PD-AAQ-789

# MAIZE AND OILSEEDS PRODUCTION PROJECT

(482-0005)

## MID-TERM EVALUATION REPORT

Agency for International Development

Rangoon/Burma

February 1, 1985

MAIZE AND OILSEEDS PRODUCTION PROJECT

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January 31, 1985

Acknowledgements

The evaluation team expresses its gratitude to all of the people associated with the Maize and Oilseed Production Project who helped us in our assignment. Our special thanks go to U Khin Win, Managing Director of the Agriculture Corporation, and to U Mya Maung and U Siang Uk, Director and Deputy Director of the project. We also owe much to Dr. Charles A. Simkins, the AID/Burma Project Officer, and to Dr. Ervin T. Bullard, the MUCIA Chief of Party. The hospitality, openess and kindness with which we were received in Burma are greatly appreciated.

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## GLOSSARY

| | |
|---|---|
| AC | Agriculture Corporation |
| AFPTC | Agricultural and Farm Products Trading Corporation |
| AID | Agency for International Development |
| ARD | Applied Research Division |
| ARI | Agricultural Research Institute |
| BARD | Burma Agricultural Research and Development (Project) |
| BIFAD | Board of International Food and Agriculture Development |
| BNF | Biological Nitrogen Fixation |
| CDSS | Country Development Strategy Statement |
| EOPD | Edible Oils Processing and Distribution (Project) |
| GOB | Government of Burma |
| K | Kyat (Burmese Currency) |
| MOP | Maize and Oilseeds Production (Project) |
| MP | Muriate of Potash |
| MT | Metric Ton (2200 lbs) |
| MUCIA | Midwest University Consortium for International Activities, Inc. |
| PACD | Project Action Completion Date |
| PFIR | Project Financial Implementation Report |
| PIO/C | Project Implementation Order/Commodity |
| PIO/P | Project Implementation Order/Participant |
| PP | Project Paper |
| PSA | Procurement Service Agent |
| SRUB | Government of the Socialist Republic of the Union of Burma |
| TA | Technical Assistance |
| TSP | Triple Super Phosphate |

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# CHAPTER I

## EXECUTIVE SUMMARY

### A. Problem and Overview

The Maize and Oilseeds Production Project (MOPP) is designed to increase production of maize and the nutritionally and economically important oilseed crops in Burma. While rice is the most important field crop grown in Burma, maize and oilseeds contribute greatly to the national diet and economy. The Burmese consume a per capita average of 6.2 lbs. of edible oils per year. Production of oilseeds crops has not kept pace with population growth and, in recent years, the government has been forced to assign scarce foreign exchange resources to import edible oil rather than to development goods and services.

Groundnuts, sesame, sunflowers and soybeans, as well as niger and safflower, are grown in Burma. With adequate extension and supporting research, and good policies encouraging production, production can be increased. Maize yields have great potential for increase and it is an important crop in cropping systems associated with oilseeds. The Burmese Government places high priority on maize and oilseeds development and is contributing about $2 for every $3 contributed by the U.S for this project.

MOPP is the first large-scale effort focussed on this problem. USAID is concentrating on this area by supplementing the production project with two other projects to strengthen research and improve the processing and distribution system for oilseeds.

### B. U.S. Assistance

USAID is providing technical assistance, training, machinery and equipment, and fertilizer through the MOP Project (482-0005) to a total value of $30 million. The Government of Burma provides $21 million. The lead agency is the Agriculture Corporation of the Ministry of Agriculture and Forests. The MOPP Grant Agreement was signed October 26, 1981; the five year project will end on September 30, 1986. The Midwest University Consortium for International Activities, Inc. (MUCIA) is under AID-direct contract to provide technical assistance, training and related services. MOPP is designated by AID as a Title XII effort.

The project's purpose is to promote and support adoption of high yielding inputs and tillage practices by farmers who grow maize and oilseeds in 26 townships. The goal is to increase production, 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 by reducing edible oil imports and increasing exports of oilcake. The specific objectives concern production increase targets and institutional development. The "Whole Township" strategy used is based on the highly successful "selective/concentration" extension model initiated for rice by the Burmese in 1976.

