary 6V Rechargeable battery for ULV	1	20	800
6.	One-row, animal pulled planter equipped with plate-type and cone-type planter boxes	1	200	8,000
7.	Two-wheel, diesel tiller tractor, 8HP equipped with 6-inch shear turning plow, cultivator frame, and sweeps and sickle attachment for rice cutting	1	1,200	48,000
8.	Inter-row cultivator, adjustable width, equipped with flat sweeps and chisel points	1	100	4,000
9.	Low volume (50 gpm) irrigation pumps for pumping from dug well (diesel motor)	2	200	8,000
			Total	81,000

TABLE B.3.e

Category D: EQUIPMENT LIST FOR AGRICULTURAL RESEARCH INSTITUTE (YEZIN)

Item No.	Description	Quantity	Est. U.S. $ Cost Unit Cost	Total Cost
Entomology				
1.	Microscope (Equivalent to Olympus VT-2)	3	700	2,100
2.	Stereoscopic dissecting microscope	3	500	1,500
3.	Drying Oven, Electric, 2 cubic feet; ± 2° C	1	900	900
4.	Camera: 35mm Single Reflex with 1.8 and macrolense	1	500	500
5.	Hand Lens, 10X	1 dzn	120	120
6.	Glass house insectory, screen sides, circulation fans; humidity pads 10 x 30 x 40 feet	2	2,500	5,000
Pathology				
7.	Glass house, totally enclosed with head house shared with Entomology glass house. Vents, water coolers, fluorescent lighting 10 x 30 x 40 feet	4	4,000	16,000
8.	Autclave, 1.5 cu.ft. Stainless steel	1	1,800	1,800
9.	Petridishes, Erlenmeyer flask, Pipettes Beakers, Boiling flasks, etc.	1	1,200	1,200
10.	Isolation Transfer booth, fluorescent light air conditioned 8 x 8 x 8 ft.	1	3,000	3,000
Soils				
11.	Centrifuge, floor model 28 inch diameter multiple heads; 2000rpm	1	2,200	2,200
12.	Hydrometers and Jars	24	30	720
13.	Glassware supply boiling flask, Pipettes etc.		1,800	1,800
14.	Titration Apparatus, Automatic	2	600	1,200
15.	Reagents for Fertility Testing		1,200	1,200
16.	Data Tape Printer for Tecnicon, Infra Analyzer; Hewlett Packard Printer #9815A	1	2,000	2,000
Agronomy				
17.	Hand operated cone-type plot planters (Equivalent to Burrows) and plot- measuring tapes	4	255	1,02(
18.	Drying oven, 3 cu. ft. ± 4° C	2	800	1,600
19.	Seed Cabinet, (Refrigerated (12 cu.ft) Humidity Control and Rodent-proof Dry Sample Storage)	1	1500	1,500

Item No.	D e s c r i p t i o n	Quantity	Est. U.S. $ Cost Unit Cost	Total Cost
20.	Rototiller, Wheel driven, 2 wheel, 8HP	2	1,100	2,200
21.	Irrigation Pump, 2 inch Diesel Motor	1	800	800
22.	Irrigation Pipe, 2 inch with 12 sprinklers (Rain bird or equivalent)	2500 ft	2	5,000
Shop				
23.	Ox-acetylene welder, brazing, cutting	1	1,200	1,200
24.	Electric welder, hood, booth	1	600	600
25.	4-ton chain hoist	2	500	1,000
26.	Air jacks	2	200	400
27.	House jacks, 5T	4	150	600
28.	Vise	2	100	200
29.	Anvil	1	100	100
30.	Electric hacksaw	1	600	600
31	Drill press, floor model	1	400	400
32.	Metal bender & jigs	1	200	200
33.	Motor cradle jack	2	300	600
34.	Heating forge	1	400	400
35.	Wrench sets & cabinet	3	500	1,500
36.	Log chains (set)	1	150	150
37.	Tire maintenance Center	1	550	550
38.	Hand tools - mallets, hammers, saws	1 lot	300	300
39.	Air compressor	1	1,500	1,500
40.	Wheel puller (set)	1	100	100
41.	Engine Analyzer System	1	2,500	2,500
Irrigation				
42.	Mainline buried irrigation pipe for tube wells 6" PVC 80 psi test, with joints	5000 ft	2.75	13,750
General				
43.	Packaging equipment for rat bait for seed and grain storage	1	5,000	5,000
44.	Transformer 11K volt to .4 Kv	1	5,000	5,000
			TOTAL	90,010

TABLE B.3.f

Category E: EQUIPMENT LIST FOR RHIZOBIUM INOCULUM PRODUCTION

Item No.	Description	Quantity	Estimated U.S. dollar cost Unit Cost	Total
1	Shaker for fernback flasks	1	3,000	3,000
2	Fernback flasks	20	100	2,000
3	Pipesetting machine	1	1,250	1,250
4	Extra assemblies for item 3		125	125
5	Autoclave Steam sterilizer, hospital type 24 x 36 x 48 in. with electric steam generator 220/240 volt	2	-	140,000
6	Laminar flow hood, 6' x 22" x 28"	1	4,500	4,500
7	Sieve shaker	1	550	550
8	Screens for item 7		-	350
9	Refrigerator	2	950	1,900
10	Freezer	2	950	1,900
11	Microscope binocular	1	3,100	3,100
12	Water demineralizer	1	750	750
13	Hammer mill	1	2,500	2,500
14	Mixer (paddle type)	1	10,000	10,000
15	Sealer for flexible film packages	1	2,500	2,500
			Sub total:	$174,425
	Plus additional supplies and inflation factor:			75,474
			Total:	$250,000

Table B.4

FERTILIZER BUDGET

Total funds budgeted for fertilizer are $25.0 million of which $15.0 million will be provided under the grant. Tables A.1 and A.2 of Annex A present an illustrative summary of fertilizer requirements for a cumulative total of 742,000 acres in eight intensive townships and 446,800 acres in 20 extensive townships, which would cost a total of $26.2 million at average estimated prices of $382/MT of urea, $372/MT of TSP, and $240/MT of MOP (all prices CIF Rangoon).

If these prices hold, or go up, the difference between actual fertilizer procurement with the $25.0 million available for the project and planned tonnage as represented in Table A.1 and A.2 will be made up by reducing acreage coverage in the extensive townships. However, if actual procurement with $25.0 million is at lower average prices than estimated, then, the acreage covered in the extensive townships will increase to or exceed the levels listed in Table A.2.

Cost estimates for fertilizer

Several different sources of data on present and projected international fertilizer prices were reviewed in arriving at fertilizer costs to be used in project planning. These included recent experience of the Agriculture Corporation, recent AID experience, and current factory prices for urea and TSP. Cost is also influenced by source of procurement and shipping. The U.S., as a major world supplier of phosphates, is more competitive for TSP than urea. Since the U.S. is an importer of potash, MOP is to be left to the SRUB for financing and procurement. First priority in use of AID funds allocated to fertilizer will be procurement of TSP, with the remainder to be spent on urea.

Based on the sets of price data available, the average life-of-project FOB prices of TSP and urea were estimated at $250/MT and $260/MT, respectively. A shipping cost was added to these figures to arrive at the average CIF figures used in Tables A.1 and A.2. Shipping costs using U.S. flag vessels were calculated to be $165/MT; however, other international shipping could be substantially cheaper. It was estimated that actual shipping costs in practice will average $122/MT for both TSP and urea when the various shipping arrangements are made, resulting in the average CIF prices of $372/MT and $382/MT. MOP, which will not be shipped at all on U.S. vessels, was calculated at $150/MT FOB plus $90/MT shipping or a CIF price of $240/MT.

Note: All commodity and shipping costs are estimated averages for the four years in which fertilizer will be purchased for this project (1981-85), including anticipated inflation in cost. Thus, the line item for inflation in the overall project budget does not include any additional inflation factor for fertilizer.

Grant-financed fertilizer

As outlined in the Procurement Plan, AID funds will be used to purchase up to 30,000 MT of TSP and 10,000 MT of urea during the project. At the prices used, this amounts to $14.98 million, or almost exactly $15 million. It also is almost identical to project needs calling for approximately 27,000 MT of TSP. The additional TSP procured, if any, will be made up by additional urea purchases by the SRUB against project requirements.

TABLE B. 5

LOCAL COSTS (SRUB)

The SRUB, in addition to its commitment of $10 million in foreign exchange for fertilizer procurement, will cover the following local costs during the life of project:

		US$ Equivalent
1.	Project Operating Costs (personnel, support for Project Team*, handling/ installation of equipment)	$ 2,000,000
2.	Construction of seed farms, seed processing facilities. inoculum production plant and production camps	1,000,000
3.	Training (salaries/allowances for participants while overseas, local staff training, and English language for some trainees)	1,000,000
4.	Costs of fertilizer handling, transport and distribution from Rangoon port to township-level godowns. (70,000 MT x approx.K400/MT)	4,000,000
	Total	$ 8,000,000

*Note:

Support for the Project Team will include office space, equipment and supplies, secretarial support, and vehicles and drivers (3) for the long-term specialists.

Personnel requirements only (preliminary calculation based on estimated salary for 48 months) will include the following:

AGRICULTURE CORPORATION: PROJECT PERSONNEL

No.	Position	K	$
	Headquarters		
1	Project Director	57,600	
3	Counterpart Coordinators	144,000	
2	Assistant General Manager	76,800	
5	Office staff	72,000	
	Seed Farms		
4	Farm Managers	153,600	
8	Deputy Farm Managers	268,800	
24	Village-Tract Managers	345,600	
	Intensive Townships		
8	Deputy Township Managers	153,600	
25	Village-Tract Managers	360,000	
225	Village Managers	2,700,000	
	Sub-total	4,332,000	
	+30% support	1,299,600	
		K5,631,600	$782,166

ANNEX C

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

INSTRUCTION: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.

Project Title & Number: _____

Life of Project: From FY ___ to FY ___
Total U.S. Funding ___
Date Prepared: ___

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1)	Measures of Goal Achievement: (A-2)	(A-3)	Assumptions for achieving goal targets: (A-4)
1. To increase agricultural production, rural incomes and rural employment and begin to improve nutrition. 2. To improve Burma's balance of trade through an increase in exports of oil cake, and a reduction in imports of edible oil.	By year 5 the following increases will have been achieved: 1. Groundnut production up: 375,000 MT (Direct -125,000 MT) (Spread 250,000 MT) 2. Sesamum production up: 49,100 MT 3. Sunflower production up: 65,500 MT 4. Soybean production up: 12,000 MT 5. Gross farm income up: K1,160 million ($161.1 million equivalent). 6. Exports of oil cake, soybean and maize up: $100.9 million 7. Foreign exchange value of increased vegetable oil availability of $94.5 million. 8. Per capita intake of vegetable oil up by 30 percent from approximately 2.8 Kgs. to 3.8 Kgs. 9. Maize production up: 375,000 MT	Items 1-4 - a) Crop reporting statistics of SRUB. b) Project reports of Agriculture Corporation. c) Routine reports Township and Village Tract Councils and Agriculture Corporation Managers Item 5 - a) Reports of prices, home consumption and marketing of project commodities of farmer participants at the township and village tract levels. b) Annual SRUB statistics on GDP contribution by state/division. Items 6 - 8 a) Bimonthly economic reports of the GSRUB on exports. b) Bimonthly SRUB reports on imports. c) Estimated domestic production of edible oils by the Ministry of Planning & Finance, Statistics Division.	1. That weather will be normal on average throughout life of project. 2. That economic, political and social conditions will remain stable permitting the farmers to plant and harvest on schedule. 3. That no unexpected difficulties will be encountered in marketing of production. 4. That policies with respect to distribution of income remain essentially as at present. 5. That price relationships between vegetable oil and other food at retail are approximately as at present.

AID 1020-20 (11-73)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

PAGE 2

NARRATIVE SUMMARY Project Purpose: (B-1)	OBJECTIVELY VERIFIABLE INDICATORS Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)	MEANS OF VERIFICATION (B-3)	IMPORTANT ASSUMPTIONS Assumptions for achieving purpose: (B-4)
To bring about a rapid rate of adoption of high-yielding inputs and tillage practices for improved maize and oilseeds by farmers in selected townships.	The following acreages (by crop) will be planted using recommended higher yielding technology and inputs: Direct Impact from Project Maize 383,200 acres Groundnuts 388,000 acres Sesamum 312,200 acres Sunflower 115,400 acres Total 1,188,800 acres Indirect-Spread Effect Groundnuts 1,500,000 acres Soybean 20,000 acres	Detailed township, village and farm records maintained at township and village tract levels on acres with improved tillage pracrices and inputs used by individual farmers.	1. That acceptable technology can be introduced. 2. That acceptable economic incentives for adoption are provided. 3. That inputs and technical information can be delivered as planned in acceptable form and in the townships selected. 4. That weather conditions are near normal.

AID 1022-26 (11-79)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: _____

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
1. Improved national research capability in maize and oilseeds	1. Research: On-going trials conducted at central research facilities in Yezin and at 40 field-level high technology sites within 8 intensive townships on seed varieties, soils, fertilizer application rates, water control and other production variables affecting yields of maize and oilseeds.	1. Regular records of Agriculture Research Institute at Yezin and other sites.	1. That necessary staff is assigned and facilities can be established for conduct of trials, development of seed farms, etc.
2. Introduction of improved maize and oilseed technology and production practices (seed, water, fertilizer, extension services).	2. Cultural Practices: Newly developed technology farm-tested at high technology sites resulting in township and/or village specific production packages for each crop per towhship.	2. Regular records of the Extension Division staff managing high technonogy sites in the intensive townships.	2. That suitable technology can be tested and proven on a timely basis for use at demonstration sites.
3. Fully equipped and staffed maize and oilseeds seed farms.	3. Seed Farms: 2 foundation seed farms of 70 acres for oilseeds and 110 acres for maize plus 2 certified seed farms of 800 acres for oilseeds and approximately 3,000 acres for maize; all four operational and integrated with seed processing facilities for drying, bagging and storing 3,550 MT's per year of maize, groundnut, sesamum, flower and soybean seed.	3. Records of seed farm managers Agriculture Corporation project staff and U.S. seed technology advisors.	3. That needed equipment, funds and staff are provided on time.
4. An operational/farm management information system for monitoring farm-level production practices and providing feedback on results to research and extension centers.		4. AC regular reports.	4. That U.S. and local procurement proceeds as scheduled. That ocean shipping, internal transport and storage can be arranged as needed.
5. Returned participant trainees in place within the research, extension, seed farm and fertilizer distribution elements of the project.		5. AC personnel records.	
6. Inputs supplied to farmer participants (fertilizer, seed, management equipment - rhizobium inoculum)		6. AC Procurement Division receipt and distribution records for fertilizer and pesticides; and AC/Extension Division records on production and distribution of improved seeds, equipment and inoculum.	
7. A functional rhizobium production facility (inoculum for groundnuts and soybeans.			

AID 1020-20 (11-73)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number:

Life of Project:
From FY ____ to FY ____
Total U.S. Funding
Date Prepared:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
	4. A functional data collection and farm management information system in place and operated by trained staff in 8 intensive townships. 5. 75%-100% of returned Burmese participant trainees occupy positions directly or indirectly involved with maize and oilseed production. 6. Cumulative inputs supplied as follows to project townships: - Fertilizer - 70,000 MT's - Seed - about 9,000 MT's - Pest management inputs - (exact mix to evolve from project). - Agriculture equipment - Approx. $5 million. - Inoculum - 8 million pounds. 7. Local inoculum production of 3 million pounds per year by fifth year of project.		

AID 1020-20 (1-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: _____

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
AID Funding 1. Technical assistance .... $2.4 million 2. Participant training ..... $3.0 " 3. Commodities ... $20.0 " 4. Contingency/ inflation ..... $4.5 " 5. Evaluation..... [illegible] " Sub-total $30.0 million	AID - ($30.0 million) 1. Technical assistance a) 156 person months of long-term TA (13 PY's x 12 mos.) b) 70 person months of short-term technical assistance 2. Participant Training a) 11 PhD degrees at 4 yrs each--(44 PY's or 528 PM's). b) 25 MS degrees at 2 yrs each--(50 PY's or 600 PM's) c) 70 short-term training programs at average of 4.5 months (315 PM's) 3. Commodity Procurement a) Fertilizer ($15.0 million) TSP -30,000 MT (Approx. UREA 10,000 MT (Approx. b) Machinery, equipment, parts and supplies ($5.00 million) (1) Seed farms with farm production, processing & storage facilities	AID - 1. - Contractor refords and quarterly reports; AID-financed documents (vouchers, etc.) 2. - Contractor records & quarterly reports; GSRUB project records; AID/Burma participant training records, 3, a, - AID/W procurement & shipping records; AC procurement, shipping, unloading records and monthly inventory reports, b, - Contractor procurement reports, AID/W financial records AC records and reports, 4, All of above depending on allocation and use of contingency reserve. SRUB 1 & 2, Agriculture Corporation Procurement Division records and monthly reports, 3, SRUB project records. and quarterly reports.	AID - 1. That the project is approved on schedule and that funds are provided as scheduled on an annual basis. 2. That contractor selection and procurement and staffing proceeds on schedule. 3. That participants are named, qualified and processed on schedule. 4. That commodity procurement proceeds as planned and accommodities are shipped, cleared and moved to project sites expeditiously. 5. That the contingency allowance for escalation in costs of TA, training and commodities proves adequate to meet needs. SRUB - 1. That SRUB budget resources are released on schedule. 2. That unusual difficulties are not encountered by the GSRUB, AID or the contractor in making needed procurement and imports. 3. That SRUB staff personnel and AID contractors can be assigned and remain in the project as planned.
SRUB Funding 1. Fertilizer ... $10.0 million 2. " Distribution [illegible] million 3. Other local costs including personnel, facilities and supplies (K equivalent in US$) [illegible] million Sub-total $18.0 million TOTAL $48.0 million			

AID 1020-28 (1-70)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: _____

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
	(2) 1 rhizobium production facility ($0.25 million) (3) Laboratory equipment publications and related research needs at ARI/Yezin ($0.10 million) (4) Equipment & materials for extension information demonstration on farm use ($1.10 million) (5) Spare parts plus procurement costs, shipping, handling, etc. ($0.85 million) 4. Contingency 15% contingency to cover inflation in costs of training, commodities and technical assistance and to finance some import needs which may have been missed in preparing detailed listings of requirements. SRUB - ($18.0 million) 1. Fertilizer ($10.0 million) UREA 26,000 MT (Approx.) MOP 4,000 MT (Approx.) 2. Fertilizer handling, transport and distribution from Rangoon port to township (over)		4. That complementary facilities and equipment can be constructed, developed or purchased locally to meet project requirements.