## C. Purpose of the Evaluation

The evaluation was conducted to assess project progress and measure its likely impact. It was to search for causes of success and failure, test the validity of the design and suggest modifications if needed, and examine critically the effectiveness of inputs. This external mid-term evaluation is supplementing annual internal reviews. Findings are based on cross-sectional analysis of a large sample of activities derived from site visits, interviews, meetings, documents and observations.

## D. Summary of Findings

Although accomplishments to date vary considerably across outputs and inputs, the evaluation team finds that overall progress is excellent and believes the project to be well on its way to a highly successful conclusion.

With 20 months remaining, progress toward specific crop production targets exceeds 50 percent for maize and sunflowers, 73 percent of groundnuts and 82.6 percent for sesame and momentum is increasing; but only about 33 percent of the edible oil target has been produced. Progress toward accomplishment of institutional development objectives, while somewhat uneven, is nonetheless tangible except in the case of Ph.D. training, which has not begun and now cannot contribute directly to the project because of time constraints, but should be fulfilled. Sixteen M.Sc. students are in the U.S. About 40 percent of the planned short-term overseas training is completed, and in-country training is vigorous. Research capability is increasing and applied research conducted on the seed farms. Technology is being applied more widely and systematically especially through the use of about 60 high technology 5-acre demonstration sites on farmer's fields in the 12 intensive townships. Four seed farms are producing about 7 percent of the project needs of seed though not yet fully operational. A farm management information system is slowly evolving; much data has been collected but analysis needs to be improved. More than half of the 600,000 packets per year produced by the Burma rhizobium inoculant production facility were used on groundnuts in the project. Fertilizer use has increased significantly.

On the input side, the Government of Burma has already contributed about 52 percent of its $21,000,000 share of the project even though construction has been delayed by limited supplies of cement, petroleum and electric power materials. USAID has contributed about 57 percent of its $30,000,000 share of the project in spite of considerable delays due to customs clearance processes and charges. Findings indicate that most components are more or less on schedule or lagging not far behind. Some special concerns were identified with respect to the MUCIA technical assistance contract and about assembly, use and maintenance of equipment.

## E. Project Design and Policy Implications

The findings and conclusions of the evaluation indicate that the project is well-designed and is being implemented by an appropriately placed and caring organization within the government structure. The Burmese Agriculture Corporation has invested heavily in making the effort successful. The purpose and objectives set for MOPP were reasonable, neither so ambitious as to be unattainable nor so easy as to be readily accomplished. In other words, the production and institutional development targets were appropriate to Burmese needs and conditions. Such success-supporting factors must be carefully considered in project design. When and where it counts, care is needed to insure that a project "belongs" to the host government or that grantee commitment exists to carry the load successfully. The size and focus of the project are also in line with the Burmese government's capacity for marshalling necessary inputs. This is a crucial dimension of effective design and implementation.

The project has had its share of problems, also. Some of these are caused by constraints impinging from the outside such as unanticipated shortages in needed commodities like diesel fuel. Others have arisen because of factors closely related to the project: i.e., regulations followed or procedures used to get MOPP going. Two examples will suffice to illustrate the point.

The Grant Agreement contains language, perfectly legal and proper from the U.S. point of view, which has cost the Agriculture Corporation a very considerable amount in unbudgeted expense. The language in question has to do with duties and taxes for project-related goods and services imported into Burma. (See Recommendations.) The problem is an onerous one, especially galling because it does not exist in projects supported by some other donors, and should be avoided in future AID project assistance.

The project was designated by AID as a Title XII effort and competition was limited to two university consortia short-listed by BIFAD. The evaluation team attributes certain problems encountered with the technical assistance component to (1) the lack of wider competition, and (2) the inappropriateness of the choice made, given the specialized requirements of working and living in Burma and of oilseeds research and technology. More detailed analysis of project technical assistance needs may have eliminated some of the problems met.

## F. Recommendations

- Continue crop production and general project activities as planned, with the same dedication and competence as already expressed.

- Plan a program of applied research for the remaining project life, drafted initially by MUCIA advisors and their Burmese professional colleagues, after full consideration of previous data and ongoing research in Burma. Applied research can be mainly at seed farms. Components may include variety testing, fertilizer trials to determine optimum rates, integrated pest control methods, water management, and soil management. Determine efficient irrigation methods and water needs.