AID 1020-25 (11-73)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

PAGE 4

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2) level godowns (K28.0 million or $ 4.0 million) 3. Other costs including pesticide, management, staff, logistical support, research and extension facilities, seed farm facilities and operation plus establishment and operation of High Technology sites. Total: (Kyat 57.6 million or $ 8.0 million) (at K 7.2 = $1 U.S.)	(D-3)	Assumptions for providing inputs: (D-4)

ANNEX D

Environmental Assessment of the Use of Pesticides in the "Maize and Oilseed Production" Project--Burma

by

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Professor and Head, Department of Entomology

Cornell University

Geneva, New York

With Editorial Modification by A.I.D./S&T/AGR

June 15, 1981

Environmental Assessment of the Use of Pesticides in the "Maize and Oilseed Production" Project--Burma

I. Introduction:

A. This Environmental Assessment (EA) examines the problems of pest control in the "Maize and Oilseed Production" project in Burma. The EA, along with crop protection sections of the Project Paper, reviews the current status of pest problems and pesticide use on these crops in Burma. The conclusion is reached that current pest losses are generally lower than expected in tropical countries, yet there are frequent small-scale pest outbreaks that require pesticide treatment to prevent intolerable losses.

B. Currently, maize and oil crop farmers in the proposed project areas use endrin, aldrin and DDT. All of these are suspended by the USEPA and are no longer used for agricultural purposes in the U.S. They also use lindane, which is currently under the Rebuttable Presumption Against Registration (RPAR) process. All of the above are classified as chlorinated hydrocarbons. Other pesticides used in Burma on maize and oil crops (see Appendix #3) are registered by the USEPA without restriction except phenthoate which is not registered in the U.S. and has not been toxicologically cleared by FAO/WHO.

Endrin, aldrin, lindane and DDT make up more than 60% of all pesticides applied to these crops in Burma. There is no evidence that such use has caused toxicological problems to applicators or harmful environmental consequences although there has not been careful monitoring for such problems. In view of the known long-term environmental impacts of the use of endrin, aldrin, lindane and DDT and the known or suspected human and/or environmental hazards, the EA concludes that long term use of these in the project should be discouraged. The EA recommends that the uses of aldrin, endrin, lindane and DDT be phased out and that relatively inexpensive and efficaceous substitutes having environmentally acceptable properties be identified and substituted for the chlorinated hydrocarbons.

The EA also recommends that appropriate training in pesticide management be provided for users of pesticides and that the project provide technical assistance in developing pest management programs.

C. The principal issue to be resolved is whether the adverse environmental impacts and health hazards associated with the use of the chlorinated hydrocarbon pesticides during the phase-out period are mitigated by the short and long-term benefits which will accrue from such use to the farmers and the project's success in increasing food supplies and export income for Burma.

II. Purpose:

A. The purpose of this EA is to examine the environmental, human health and economic aspects of the following five alternatives:

1. Using no pesticides in the project areas on maize and oil crops.

2. Using in the project areas on maize and oil crops only pesticides registered by USEPA for the same or similar uses without restrictions.

3. Using in the project area on maize and oil crops only pesticides registered by USEPA for same or similar uses with or without restrictions.

4. Using the project area on maize and oil crops only pesticides registered by USEPA for the same or similar uses without restrictions except aldrin for soil and seed treatment and with a phase-out of the use of aldrin over a two-year period.

5. Continuing the use of endrin, aldrin, lindane and DDT on maize and oil crops in the project area until the local farmers can be familiarized with the new names, physical characteristics, application procedures and efficacy of more environmentally acceptable substitutes and the initiation of a search to identify the most cost effective of these substitutes with the goal of phasing out the chlorinated hydrocarbon pesticides over a period of two years, if possible, but in any event no later than the end of the project.

III. The USEPA Registration Status of Pesticides Currently In Use in Burma

1. DDT is no longer registered for use in the U.S. except for public health purposes. The acute LD_{50} of the technical material* is 113 mg/kg for rats and is relatively non-toxic dermally. The formulations used in Burma are a 25% emulsifiable concentrate and a 75% wettable power. By extrapolation, the acute LD_{50} for the liquid is 430 mg/kg and 143 mg/kg for the powder. Farmers add these formulations to water and apply to crops with knap-sack or similar hand-operated equipment. Although DDT is no longer registered for use on corn in the U.S., there is still a U.S. legal tolerance of 3.5 ppm on sweet corn (kernels plus cob). This tolerance, however, is intended only for inadvertent and unavoidable residues resulting from past use of DDT. The FAO/WHO Joint Meeting on Pesticide Residues recommended an international tolerance of 7 ppm on all vegetables.

2. Endrin is no longer registered for use in the U.S. The acute oral LD_{50} of the technical material is 7 mg/kg for rats. Dermal toxicity of endrin is considerably less at 60 to 123 mg/kg. Endrin is available in Burma as a 19.5% emulsifiable concentrate. By extrapolation, the oral and dermal toxicities of the formulation are 34 mg/kg and 292 to 585 mg/kg respectively.

3. Aldrin uses in the U.S. are now restricted to termite control, dipping of non-food plants and moth proofing. The acute oral LD_{50} of the technical material is 67 mg/kg and the dermal for rabbits is 98 mg/kg. Aldrin is used predominantly in Burma as a 5% dust for seed or soil treatment. By extrapolation the oral and dermal toxicities of the dust are 1,273 mg/kg and 1,862 mg/kg respectively. Aldrin as used presents relatively lower user hazards and should not result in significant crop residues if groundnuts grown in treated areas are blended with those from non-treated areas. Significant quantities of aldrin or its soil degradation product, dieldrin, should not accumulate in the physical or biological environment under the conditions and levels of use.

4. Lindane is still registered for some crop uses in the U.S. but an RPAR has been issued on the basis of possible oncogenicity, teratogenicity, reproductive effects and toxicity. The acute oral and dermal LD_{50}s of the technical material are 88 mg/kg and 1,000 mg/kg for rats respectively. In Burma, it is used predominantly as a 1.3% gamma isomer wettable powder which

*All technical materials are considered to contain 95% active ingredient.

extrapolates to 6,431 mg/kg oral and 63,333 mg/kg dermal for the formulation. Lindane is applied mostly diluted with water from knap sack sprayers and presents minimal user hazards. It is not a "restricted use" pesticide in the U.S. As used in Burma, tolerances should seldom if ever exceed U.S. or FAO/WHO tolerances for food.

5. Malathion, diazinon, chlorothalonil and carbaryl are registered without restriction by the USEPA for the same or similar uses as proposed in Burma.

6. Phenthoate is not registered in the U.S.

IV. Alternatives, Including the Proposed Action

A. Background

1. No pesticides are produced in the Socialist Republic of the Union of Burma (SRUB). They are purchased, imported and controlled internally by SRUB. In the past, SRUB selected insofar as possible the least expensive products in order to conserve foreign exchange. These products have included certain organochlorine and cyclodiene insecticides which are now considered to be too hazardous to the environment and/or to humans to be used in the U.S. and certain other countries. SRUB considers environmental hazards to be insignificant because of the relatively small quantities used in the country. However, officials are deeply concerned about the health and safety of Burmese farmers and have initiated training programs in the safe use of pesticides. They are also seeking effective and safer alternatives to those that pose human and/or environmental hazards.

2. Pesticides of all types are used on very small percentages of maize and oil crop sown areas: 0.25% or less of maize, less than 2% of groundnut and less than 0.05% of sesamum for the 1977-78 cropping season (see Appendix #1).

3. Endrin, lindane, aldrin and DDT were the major insecticides used on maize and oil crops during the 1979-80 season representing 63% and 60% of the active ingredient applied to maize and oil crops respectively. However, the total active ingredients for all sown acres averaged 0.02 and 0.007 pounds per acre for maize and oilseeds respectively.

4. SRUB scientists state that there appears to be effective alternative chemical insecticides for endrin, lindane and DDT uses on maize and oil crops but not aldrin seed and soil treatments against termites, crickets and white grubs. Even though alternatives are now known for most uses, the small farmers are not familiar with their physical characteristics, methods for application or their general relative efficacy. Therefore, a sudden imposition of these alternatives could cause confusion and ill will.

B. Alternatives

1. Using no pesticides in the project area on maize and oil seed crops. Even though pests on these crops are not considered to cause high average yield losses, there are severe local infestations that cause unacceptable yield reductions. Elimination of all pesticides would alienate farmers and jeopardize the success of the project.

2. Using in the project area on maize and soil crops only pesticides by USEPA for the same or similar uses without restrictions. The only insecticides in this category that are available in Burma are carbaryl, malathion and diazinon. These are known to be effective against some but not all pests of these crops, especially soil pests such as termites, crickets and white grubs. This alternative would eliminate the potential environmental and/or human hazards created by several of the pesticides now in use. However, the general lack of knowledge regarding specific alternatives to aldrin as a soil insecticide and unfamiliarity of farmers to endrin, lindane and DDT substitutes would create a lack of confidence in the project among most farmers and unacceptable losses for some.