- Continue urgently the development of the seed farms. Improve land leveling and preparation. Continue actions to develop irrigation and drainage systems for major parts of seed farms.

- Conduct tests of oil content as an integral part of all variety testing of oilseeds.

- Establish systematic maintenance and continuous training programs for all MOPP equipment: agricultural, irrigation, seed processing, vehicles, etc.

- Continue development of facilities and programs to produce and distribute rhizobium inoculant for legumes, with attention to quality as well as quantity.

- Demand that MUCIA thoroughly orient, prepare and support contract personnel, and that a greater effort be made to provide appropriate expertise. Continue support of contract staff, as far as possible, by USAID and the Agriculture Corporation.

- Continue efforts by AID and Agriculture Corporation to provide for duty-free entry of project commodities and related goods, and to expedite customs clearances.

- Select and process personnel for appropriate short-term training as soon as possible, so their training can be useful during the remaining project life.

- Develop an operationally useful farm management information system based on the foundation of existing data. Use information for project monitoring and evaluation of the intensive-extensive township model. Strengthen internal project monitoring and evaluation through greater analysis of existing and additional data.

- The final project evaluation should be a joint Government of Burma-USAID activity and include a careful assessment of impact on maize and oilseeds producers, and include an assessment of the social and economic impacts on the non-farmers in the community.

# CHAPTER II

## THE PROJECT SETTING

### A. BURMA OVERVIEW

Burma, famed around the world as the Land of Pagodas, is the largest country in mainland Southeast Asia. Covering 676,550 $km^2$, it is only slightly smaller in size than Texas. It is bounded on the east and north by Thailand, Laos and China, while its western neighbors are Bangladesh and India. Its long Bay of Bengal coastline, its three large river systems, its variable topography -- ranging from high mountains through vast plateaus and floodplains to an extensive riverine delta -- combine with a tropical to semi-tropical monsoon climate and a wealth of valuable natural resources to give Burma enormous potential for economic growth and development. Yet Burma is ranked among the poorest of the world's nations. Its per capita GNP is currently estimated to be approximately $190, imports exceed exports, and the country now suffers from a serious foreign exchange problem and a seriously deteriorating infrastructure for development.

The people of Burma are its richest resource. The thirty-six million strong populace is predominantly Buddhist in religion and heritage and resides mostly in the flood plains and delta of central and lower Burma. A sizeable minority population, residing primarily in the states bordering the nation's frontiers, is composed of Shans, Kachins, Chins and several other ethnic groups. Political unrest in the border regions has placed a heavy burden on the government.

After achieving independence from Britain in 1948, and following the trauma of World War II, Burma tended to emphasize large capital intensive infrastructure and social service programs at the expense of sustained economic growth. In the 1950s and 1960s, many countries and international aid organizations, including the United States, contributed to Burma's development programs. During the 1960s and 1970s, however, there occurred a widespread diminution in foreign assistance as the country chose to look inward for solutions to its development problems. It was only in the late 1970s and early 1980s that this situation changed somewhat, allowing for the resumption of bilateral foreign assistance programming. The United States' development assistance program resumed in 1980, after a hiatus of 15 years.

#### 1. Agriculture in Burma

Burma is predominantly an agricultural country. Although it has substantial mineral deposits and some 67 percent of its land area is forested -- much of it with valuable hard woods, including teak -- agriculture forms the base of the economy. Sixty percent of Burma's export earnings come from agriculture, and the agricultural sector contributes 46 percent of GDP, employing some 53 percent of the total labor force. Rice dominates the agricultural scene. It exceeds all other crops combined, both in area sown and in production. It is the

basic staple of the Burmese diet. Other major food crops are maize, sesame, peanuts and pulses of several types. Cotton and sugar cane are also grown on substantial acreages, as are a growing number of horticultural crops, both fruits and vegetables. Wheat is increasing in importance in the north. The potential for growth in these and other crops is great.

With its large tracts of arable land, Burma has greater possibilities for increasing food production than any other Southeast Asian nation. Not only does it have the opportunity to expand its cropped area, there is even greater opportunity to increase its relatively low crop yields through double and triple cropping and more intensive production.

2. The Importance of Maize and Oilseeds

Maize has been a minor crop in Burma, but with an expanding acreage, and solid potential for better yields. The use of maize is intended mainly as poultry and animal feed plus for export as the supply permits and if there is a market.

Oilseeds are more crucial, since edible oil is an important part of the Burmese diet, and domestic production is far below nutritional requirements and needs to satisfy dietary preferences. Thus, there is strong motivation to produce more oilseeds, both to reduce the need for imports and to increase dietary intake.

3. Major Constraints to Agricultural Development

The greatest constraints to rapid agricultural development, at a pace capable of widening the gap in the race between production and population growth, are the lack of irrigation and the paucity of research, chemical fertilizers and other modern inputs. While Lower Burma experiences 100 inches of rainfall annually, Upper Burma receives 30 inches or less. Thus, lack of water resources constrains agriculture in the north, while the need for improved water management is of great importance in the south. Development of the irrigation and power generating potentials of the river systems, especially those of the Irrawaddy and Chindwin Rivers, which flow through the large flood plains of the central section, remains largely in the future. Road, rail and river transportation infrastucture is limited and communication and commerce constrained thereby. Petroleum fuels are in short supply, with diesel oil and gasoline severely rationed and power for agriculture and industry curtailed.

The agricultural research system is currently in a building stage, constrained by a shortage of both well-trained scientists and facilities for basic and applied work. Nor are there sufficient amounts of chemical fertilizers and pesticides available for large scale nationwide production increases. While Burma's internal capacity to produce urea, perhaps the most vitally needed man-made production input, is increasing, there remain severe shortages. More will be said about research and fertilizer later in this report.

## B. ORGANIZATION FOR AGRICULTURAL DEVELOPMENT

### 1. The Ministry of Agriculture and Forests

Acting under the guidelines of the BSPP and the National People's Assembly, prime responsibility for agricultural development resides with the Ministry of Agriculture and Forests, although many other organizational units, including departments and corporations under other ministries, are also involved. The relationship of the Ministry to the wider government structure for policy formulation and program implementation is shown in Appendix A. The above statements notwithstanding, the reader is advised to look beyond these governmental organizations for a full appreciation of how agricultural development activities are undertaken in this complex, socialist, Theravada Buddhist oriented nation. It is beyond the scope of this report to delve deeply into the intricacies of planning, budgeting, coordinating and implementing the development program for agriculture. Nevertheless, it is important to note that major participatory roles are played in these vital processes by the people, both directly through local organizations such as cooperatives and farmers associations and through the Burma Socialist Program Party and People's Councils, which are active at all levels of national, regional and local life.

Burma is composed of 14 Divisions and States (seven of each). Altogether, these, in turn, are made up of 314 Townships (127 urban and 187 rural). The rural townships are sub-divided into Village Tracts. Division (and State), Township and Village Tract People's Councils all play important parts in the planning and negotiation of program and production decisions and in the implementation of activities.

There are three other points which should be made before describing the Agriculture Corporation, which is the implementing agency for this project and a prime subject of the evaluation. The first point is that Burma has a complex dual economy with an active private sector engaged in a wide variety of enterprises variously classified as legal or as part of the "free" market. The second point is that while government is very active in establishing prices and determining and/or providing required market channels for agricultural produce, the system is flexible to a degree and is not uniformly applied. Prices and marketing mechanisms for some kinds of products are not controlled by government, as in the case of oilseeds, which are largely uncontrolled. And finally, the third point is this: the Party and the government are dynamic organizations committed to the economic development of the country. The policy framework for agricultural development changes over time. In recent years a number of reform measures have been taken which are having substantial impact on both productivity and production.

a. The Agriculture Corporation:

The Agriculture Corporation is one operational arm of the Ministry of Agriculture and Forests. It and the many other corporations of the government are differentiated from departments because of certain parastatal-like, income-generating functions which distinguish them from the more straight-line departmental entities. The Agriculture Corporation is itself a large and complex organization, national in scope, with 10 separate divisions, offices in most rural Townships, and some 21,000 staff members. Its responsibilities are many and varied. Several of the Corporation's ten divisions are actively and continuously engaged in the MOP Project. Most directly associated with its activities, of course, is its home base, the Extension Division, but strong program links tie MOPP also to the Applied Research Division and the Agricultural Research Institute of the Corporation, while more administratively-oriented divisions are involved with the project for obvious managerial, planning and support reasons.