3. Using in the project area on maize and oil crops only pesticides registered by USEPA for same or similar uses with or without restrictions. In addition to carbaryl, malathion and diazinon, this alternative would permit the use of phosphamidan and EPN. Both products are restricted in the U.S. on the basis of hazards to the operator and EPN is in RPAR because of neurotoxicity. These products have only been used in very small quantities on maize and oil crops in the past because they are not superior to the less toxic insecticides or are not effective alternatives to endrin, lindane, aldrin and DDT against some important pests. Thus essentially an increased risk with no increase in benefit of Alternative #2 would apply here.

4. Using in the project area on maize and oil crops only pesticides registered by USEPA for same or similar uses without restrictions except aldrin for soil or seed treatments and with a phase-out of the use of aldrin when a satisfactory substitute is found. Burmese crop production scientists do not know of any potentially effective substitutes for aldrin for soil insect control although several candidate soil insecticides are likely to be effective. This alternative would enable farmers in the project area to continue to use a pesticide that they know by experience to provide good results and allow time for efficacy evaluations to be conducted on alternatives. The limited amount of aldrin used in seed and soil treatments on maize and oil crops would not create serious environmental or human hzards. As soon as satisfactory alternative insecticide or other management practices can be determined through research, aldrin use would be phased out. If tests begin as soon as possible, alternatives should be available within a two-year period. None of the other pesticides proposed for use would have a significant adverse effect on the environment or create public health hazards.

5. Continuing the use of endrin, aldrin, lindane and DDT on maize and oil crops in the project area until the local farmers can be familiarized with the new names, physical characteristics, application procedures and efficacy of more environmentally acceptable substitutes and the initiation of a search to identify the most cost-effective substitutes for all of the chlorinated hydrocarbons with the goal of phasing out the chlorinated pesticides over a period of two years if possible, but in any event no later than the end of the project. Endrin, aldrin, lindane and DDT have been identified by Burmese officials as effective insecticides against most major and minor pests of maize and oil crops. They are preferred on the basis of cost and are judged not to be a threat to the overall environment in the quantities used. However, as reported in Section IV, there is concern for the users and long-term environmental consequences if use is continued for many years.

In most of the developed nations as well as in many of the developing countries, the persistent chlorinated pesticides including aldrin, DDT and endrin have been withdrawn from agricultural and food crop use and reserved solely for public health purposes. In certain other countries these pesticides are also still allowed for use on cotton but not on food crops per se. Monitoring studies have clearly shown marked elevations in levels of chlorinated pesticides in human mothers' milk and body tissues where chlorinated hydrocarbon pesticides are used for general agricultural purposes. Also excessive use of the chlorinated hydrocarbons has led to increased overall insect resistance with concommitant losses of their efficacy when used in critical public health programs such as malaria control. While the chlorinated pesticides are admittedly the cheapest pest control agents on a pound per pound basis, the health risks and ecological damages over the long term outweigh the gains accrued. Since no alternative is currently known for the use of aldrin to treat seed (or soil) for control of termites, cricket and white grubs, a search for a cost effective and environmentally acceptable substitute should be started immediately. In the case of DDT, lindane and endrin there are effective substitutes (diazinon, malathion and carbaryl) but farmer familiarity with these pesticides in terms of "hands on" use and personal knowledge of efficacy is practically nil. Therefore a period of indoctrination, sensitization and demonstration of the need for and the utility of substitutes will greatly enhance farmer acceptance. Also during the same period, additional efforts can be made to determine the most cost effective substitutes and the minimum dosage required.

It is noteworthy that only a very small portion of the total acreage of active maize and oilseed production is involved and therefore such a phaseout should have minimal impact--only 0.25% or less (1,324 acres) of maize, less than 2% (16,623 acres) of groundnut and less than 0.1% (969 acres) of sesamum will be involved with treatment by chlorinated pesticides. Hopefully, the improved pest management practices (including the phaseout of the chlorinaded pesticides) in this project will serve as an example and as a catalyst to similar positive actions by the Burmese and will be extended to other agricultural areas within the country.

V. Basis of Selection of Pesticides Proposed for Use

These alternatives were considered and evaluated on the basis of current pesticide use practices in Burma. Heavy reliance is placed on: chlorinated hydrocarbons (endrin, aldrin and DDT) which have now been suspended and cancelled in the U.S. for all agricultural uses; EPN and phosphamidon whose use is restricted based on human hazard; and lindane, which is currently under the RPAR process. Also, five additional pesticides currently registered by the USEPA for many uses, without restriction, are in limited use. These are the organophosphate insecticides, malathion and diazinon; the carbamate, insecticide carbaryl; and the fungicides, cuprous oxide and chlorothalonil. Typically, endrin, aldrin, DDT and lindane represent 63% and 60% of the total insecticide active ingredient applied to maize and oil crops respectively. Farmers rely on them to control such pests as: *Spodoptera litura*, *Diacrisia obliqua*, *Acherontia styx*, *Antigastra catalvanalis*, *Anomala antiga*, *Stomopheryx subsecivella* and *Maruce testualis* on maize and oil crops. Reportedly these insects can also be controlled by use of carbaryl, diazinon and malathion although such uses have not yet been extensive in Burma.

According to Burmese specialists, certain soil insects infesting maize and peanut areas can only be controlled by the use of aldrin dust. Even the pesticide lindane is reportedly not effective although this insecticide is generally quite effective against soil insects. The pest complex involved includes termites, crickets and white grubs. Usually treatment involves treating seeds but sometimes oils are treated directly.

The rate of application is 5 pounds of 5% dust per bushel of seed per acre or 0.25 pounds of active ingredient per acre.

VI. Extent to which the Proposed Pesticides Users are part of Integrated Pest Management Programs

These insecticides are not well adapted to IPM programs and will not be so used. However, one of the objectives of the project is to develop monitoring systems that will enable use of pesticides only as needed and with optimum timing of applications. As a result, some use reductions are expected very early in the project (see Crop Protection Section III-A-1).

VII. Proposed Method or Methods of Application Including Availability of Appropriate Application and Safety Equipment

Burmese maize and oilseed farms in the project area are small, averaging about 5 acres. Most pesticides are applied with hand sprayers and dusters. Seed treatment will be done manually. Thus, there normally will not be excessive drift away from the target area. Some user exposure will result from such application methods because safety equipment is generally not available.

VII. Acute or Long-term Toxicological Hazards and Measures Available to Minimize Such Hazards

The acute hazards of all pesticides proposed for use in the project are low to medium except for endrin which is highly toxic. LD_{50} values ranging from 10,000 mg/kg (chlorthalonil) to 7 mg/kg (endrin). None of the pesticides, with the exception of the chlorinated hydrocarbons, are expected to be especially persistent. Furthermore, with the exception of the chlorinated hydrocarbons there are no known long-term toxicological hazards known to be associated with their use. The long-term toxicological hazards associated with DDT, endrin and aldrin are well known and Federal Register reference describing these hazards in detail can be found in the USEPA publication "Suspended and Cancelled Pesticides," USEPA, OPA 159/9, Second ed., October 1979. The hazards associated with lindane are described in the Federal Register notice related to the lindane RPAR. Safety equipment and pesticide safety education are not always available to small farmers; there will be some hazard to applicators. Plans for pesticide management training are included in the Project Proposal to maximize safe handling and proper use of pesticides. Also efforts will be made to find safer alternatives.

IX. Effectiveness of the Requested Pesticides for the Proposed Uses

See paragraphs B above, and III-A, 1-4 (Crop Protection Section).

X. Compatability of the Proposed Insecticides with Target and Non-Target Ecosystems

The pesticides DDT, endrin, lindane and aldrin are all toxic to fish and to wildlife, and their persistence can cause carry-over effects from one year to the next. However, the relative small acreages involved will minimize the actual impact. This coupled with the early proposed phaseout, should bode well for the long-term well being of that portion of the environment not yet negatively affected. The three alternate pesticides now available in Burma-malathion, carbaryl and diazinon--are all relatively non-persistent and are fully acceptable for agricultural purposes. Minimum impact on non-target areas would be expected to occur. Likewise the fungicides, copper oxychloride and chlorothalonil, and the rodenticide, zinc phosphide, should cause no untoward problems if used according to U.S. label directions.

XI. The Conditions Under Which the Pesticides are to be Used

These pesticides will be applied in open fields of maize and oil crops which are annually subject to periods of heavy rainfall and extended periods of drought and continuous high temperatures. These tropical conditions and rotations with other crops should result in relatively more rapid degradation of residues than in temperate regions. The application of these materials with hand sprayers or dusters will minimize drift to non-target flora and fauna and to bodies of water.

XII. The Requesting Country's Ability to Regulate or Control the Distribution, Storage, Use and Disposal of Pesticides

The Socialist Republic of the Union of Burma has complete control of the importation, distribution and recommendations for use of pesticides. None are manufactured in Burma. Distribution is from a central storage to divisions or states to township storage facilities and then either directly or through village cooperatives to the farmers. There are no established residue tolerances nor are there capabilities to monitor pesticide residues.

XIII. The Provision Training Users and Applicators

The Burmese government has initiated a program through its Extention Division Crop Protection (FAO) Project to provide training to users of pesticides in proper and safe handling methods. Additionally, this maize and oil crop project provides for training programs in pesticides management for project personnel, seed-farm workers, farmers and others involved in the use of pesticides.