The Agriculture Corporation is involved in most aspects of the government's agricultural development program, including such diverse functions as export of commodities and land use planning. It operates under the direction of a Managing Director appointed by the Minister of Agriculture and Forests and approved by the Council of State. Each of the divisions is headed by a General Manager or Deputy General Manager.

b. Agricultural Planning:

An earlier section commented on the active roles played by farmers and rural citizens in the planning and implementation of the country's developmental programs for agriculture. Similarly, brief references have been made to the wide-spread staff of the Corporation and to the parallel nature of the governmental and party outreach organizations. The inter-relationships among these various elements, obviously intricate and sometimes rather confusing to the outsider, are clearly multi-dimensional, with two-way communication flowing at virtually every level. This point is apparent from study of Appendix A.

Among many other things, the system provides the mechanisms whereby policy decisions are programmed and implemented. It provides the vehicle through which decisions are made and programs carried out with respect to agricultural production targets. Farmers and their communities are able, through negotiations, to influence decisions on matters closely affecting their needs and aspirations. Thus, while planning involving such things as acreage and production targets is largely centralized, Burmese procedures allow for much local input to the process. There appears to be fairly widespread knowledge at the community level as to what the important decisions are and who they involve, as well as a general understanding of the steps necessary to goal accomplishment.

c. The Whole Township Strategy:

As indicated in a previous section, Burma has great potential for increased crop production, probably the greatest potential of any AID-assisted country in East Asia. With its large land area and significant water resources, and with new agricultural technologies only beginning to be utilized, there are great opportunities both for increasing the cropped area, i.e. bringing more land under cultivation, and for intensifying production on existing cultivated lands through the use of improved technologies and multiple cropping to increase total per acre yields.

The Burmese Government has chosen to emphasize the latter course, although the data reveal significant increases occuring in acreage, as well. It appears, however, that a large measure of the increased acreage is due not to physical expansion but to double cropping. The vehicle chosen for the push to increase yields is known as the Whole Township Program. After pilot testing in 1975-76, it was begun on a national basis in 1978-79 with rice, an appropriate choice of crop given its central role in the nation's economy and diet. Using high-yielding rice varieties obtained from IRRI, the government instituted a "selective concentration" extension model involving the active participation of elected Township and Village Tract Councils, party officials and extension staff of the Agriculture Corporation to promote rapid adoption by farmers of improved production technology. The program has, in general, been most successful, resulting in steady and impressive gains in rice production each year, and a parallel annual increase in rice exports. By 1980-81, the program operated in 72 of the country's 187 rural townships, covering five million acres or 40 percent of the sown rice area. It has since been even further expanded and today covers 80 townships. (For a more detailed explanation of the Whole Township Program, the reader is referred to the Maize and Oilseeds Production Project Paper, which contains an excellent, brief discussion on pages 7 and 63-64).

The same general model is used for the MOP Project, with some variations appropriate to its different crop focus. Included in the MOPP area are 26 townships in selected areas producing maize and the several oilseed crops. (Documents generally refer to 28 townships, two of the number having two crop programs each). These 28 townships are divided into two categories, "intensive townships" (12) and "extensive townships" (16). The main difference between the categories is the level of production inputs made available. While both kinds of township contain "production camps", usually five per township, where extension personnel are located and through which production inputs and information flow to farmers, the inputs are greater in scope and volume in the "intensive township" category.

Another important distinction between the two kinds of townships is the location in the "intensive" ones of "high technology sites" (HTS). Of these there are normally five in each township. The purpose of these "high technology sites" is to field test and

demonstrate for visiting farmers closely monitored applications of production inputs of the kind described in Chapter III. A part of each participating farm (usually five acres in size) receives these inputs. The plan calls for close monitoring and precise records on crop responses to the improved packages used. In turn, findings from this applied research program form the basis for crop production recommendations made to other farmers and other townships.

## C. U.S. AND OTHER DONOR ASSISTANCE TO AGRICULTURE

The United States provides grant assistance to Burma primarily in the fields of agriculture and health, though there is a small, more generally applied participant training project supplementing those activities. At this time, the MOP Project is the sole effort in agriculture. Two other, related projects have been designed and are approaching final negotiation with the government. These are the Edible Oils Processing and Distribution Project (482-0006), to be implemented by the Ministry of Cooperatives, and the Burma Agricultural Research and Development Project (482-0012) with the Ministry of Agriculture and Forests. The former project will increase the efficiency and capacity of existing oil extraction mills owned and operated by cooperatives and by entrepreneurs in the private sector. The latter will be focused on strengthening the Agriculture Corporation's premier research organization, the Agriculture Research Institute, located at Yezin. Both projects will be closely articulated -- to the Maize and Oilseeds Production Project and to each other -- and will be mutually supportive of the government's (and USAID's) strategy for increasing productivity and production of maize and oilseeds and other selected crops grown in conjunction with those vitally important contributors to the agricultural economy and the health and welfare of the people.

The American assistance effort in Burma, while modest and more sharply focused than are the aid programs of several other bilateral and multilateral donor organizations operating in Burma, is nevertheless an important contribution, and one that is highly valued by the Burmese. Among the largest donors are Japan, the Federal Republic of Germany, the World Bank, the Asian Development Bank, and several United Nations organizations.

## D. PURPOSE AND METHODOLOGY OF THIS EVALUATION

This is a mid-term progress evaluation report. The project grant agreement, dated October 26, 1981, stipulates September 30, 1986, as the "Project Assistance Completion Date" (PACD). Thus the project is currently well into the second half of its life. However, although conditions precedent to the disbursement of funds under the grant were met on November 20, 1981, the selection of the technical assistance contractor took time and a contract was not signed until September 22, 1982. Viewed from this perspective, the evaluation is indeed occuring at approximately the mid-point of project activities. Roughly 21 months remain before the PACD.

The purpose of the evaluation is three fold:

- to assess the continuing validity and relevance of the project and to suggest such modifications as may be required to increase the likelihood that the project will achieve its objectives;
- to assess the effects of external and unanticipated actions and/or events on the project;
- to assess the performance of the project with respect to the objectives set for it at the outset and to determine what, if any, adjustments or modifications in inputs or outputs are required to improve project effectiveness.

1. Methodology

The evaluation follows the general guidance contained in AID Handbook 3, chapter 12. Detailed instructions to the evaluation team are provided in the Evaluation Statement of Work, a copy of which is found in Appendix B.

In pursuing its assignment, the team used a cross-sectioned analysis approach to its assignment. Recognizing the need for sampling, it travelled with the Agriculture Corporation's assigned Project Director and the USAID Agricultural Development Officer to visit a representative number of project sites and activities. During these travels the team consulted with project, township and other government officials and with local farmers involved in the program. The itinerary included visits to production camps and farms in six of twelve intensive and eleven out of sixteen extensive townships where the project is active, to all four of the project seed farms, to the Agriculture Research Institute at Yezin, to the delta region, and to several other places where observations and/or consultations pertinent to its task were possible. The team also met with government, USAID and MUCIA officials in Rangoon, both collectively and individually. The itinerary followed and the personnel consulted are itemized in Appendix C. The same appendix contains a map of Burma showing the route followed by the team. Altogether, 11 days were spent in the field, 13 to 16 days in Rangoon, the Capital.

This procedure, while constrained by time and the distances involved, nevertheless provided the team with information and perceptions adequate to its needs. The combination of on-site visits and consultations/conversations with responsible officials and other knowledgeable individuals was particularly useful. Additionally, the team was given access to a large number of reports and documents which provided invaluable data.

The team was assisted throughout the evaluation by the Agriculture Corporation's Project Director and the USAID Agricultural Development Officer who are both technically and professionally well-qualified and thoroughly knowledgable about all aspects of the project.