XIV. The Provisions Made for Monitoring the Use and Effectiveness of the Pesticides

The project provides backstopping research by the Agricultural Research Institute at Yezin to develop appropriate pesticide use efficacy data for pest problems encountered in the project. Additionally, the High Technology Sites will provide an opportunity to conduct practical field trials of pesticides as well as other production technologies.

XV. Affected Environment

See Project Paper I-A-2, I-D and III-A-1 (Crop Protection).

XVI. Environmental Consequences

Alternative #1--Using no pesticides in the project area on maize and oil crops. The environmental impacts of this option are limited to the unchecked damage and yield losses caused by pests of maize and oil crops, the resulting economic losses and reduced food and oil production. Such losses are considered to be unacceptable and would alienate a considerable portion of the affected farmers.

Alternative #2--Using in the project areas on maize and oil crops only pesticides registered by USEPA for the same or similar uses without restrictions. The evironmental consequences of this option are similar but not as severe as for the first in terms of pest induced reduced yields and economic losses to farmers. On the other hand, attempts to use available unrestricted pesticides that have not been tested adequately or are minimally effective against some pests would alienate farmers and compromise the success of the project. Thus, this is not a desirable action.

Alternative #3--Using in the project areas on maize and oil crops only pesticides registered by USEPA for the same or similar uses with or without restrictions. This alternative adds phosphamidon and EPN to the list of materials available under Alternative #2. Both have been little used on maize and oil crops in the past in Burma. Both are rated as "extremely hazardous" by WHO, i.e., the same category as endrin. Thus farmers would be exchanging safe insecticides with known efficacy value for equally or more hazardous materials that have not been tested for a number of pests. This option would have the same consequences of Alternatives #1 and #2 plus adding an extra human risk factor.

Alternative #4--Using in the project area on maize and oil crops only pesticides registered by USEPA for the same or similar uses without restrictions except aldrin for soil or seed treatment and with a phaseout of aldrin over a two-year period. Just as with Alternatives #2 and #3, this alternative will require farmers to shift too rapidly from some long-established well-known materials. It has the advantage of continuing the use of an essential insecticide aldrin for seed and soil treatment until a substitute can be found. With the exception of endrin, all of the pesticides proposed represent those having a low hazard to humans and should have a minimal effect on the environment.

Alternative #5--To allow for continued use of endrin, aldrin, lindane, and DDT in the project area on maize and oilseeds in situations where local farmers are not familar with names, physical characteristics, application procedures and efficacy of potential substitutes, and to call for the initiation of investigation into least hazardous and cost-effective substitutes for endrin, aldrin, lindane and DDT use with a goal of phasing out these chlorinated hydrocarbon pesticides (i.e., DDT, aldrin, etc.) in the

project over a two-year period, if possible but in any event no later than the end of the project. This alternative adds an incremental exposure to Alternative #4 of the pesticides lindane, endrin and DDT where 471, 847, and 6,250 pounds respectively are used over a total agricultural area of over 2,000,000 acres. While these amounts are by no means insignificant, especially within the areas of treatment per se, the overall impact would be expected to be of an acceptable level relative to total land area involved.

XVII. Actions Recommended if Alternative #5 is Utilized

Subject to the approval of the proposed Alternative #5, it is recommended that:

1. Project personnel should, in cooperation with SRUB, conduct high priority testing for locating alternatives to aldrin on maize and oilseeds to control termites, crickets and white grubs. All reasonable alternatives should be evaluated and at a minimum chlorpyrifos and oftanal should be tested. Additional candidates can be selected from information available in the U.S. at the USDA Termite laboratory in Gulfport, Mississippi. Testing should be completed within the next two years so that alternatives can be used as early as the third year onward. Testing protocols should provide for collection of residue data in the harvested agricultural commodity, if tolerances and/or MRLs have not already been established for that use. AID/W/S&T/AGR can provide assistance with test protocol design.

2. Any promising candidate pesticides should then be tested the second year in practical trials on the high technology farms and elsewhere. For those use patterns which do not have established food tolerances (USEPA or FAO/WHO), samples should be collected for residue analysis.

3. Treatment instructions, including elementary safety precautions should be translated into Burmese and these instructions will be affixed, as labels, to each farmer's allotment of pesticide.

4. Field trials using the DDT/lindane/endrin substitutes--malathion, diazinon and carbaryl--should be conducted to determine minimum required dosages, and demonstrations made to farmers to achieve widespread acceptance.

5. Other candidate pesticides should also be evaluated as they become known to project personel since pesticide management is a dynamic field with the search for new, more cost effective and safer materials a continuous effort. Emphasis should be given to pesticides which have been toxicologically cleared by the USEPA or FAO/WHO.

6. Since peanuts grown in the presence of aldrin will translocate new residues to the soil metabolite dieldrin, special attention should be taken to distribute (mix) these peanuts with those harvested from non-treated areas.

7. SRUB should re-examine the real (total) cost of pesticides considered for importation giving full consideration to such factors as environmental costs, health hazards, effects of beneficial organisms and usefulness in integrated pest management as part of total farming systems. SRUB has recently formed an advisory board made up of experts on pesticides, to assist in the decisions regarding their importation and use in Burma.

8. As part of the Pest Management Extension effort (see Project Paper, page 33, Section III A.1(4)), farmer training in the proper use of pesticides should be provided. AID/W assistance in the form of train the trainer programs will be available in late CY 1982.

APPENDIX #1

ACRES OF MAIZE, GROUNDNUT AND SESAMUM TREATED WITH PESTICIDES, INSECTICIDES, FUNGICIDES AND RODENTICIDES IN 1976-77 AND 1977-78 CROPPING SEASONS

	76-77 Acres			77-78 Acres		
	Sown	Treated	%	Sown	Treated	%
Maize	549,420	215	0.04	527,191	1,324	0.25
Groundnut	1,507,304	40,341	2.68	1,481,263	16,623	1.12
Sesamum	2,630,504	76	0.003	2,696,095	969	0.04

Source: Green Statistics Book

APPENDIX #2

INSECTICIDES USED IN BURMA ON MAIZE AND CROPS DURING THE 1979-80 CROPPING SEASON

Insecticide	Quantity Used: Maize	Quantity Used: Oil Crops
Endrin 19.5% EC	2,515 gal.	1,722 gal.
Malathion 90% EC	455 gal.	1,488 gal.
Lindane P 1.3%	3,797 lbs.	32,568 lbs.
Aldrin 5% D	32,489 lbs.	101,018 lbs.
DDT 25% EC	0	1,000 gal.
DDT 25% WDP	0	8,000 lbs.
Sevin 85 WP	0	0
Diazinon 40% EC	2 gal.	12 gal.
Diazinon 10% G	993 lbs.	0
Dimecron 50 SCW	0	114 gal.
EPN 45% EPN	0	309 gal.

APPENDIX # 3

STATUS OF PESTICIDES CURRENTLY USED ON MAIZE AND OIL CROPS IN BURMA

Common Name	Activity	Acute Oral LD50 (Mg/Kg)	USEPA Registration Status
Endrin	Ins.	7	All uses cancelled
Aldrin	Ins.	67	All food uses cancelled 6/
Lindane	Ins.	88	RPAR 7/
DDT	Ins.	113	Most uses cancelled 8/
Phosphamidon 1/	Ins.	17	Restricted
EPN	Ins.	14	Restricted, RPAR 9/
Diazinon	Ins.	300-400	Registered w/o restriction
Malathion	Ins.	1375	Registered w/o restriction
Carbaryl 2/	Ins.	850	Registered w/o restriction
Phenthoate 3/	Ins.	400	Not registered in U.S.
Cuprous oxide 4/	Fung.	470	Registered w/o restriction
Chorthalonil 5/	Fung.	10,000	Registered w/o restriction
Zinc phosphide	Rod.	46 10/	Registered w/o restriction

1/ Dimecron

2/ Sevin

3/ Elsan

4/ Perenox

5/ Daconil

6/ All uses cancelled except termites, non-food plant dip and moth proofing.

7/ RPAR because of acute toxicity, oncogenicity, teratogenicity, reproductive effects toxicity.

8/ All uses cancelled except public health and body lice.

9/ RPAR because of neurotoxicity

10/ Estimated LD_{50} of 2% formulation is 2,300.

Table 1

Annual Consumption of Insecticides on Maize and Oil Crops in Burma 1976-80
(Agricultural Corporation Data)

Insecticide	Formulation	Maize 76-77	Maize 77-78	Maize 78-79	Maize 79-80	Oil Crops 76-77	Oil Crops 77-78	Oil Crops 78-79	Oil Crops 79-80
Endrin	19.5% EC	5	150	2418	2515	1335	1899	2543	1722
Malathion	90% EC	0	0	362	455	1059	1395	2931	1488
Lindane	P 1.30%	0	20	4273	3797	62477	23694	68867	32568
Aldrin	5% D	0	0	28904	32489	151764	28138	1915	101018
DDT	25% EC	0	0	0	0	200	807	26	1000
DDT	75% WDP	1372	1276	1200	0	7153	5291	159	8000
Carbaryl	85% WP	0	0	0	0	1356	616	0	0
Diazinon	40% EC	0	0	0	2	0	0	0	12
Diazinon	10% G	0	0	0	993	0	10	0	0
Dimecron	505 CW	0	0	0	0	35	0	31	114
EPN	45% EC	0	0	0	0	2	163	0	309

EC = emulsifiable concentrate (gallons)
P = powder (pounds)
D = dust (pounds)
WDP = wettable dry powder (pounds)
WP = wettable powder (pounds)
G = granules (pounds)
SCW = soluble concentrate (gallons)

ANNEX E

SUPPLY, PRICE AND DEMAND FOR VEGETABLE OIL, OILCAKE AND MAIZE

1. Vegetable Oil

Vegetable oil is considered the second most important commodity, after rice, in the Burmese diet. Average consumption of vegetable oil per capita is very low (2.3 kg to 3.1 kg per year), and obviously a very large unsatisfied demand exists. Vegetable oil in one form or another enters into every meal or would if consumers could afford it and could obtain sufficient supplies.

Review of supply and prices over the past 15 years shows sharp fluctuations in prices (especially on the upside when supplies are short). Between 1974-75 and 1980-81 supplies have varied between 2.32 kg and 3.11 kg per capita nationally. A reduction in supply of about 20% has resulted in a doubling of prices and an increase in supplies of 25% in a halving of Rangoon prices. Table 1 shows prices, production and supplies of vegetable oil. Data from 1965-66 to 1973-74 and in parentheses for 1974-75 are from U.S. Attache Reports and from 1974-75 to date from AC estimates. Both appear to overestimate prevailing oil extraction rates.

Oil and protein content for different oilseeds based on 6-10% moisture are estimated as follows:

	Oil	Protein
Sesamum	43%	27%
Safflower (whole seed in hull)	30%	16%
Sunflower (whole seed in hull)	26%	17%
Groundnuts (shelled)	48%	30%
Soybeans (whole seed)	19.5%	38%
Cotton seed (whole seed)	21.5%	23%

At 10% residual oil in the cake from village-type mills, the extraction rates based on original product weight would be approximately as follows:

Sesamum	36-37%
Safflower (whole seed with hull)	22-23%
Sunflower (whole seed with hull)	18%
Groundnut (shelled)	42%
Soybean	10-10.5%
Cotton seed	11.5-12%

There tend to be some product losses in processing (averaging about 5%) so overall oil extraction and residual cake tend to be somewhat less than the above. In contrast Government statistics are based on the following oil extraction rates:

Sesamum 45%
Groundnut 29.1% (shell basis)
Groundnut 45% (seed basis)
Sunflower 40% of whole seed

Inflation and increases in cost of living index make it somewhat difficult to quantify the supply/price relationship, especially in the absence of reliable data. As shown in Table 1, vegetable oil seed production and consequently vegetable oil production estimates are up sharply for the 1981-82 consumption season from the prior year. Despite this sharp increase in supplies, retail oil prices in Rangoon have only dropped from a peak of K45/viss in July 1980 to K30/viss in March-May 1981. Part of this may be a reflection of reduced foreign imports into the Rangoon port in recent months. The large 1979-80 arrival from abroad may have held prices in Rangoon well below what national supplies would otherwise have brought. There appears to be some increase in quantity demanded per capita in recent years at a given price.

Given the slight increase in real income and a higher than 2% rate of population growth, the project's planned increase in output of 30% of current production is likely to meet national needs and result in prices in Rangoon averaging near K30/viss in real terms (K30 adjusted upward by increases in wholesale and retail price indexes). For farmers this should result in prices of a basket of groundnuts and sunflower of K40 or more. The soybean oil extracted from a basket (60 lb) of beans at 10% residual oil would have a value of K48. The cake at $200 per MT would have a value of about K28 per basket of beans. A basket of groundnuts in shells (25 lbs) should have an extractable oil value of about K57-60 with local processing of shelled nuts; a basket (54 lbs) of sesamum would yield oil valued at about K160; a basket (32 lbs) of sunflower with local oil expelling should yield about K47 worth of oil at retail prices. These values are all well above prices assumed for oilseeds, K120 for sesamum, and K40 for groundnuts and sunflower.

2. Oil Cake

Burma is a regular exporter of oil cake, with the largest and most consistent export item being oil-pressed rice bran. Exports of the oil cake have varied with supply and policy on exports (Table 2). Exports of oilseed cake (other than rice bran) have varied from 11,000 to 93,000 MT. Domestic production of oilseed cake has recently ranged between 150,000 MT and 220,000 MT and consumption averaged 130-140,000 MT.

We would expect most of the cake and/or meal from this project to be exported. Local demand for oil cake for increase in domestic production of livestock, mostly poultry, under modern systems possibly might grow by 2,000 MT per year which by Year Five of the project would reduce oil

cake exports by up to 10,000 MT per year from levels otherwise obtained. Because of this dependence on export, oil cake prices are expected closely to reflect world market prices adjusted for quality and cost to shipside. This is similar to the present situation. However, with the much larger levels of export, more attention to export is to be expected and somewhat better FOB prices should be obtained.

3. Maize

Maize production for grain in recent years has grown significantly and now is over 100,000 MT per year. Government procurement in recent years has been 5,000 to 15,000 MT per year with most of that exported (3,000 to 15,000 MT per year). If the project proceeds as planned, production will be up about 137,000 MT by 1985-86. Since demand internally appears to be fairly inflexible, it is expected that the major part of the increase will be offered to the Government for export. A small part of that increase might go into mixed feeds for local poultry production under modern system, but at least 75% and probably over 85% will be available for export. Thus the domestic price is likely to reflect the Rangoon FOB price less costs of handling. At present, the Government pays K20/basket to procure maize for export which is near the world price adjusted for costs to shipside. With adjustment for world inflation, this is expected to continue as the basis of pricing. K20/basket has been used in the economic analysis.

TABLE

ESTIMATED PRODUCTION OF VEGETABLE OIL, VEGETABLE OIL IMPORTS, OIL PRICES IN RANGOON, AND ALL CAKE EXPORTS
(PRODUCTION, IMPORTS, CAKE EXPORTS IN THOUSAND MT)

	Ground-Nut	Sesamum	Other	Imports	Per Capita Supply (kg)	Price Ground-nut	(K/Viss) Sesamum	Cake Exports 1/
1965-66	49	35	2	.2		11.4	11.7	
1966-67	47	19	2			9.9	9.6	145
1967-68	66	18	1			18.6	18.1	98
1968-69	73	37	2	.2		9.3	9.3	114
1969-70	81	28	3	-		5.9	5.6	94
1970-71	102	34	3	-		10.1	10.1	86
1971-72	86	45	3	-		17.9	17	125
1972-73	73	30	4	-		15.	13.9	128
1973-74	96	24	4	-		20	18	167
1974-75	84(86)	32(51)	4	.2	2.48	21	20	83
1975-76	73	46	4	1.4	2.54	38	34.4	86
1976-77	77	31	6	3.6	2.32	47	42	67
1977-78	89	37	10	4.1	2.73	37	35	53
1978-79	74	74	10	3.0	3.11	22	21	77
1979-80	61	36	10	13.0	2.25	32	31	90
1980-81	75	54	15	1.8	2.54	37	35	63
1981-82	129	98	21	-	4.42	30 2/	30 2/	65

1/ Oil extracted rice bran usually accounts for 60-75% of cake exports.

2/ Beginning of the 1981-82 consumption year.

Table 2

Exports of Oil Cake and Maize By Years

	Groundnut	Sesame	Cotton Seed	Pressed Bran	Maize
1968	40	4	5	44	9
1969	37	12	2	35	8
1970	40	13	2	70	10
1971	43	23	3	59	12
1972	79	14	-	74	16
1973	30	13	5	34	5
1974	29	27	2	28	3
1975	18	18	2	38	4
1976	7	4	-	21	6
1977	7	5	2	49	18

ANNEX F

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Department of State

OUTGOING TELEGRAM

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ORIGIN AID-35

ORIGIN OFFICE ASPT-02
INFO AAAS-01 ASEM-01 ASDP-02 PPCE-01 PDPR-01 PPPB-03 PPEA-01
ASPD-01 ASTR-01 AADS-01 C-01 CASI-02 CPS-02 DSAG-02
CHB-01 AGRI-01 EPA-03 RELO-01 9L-00 /030 A0

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APPROVED BY AID/A-AA/ASIA:RHALLIGAN
AID/ASIA/PD:RVANRAALTE
AID/ASIA/TR:DLUNDBERG
AID/ASIA/TR:JSTANLEY (SUBS)
AID/ASIA/OP:JMCCARTHY (SUBS)
AID/ASIA/PTB:DCHANDLER
AID/SER/COM:DCOWLES (SUBS)
USDA/OICA:ADYE (INFO)

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TAGS:

SUBJECT: MAIZE AND OILSEED PRODUCTION PID

REF: (A) RANGOON 1380 (B) STATE 88797

1. THE ASIA PROJECT ADVISORY COMMITTEE (APAC) APPROVED THE SUBJECT PID ON MARCH 16. THE FOLLOWING ISSUES SHOULD BE ADDRESSED DURING THE PROJECT DESIGN AND RESOLVED/REFLECTED IN THE PP. THESE COMMENTS ALSO REFLECT OUR PRELIMINARY RESPONSE TO REF A.