## CHAPTER III

## THE PROJECT AND ITS PROGRESS

### A. PROJECT DESCRIPTION

This chapter will record in some detail the observations of the evaluation team with respect to the several elements and aspects of the project. Before proceeding to that undertaking, however, it is necessary to identify as a part of this report the criteria against which measurements and judgements were made, as well as provide some basic information on the implementation and the budget. This can best be done by reference to the two documents which laid the foundation for the project, i.e., the Project Paper and the Project Grant Agreement. Section B of the chapter quotes briefly from each of these documents to establish benchmarks and set the stage for the discussion of progress and problems found in Section C. That discussion will be centered primarily on planned inputs, with special attention given to the evaluation of progress toward objectives and targets, and the performance of the parties involved in the project's activities. The project log frame was used by the team as a guide for the coherent organization of its observations, findings and conclusions (Appendix D).

#### 1. Purpose, Goals and Objectives

According to the Project Paper, 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 oilseeds crops in the 28 project townships."

Also according to the Project Paper, the sector or program goals to be served by the stated purpose are: (1) "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," and (2) "to improve Burma's balance of trade through reduction of imports of oil and through an increase in exports of oil cake." The second goal is described as an "auxiliary" one.

The Grant Agreement defines the project purpose in terms identical to the first goal cited in the Project Paper (see above). No direct reference is made in the Grant Agreement to the Project Paper's second "auxiliary" goal, although it is alluded to twice in the document's statement of production targets.

From that point on, however, the two documents closely follow each other except for minor differences in terminology and, more importantly, some fairly substantial downward revisions from the Project Paper to the Grant Agreement in "sub-goals" or "targets." These resulted from negotiations leading to the signing of the Grant Agreement. The Project Paper was not amended to reflect these changes.

2. Methods

The Grant Agreement (Appendix E) describes the kinds of activities to be applied to the achievement of the project purpose as follows:

"The Project will apply at least ten means to higher yields and increased production of maize and oilseeds. They are: (1) use of improved higher yielding 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 techniques; (8) weed control; (9) timely harvesting; and (10) irrigation/water management practices."

Further referring to these activities, it goes on to say, "This will be accomplished through a comprehensive program including technical assistance, training, provision of agricultural machinery and equipment, and fertilizer procurement".

3. Expected Outputs

The Grant Agreement describes two general kinds of outputs expected from the project. The evaluation team has classified these as (a) production targets and (b) institutional development.

a. Production Targets:

These are described as follows:

"(1) To increase maize production by 228,000 MT.

(2) To increase groundnut production by 258,000 MT, of which 87,000 MT will be directly attributable to Project acres included in intensive and extensive townships and an additional 171,000 MT attributable indirectly to other groundnut acreage throughout Burma through the spread of rhizobium inoculation technology.

(3) To increase sesamum production by 25,000 MT.

(4) To increase sunflower production by 53,000 MT.

(5) To increase soybean production by 12,000 MT.

(6) To increase gross farm income by K1,273 million ($177.0 million).

(7) To increase production and possible export of oilcake and related products by K373.0 million ($52.0 million).

(8) To increase the value and reduce possible imports of edible oil by K499.0 million ($69.0 million).

(9) To improve nutrition by an increase in availability of edible oil by 30 percent from approximately 2.8 kg to 3.8 kg per capita."

b. Institutional Development Outputs:

In addition to the production targets cited above, the Grant Agreement lists the following institutional development targets, or outputs:

"(1) Improved national research capability in maize and oilseeds.
(2) Introduction of improved maize and oilseed technology and production practices.
(3) Four fully-equipped and staffed seed farms.
(4) An operational farm management information system for monitoring farm-level production practices and providing feed-back on results to research and extension centers.
(5) Returned participant trainees in place within the research, extension, seed farm and fertilizer distribution elements of the project.
(6) A functional rhizobium production facility (inoculum for groundnut and soybeans)".

4. Intended Beneficiaries

The question of beneficiaries is not discussed in the Grant Agreement. However, the Project Paper does provide information on this score. The discussion therein concerns: (1) direct benefits, and (2) indirect social benefits to the nation.

In summary, the Project Paper indicates that some 200,000 farm families living in the 28 townships covered by the project will be its most direct and immediate beneficiaries due to the provision of improved seeds, inputs and extension services. Further, the expectation was that many farmers would benefit from the spread effects rising from acceptance of improved technology "packages" and the resulting yield, employment and income increases, assuming a reasonable degree of project success. The rationale for this expectation rests on calculations of the ratio of marginal return to marginal cost. The data are drawn from the paper's farm level economic analysis, which concludes that farmers participating in HYV programs do much better than those who rely on traditional varieties and practices.