2. PROJECT FUNDING: THE PID'S PROPOSED LOAN-GRANT SPLIT WAS DISCUSSED AT LENGTH. AID REP FULLY EXPLAINED JUSTIFICATION FOR GRANT FUNDING IN BURMA WHICH THE BUREAU ENDORSES; HOWEVER, GIVEN UNCERTAINTIES ABOUT AGENCY GRANT FUNDING LEVELS, APAC INSTRUCTED AID REP TO ALERT THE GSRUB TO THE POSSIBILITY THAT THE FERTILIZER COMPONENT IN ADDITION TO ANY OIL EXTRACTION EQUIPMENT PROVIDED MAY HAVE TO BE LOAN FUNDED. WE NOTE PER REF A THAT AID REP HAS BROACHED THIS SUBJECT WITH GSRUB. WHILE WE CAN CERTAINLY MAKE NO COMMITMENT AT THIS TIME RE GRANT/LOAN AVAILABILITIES GIVEN FUNDING UNCERTAINTIES, BUREAU POSITION IS THAT WE WILL MAKE EVERY EFFORT TO OBTAIN NECESSARY FUNDING, INCLUDING MAXIMUM GRANT FINANCING FOR FERTILIZER WHICH IS REQUIRED INPUT TO ASSURE VIABILITY OF PROJECT. THEREFORE, BELIEVE IT IS PREMATURE TO SERIOUSLY CONSIDER PHASING OF PROJECT AS SUGGESTED REFTEL. BECAUSE DOLS 30 MILLION (WHICH EXCLUDES EXTRACTION PLANT; SEE PARA 5 BELOW) MIGHT NOT BE AVAILABLE FOR THIS PROJECT OVER THREE-YEAR PERIOD, APAC DECIDED THAT FOUR-YEAR PROJECT SHOULD BE DESIGNED WITH FINANCING TO BE PROVIDED DURING FIRST THREE YEARS. THIS WOULD ENABLE FINAL FUNDING TO BE PROVIDED IN YEAR FOUR IF NECESSARY.

3. FOCUS ON OILSEED AND MAIZE: APAC EXPRESSED ITS SUPPORT OF MISSION'S CROP-FOCUSED LONG TERM AGRICULTURAL PROGRAM STRATEGY AND AGREED THAT INITIAL FOCUS ON OILSEED AND MAIZE PRODUCTION THROUGH THIS PROJECT IS APPROPRIATE.

4. MARKETING STRATEGY: PID DID NOT SUGGEST MARKETING STRATEGY FOR SELECTED CROPS. APAC AGREED EXAMINATION OF MARKET OUTLETS FOR CROPS TO RECEIVE SUPPORT SHOULD BE MADE TO DETERMINE IN ADVANCE WHETHER THIS COULD BE A CONSTRAINT TO INCREASED PRODUCTION.

5. OIL EXTRACTION: APAC NOTED CONCERNS ABOUT THIS PROPOSED PART OF PROJECT. IN SUBSEQUENT DISCUSSION HERE IT WAS DECIDED TO DEFER THE OIL SEEDS EXTRACTION SEGMENT AND CONSIDER IT AT A LATER DATE AS A POSSIBLE SEPARATE PROJECT WITH ITS OWN PID AND PP.

6. ENVIRONMENTAL ANALYSIS: THE APAC AGREED WITH IEE'S POSITIVE DETERMINATION AND RECOMMENDED THAT FURTHER ENVIRONMENTAL ANALYSIS BE LIMITED TO ASSESSMENT OF IMPACTS OF PESTICIDE PROPOSED FOR USE IN PROJECT. SINCE IT IS AID POLICY TO PROMOTE INTEGRATED PEST MANAGEMENT (IPM) TECHNIQUES IN ITS PROJECTS, APAC SUGGESTED THAT A PEST MANAGEMENT SPECIALIST, WITH EXPERTISE IN IPM, BE INCLUDED ON THE DESIGN TEAM. SUCH A SPECIALIST WOULD:

(A) INCORPORATE IPM TECHNIQUES (WHICH ARE LESS HAZARDOUS TO THE ENVIRONMENT) INTO PROJECT DESIGN; AND

(B) PERFORM ENVIRONMENTAL ANALYSES REQUIRED BY AID ENVIRONMENTAL REGULATIONS ON ANY PESTICIDES PROPOSED FOR USE IN THIS PROJECT.

7. COMMODITY PROCUREMENT AND MANAGEMENT: THE PP DESIGN TEAM SHOULD GIVE CAREFUL CONSIDERATION TO THE ROLE OF THE BURMESE GOVERNMENT AND AID IN COMMODITY PROCUREMENT AND MANAGEMENT. GIVEN PROPOSED LEVEL OF COMMODTY FINANCING (DOLS 15 MILLION FOR FERTILIZER AND DOLS 5 MILLION FOR FARM MACHINERY), AND THE FACT GSRUB HAS NO RECENT EXPERIENCE IN AID-FINANCED PROCUREMENT, APAC RECOMMENDED DEVELOPMENT OF A COMPREHENSIVE PROCUREMENT PLAN. IN ORDER THAT GSRUB AND USAID RESPONSIBILITIES BE CLEARLY UNDERSTOOD FROM THE START AND REFLECTED IN PP, IT WAS RECOMMENDED THAT A COMMODITY MANAGEMENT ADVISOR FROM SER/COM BE INCLUDED ON THE DESIGN TEAM TOWARD THE END OF PROJECT PREPARATION FOR TWO TO THREE WEEKS.

8. PROJECT DEVELOPMENT: APAC DECIDED PROJECT WAS WELL SUITED FOR DESIGN AND IMPLEMENTATION UNDER TITLE XII BY USDA. INITIAL THINKING IS TO HAVE USDA PROVIDE TECHNICAL SPECIALISTS FOR DESIGN TEAM FROM ITS OWN STAFF OR BE CONTRACT. THEY WOULD BE ACCOMPANIED BY OFFICER(S) FROM ASIA/TR AND/OR PD AS WELL AS DS/AGR. CURRENT PLANNING IS FOR ARRIVAL IN BURMA IN EARLY MAY. REQUEST REPLY TO REF B ON THIS SUBJECT. HAIG

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THE SOCIALIST REPUBLIC OF THE UNION OF BURMA
MINISTRY OF PLANNING AND FINANCE
FOREIGN ECONOMIC RELATIONS DEPARTMENT
OFFICE OF THE MINISTER
RANGOON

D.O. No. .....

Dated, the 14 October 19 81.

Mr. David N. Merrill
AID Representative
American Embassy
RANGOON.

Dear Mr. Merrill,

I wish to refer to your letter of 31 August 1981, relating to the United States Agency for International Development's authorization of the Maize and Oilseeds Production Project, and to inform you that the project has been approved by our authorities. I am also pleased to inform you that the Project Grant Agreement, as negotiated by the representatives of our two Governments on 17 September 1981, has been approved by our authorities for signature.

Accordingly, I should like to make a formal request on behalf of the Government of the Socialist Republic of the Union of Burma for a grant of $30 million (United States dollars thirty million) from the United States Agency for International Development, to meet the A.I.D. contribution to the Maize and Oilseeds Production Project over the life of the project.

I also have the pleasure of proposing that the said negotiated Agreement be signed by representatives of our two Governments in Rangoon at an early date.

Yours sincerely,

Thein Myint
Director-General

ANNEX H

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

Country: Burma

Project: Maize and Oilseeds Production

Project No.: 482-0005

Pursuant to Part I, Chapter 1, Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Grant to the Government of the Socialist Republic of the Union of Burma (the "Cooperating Country") of not to exceed Five Million United States dollars ($5,000,000*, the "Authorized Amount") to help in financing certain foreign exchange costs of goods and services for the project as described in the following paragraph:

The project (hereinafter referred to as the "Project") is designed to assist the Government of the Socialist Republic of the Union of Burma ("SRUB") in increasing production of oilseed crops and maize in 28 townships of rural Burma, with positive effects on rural income and employment and on national food supply and nutrition. This will be accomplished by an improved national research capability in maize and oilseeds; the introduction of improved maize and oilseed technology and production practices; the establishment of maize and oilseeds seed farms and a rhizobium production facility; and through the provision of the necessary inputs of material, technical assistance, training, local staff, and local costs.

I approve the total level of A.I.D. appropriated funding planned for this Project of not to exceed Thirty Million United States Dollars ($30,000,000) including further increments during the period of grant funding up to this total, subject to the availability of funding in accordance with A.I.D. allotment procedures.

I hereby authorize the initiation of negotiation and execution of the Project Agreement by the officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority subject to the following essential terms and major conditions together with such other terms and conditions as A.I.D. may deem appropriate:

a. Source and Origin of Goods and Services

Except for ocean shipping, goods and services financed under the Grant shall have their source and origin in the Cooperating Country or in the United States, except as A.I.D. may otherwise agree in writing, provided that: 1) training services may be undertaken in third countries as well as in the United States, in accordance with the provisions of AID Handbook 10, and 2) the services of third-

*$5,000,000 is FY-82 C.P. level for this project;
($10,000,000 in FY-1982 is sought, funds permitting)

country technicians may also be financed from the Grant by the United States contractor. Ocean shipping financed under the Grant shall be procured in the United States except as A.I.D. may otherwise agree in writing.

b. Initial Conditions Precedent to Disbursement

Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement, for any expenditure of funds, the Cooperating Country shall designate representatives to undertake the Project and to coordinate actions with A.I.D.

c. Covenants

1. The Cooperating Country shall covenant to provide sufficient existing and incremental budgetary and staff support to accomplish the objectives of the project.

2. The Cooperating Country shall covenant that during the period of the project, if A.I.D. grant contributions totalling $30 million are provided, an amount of fertilizer from both AID and SRUB financing totalling not less than $25 million in value shall be properly applied to acreage and crops in the project townships.

3. The Cooperating Country shall covenant to process and clear expeditiously, and to store and distribute properly, all goods financed under the Grant.

4. The Cooperating Country shall covenant to pay any and all taxes and duties on AID-financed commodities, and/or to exempt such commodities from such costs.

5. The Cooperating Country covenants to afford A.I.D. representatives the opportunity at all reasonable times to inspect the project and the utilization of goods and services funded under the Grant.

6. This project shall be subject to such other covenants as A.I.D. may deem advisable.

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Assistant Administrator
Bureau for Asia

ANNEX I : Waiver for Shipping

I. Waiver Required

Procurement of source and origin waiver from AID Geographic Code 000 (U.S.) to Code 935 and to host country for procurement of transportation services from the U.S. to Burma.

II. Summary Waiver Information

Cooperating Country: SRUB
Authorizing Document: Project Paper
Activity: Maize and Oilseed Production Project
Nature of Funding: Grant for transportation services from U.S. to Burma
Approximate Total Value: $700,000
Proposed Source/Origin: Code 935 and host country

III. Discussion

When necessary to assure adequate competition and competitive pricing for the shipment of commodities, AID may authorize financing of ocean transportation on vessels under flag registry of countries included in Code 935 and the host country. Given the limitations of the Rangoon port facilities (draft of vessels may not exceed 24 ft and length may not exceed 480 ft)it is anticipated that few U.S.-flag vessels will be available to offer service to Rangoon. Since Code 000 would normally be authorized for this project, this waiver will allow for the financing of ocean transportation on Code 935 and on host country vessels only to the extent that U.S.-flag vessels are not available to carry the commodities for which transporation is solicited. The Office of Commodity Management (SER/COM) will determine when it is necessary to authorize financing in accordance with this waiver.

IV. Authority

Pursuant to HB 11, Chapter 3, section 2.6.4.2.e., source and origin waivers for transporation services may be granted by the Office of Commodity Management (SER/COM) acting in consultation with the concerned geographic bureau.

V. Certification

The interests of the U.S. are best served by permitting financing of transportation services on ocean vessels under flag registry of free world countries other than the cooperating country and countries included in Code 941.

ANNEX J

COUNTRY CHECKLIST/STATUTORY CHECKLIST

I. COUNTRY CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?

Yes.

2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the United States unlawfully?

No. Government cooperates actively with U.S. Government in narcotics suppression programs.

3. FAA Sec. 620 (b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?

Yes.

4. FAA Sec. 620 (c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?

No.

5. FAA Sec. 620 (e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?

Status has been under review by State/L and EB for several years and no negative finding has been made as of the date of this Project Paper.

6. FAA Sec. 620(a), 620(f); FY 79 App. Act, Sec. 108, 114 and 606. Is recipient country a Communist Country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola?

No.

7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?

No.

8. FAA 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action.

No.

9. FAA 620(l). If the country has failed to institute the investment guarantee program for the specific risks of expropriation, inconvertibiliry or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?

As pointed out in the Development Training Project Paper submitted in May 1981, a statement was to be drafted for the signature of AA/Asia recommending that an OPIC agreement not be made a prerequisite to an AID program. AID/W should determine whether such a statement was drafted and signed. It is still possible that such an OPIC agreement could be offered at a later date.

10. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5.
If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters (a) has any deduction required by the Fishermen's Protective Act been made? and (b) has complete denial of assistance been considered by AID Administrator?

N/A

11. FAA Sec. 620; FY 79 App. Act, Sec. 603. (a) Is the government of the recipient country in default for more than 6 months on interest or principal of any AID loan to the country? (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriate funds?

Government has been in arrears since mid-1980 on one loan made under the authority of P.L. 480 (#001) and two loans made by Ex-Im Bank prior to the FAA of 1961 (#002 and #003). All three are local currency repayable. None are believed to fall within

the meaning of Section 620 of the FAA or Section 603 of the FY 1979 Appropriation Act. Intensive and high-level discussions and reconciliation of records are still actively underway.

12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons sytems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s) This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

N/A

13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?

No.

14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?

SRUB is not known to be in arrears in its U.N. obligations.

15. FAA Sec. 620A, FY 79 App. Act. Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism?

No.

16. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the non-proliferation treaty?

No.

B. FUNDING CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy?

The Third Four Year Plan, which is still in effect, involves the poor in development. Criteria to assess commitment have been established and taken into account in relevant program areas.

b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor?

Project will have significant impact on maize and oilseeds production in both intensive and extensive townships. Project will also strengthen existing agricultural research capabilities of Burmese institutions like the Yezin Agriculture Research Institute.

2. Economic Support Fund Country Criteria

N/A

II. PROJECT CHECKLIST

A. GENERAL CRITERIA FOR PROJECT

1. FY 79 App. Act Unnumbered; FAA Sec. 653(b); Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?

(a) Project was originally contained in FY 1981 Congressional Presentation but was shown at $15.0 million and was entitled "Accelerated Agriculture Development". There have been significant changes in design and scope of the project, retitled Maize and Oilseeds Production, and the AID assistance component is now estimated at $30.0 million. Thus, under current Congressional notification procedures an Advice of Program change should be initiated by AID/W as soon as possible so as not to delay Project Authorization.

(b) Project has been included within FY 1982 OYB at a level of $5.0 million.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000 will there be (a) engineering, financial and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

Some engineering studies will be required to design and construct the seed farms envisioned under the project as well as to test and install diesel and electric pumps to be provided with AID funded All engineering studies are expected to be done by Burmese agencies when concerned.

The Project Paper contains the required financial plan, including reasonably firm cost estimates. A Procurement Plan has also been completed.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

No action required.

4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

The project is expected to meet proper standards and criteria in the development of seed farms and high technology sites where irrigation will be required.

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?

All capital construction, such as the establishment of seed farms, will be funded by the SRUB as a local cost contribution. The SRUB has the capability to maintain and utilize such facilities. Additionally, some short-term TA is included to help with seed farm layout, building plans and AID-funded equipment installation.

6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.

The project should be executed as a bilateral AID project. However, as highlighted in the Project Paper, there are some linkages to FAO/UNDP projects in seed development and multiple cropping systems as well as to CIDA/IRRI research in appropriate farm machinery testing and prototype development.

7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

(a) Yes.
(b) No.
(c) Yes.
(d) No.
(e) Yes.
(f) No.

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

It is expected that a U.S. university, or consortium of universities, will be awarded an AID-Direct contract to provide long and short-term technical assistance, arrange participant training and be responsible for commodity procurement of machinery and equipment required in the project.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

The SRUB will provide a contribution in local currency of $8.0 million for local costs of the project. For discussion of U.S.-owned local currency, see #10 below.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?

The U.S. does own excess Burmese currency. However, this project does not require the U.S. to provide foreign currencies as the SRUB intends to fund all local costs. Discussions are still underway to secure the release of U.S.-owned excess currencies for agreed development purposes.

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

The project will most likely use competitive selection in the award of an AID-Direct contract to a U.S. University or consortium of universities for technical assistance, participant training arrangements and commodity procurement (other than fertilizer). Fertilizer will also be procured competitively.

12. FY 70 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?

Project will result in an increase in the amount of oilseed cake and maize available for export. Neither commodity is in surplus on world markets. Expected export increase should not cause injury to any U.S. producers.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

The purpose of the project is to bring about a rapid rate of adoption of high-yielding inputs and tillage practices for improved maize and oilseeds by farmers in selected townships.

The SRUB encourages the participation of rural farmers in the planning and implementation of development projects. The estimated 200,000 direct farm family beneficiaries of the project will participate as members of farmer associations, Cooperative Societies and Peoples' Councils, in the decision-making process at village, Village Tract and Township levels, to determine acreage targets, input requirements and other program components like credit, training and administrative arrangements.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available; (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(103) for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor;

Project will directly introduce a HYV package of inputs, extension service and new cultivation practice to some 200,000 farm families and indirectly to as many as 800,000 farm families. Net returns on investment in HYV maize and oilseed crops will be significant.

c. (107) Is appropriate effort placed on use of appropriate technology?

Yes, some new farm equipment, of an appropriate, and not labor-displacing type, will be introduced under the project.

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country?)

Yes.

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to the Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

No.

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.

Project is an attempt to assist Burma reach its own objective of self-sufficiency in edible oils and increased maize production for export and for domestic livestock consumption. Project will only augment, through technical assistance and training, existing SRUB capacity to plan and implement a national maize and oilseed production program.

SRUB planning process encourages citizens' participation at all levels of government down to the village.

The project strategy is two-fold; first, to assist the SRUB increase maize and oilseeds production as quickly as possible; second, to increase the SRUB institutional capacity to plan, design and implement the Government's overall agriculture production programs.

g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?

Project will contribute to an increase in SRUB productive capacities in agriculture and to sustained economic growth.

2. Development Assistance Project Criteria (Loans Only)

N/A