Other direct beneficiaries are identified as employees and trainees of the project who gain from opportunities for employment and education/training.

The indirect social benefits expected to accrue to the nation include greater availability of edible oil, and reduced un- and under-employment at the individual level. At the aggregate level are listed import substitution, an expanded livestock industry and greater exports of maize and oilseed cake.

5. Implementation Plan and Summary of Contributions

The project implementation plan and a summary of planned Burmese Government and USAID contributions for the project are provided in Appendix F for interested readers. Total planned contributions amount to $30 million by AID, including $15 million in fertilizers, and $21 million by the Burmese Government.

B. PROJECT PROGRESS

1. Crop Production

MOPP is a production project, distinctly targeted on maize, groundnuts, sesame and sunflowers, with soybeans covered on a pilot basis. This section will relate project actions to production results, and those results to project goals. Following sections will examine separately the major project activities of fertilizer application, seed production, legume inoculants, extension, and applied research.

The central data addressed by this section are displayed in Tables 1 and 2. The first provides area, yield and production data for the four main crops for the base year 1981-82 and three project years through 1984-85. Table 2 provides evaluation team estimates of production increases. Reference also is made to national data on area harvested, yields, and production (Appendix Tables G1, G2, G3, and G4). National data show there have been general increases in area harvested and yields.

Looking ahead of the following discussion, the broad conclusion is that rapid progress toward MOPP goals indicates the validity of the project strategy, and the energetic, timely execution of key elements when the short life of the project to date is recognized. Progress to date toward quantitative project targets is 51.2 percent for maize, 73.8 percent for groundnuts, 82.6 percent for sesame, and 50.9 percent for sunflower. With twenty months (one full cropping year) remaining before the PACD, the team assumes that, all things being equal, the project has a good chance to achieve many of its production targets. This assumption is strengthened by our knowledge that the seed farms and rhizobium facility are likely to become more productive as they are completed and become fully operational. Looking beyond the PACD, we expect to see continued production increases, especially through higher yields if fertilizer is available. Table 3 suggests the framework for such reasoning by showing national yields, yields in project townships, and yields on high technology sites.

Table 1. Crop Area and Production, Project Townships

| Crop and Year | Area | | Yield per Acre | | Production | |
|---|---|---|---|---|---|---|
| | Sown | Harvested | Baskets | Pounds | Baskets | M. Tons |
| | (Acres) | | | | | |
| **Maize** | | | | | | |
| 81-82 | 57,000 | 51,387 | 25.00 | 1,375 | 1,284,680 | 32,059 |
| 82-83 | 55,870 | 48,248 | 41.29 | 2,271 | 1,992,156 | 49,714 |
| 83-84 | 84,530 | 75,601 | 41.08 | 2,259 | 3,105,800 | 77,504 |
| 84-85[a] | 91,164 | 85,980 | 40.00 | 2,200 | 3,439,340 | 85,827 |
| **Groundnuts** | | | | | | |
| 81-82 | 70,700 | 67,255 | 38.68 | 967 | 2,601,430 | 29,508 |
| 82-83 | 71,940 | 70,394 | 46.08 | 1,152 | 3,243,760 | 36,794 |
| 83-84 | 92,665 | 90,197 | 53.17 | 1,329 | 4,595,853 | 52,131 |
| 84-85[a] | 102,300 | 97,110 | 55.90 | 1,398 | 5,428,463 | 61,575 |
| **Sesame** | | | | | | |
| 81-82 | 59,000 | 52,974 | 4.54 | 245 | 240,500 | 5,892 |
| 82-83 | 61,130 | 52,763 | 9.33 | 504 | 492,279 | 12,061 |
| 83-84 | 72,291 | 66,417 | 7.59 | 410 | 503,875 | 12,345 |
| 84-85[a] | 79,405 | 68,078 | 8.34 | 450 | 567,642 | 13,908 |
| **Sunflower** | | | | | | |
| 81-82 | 15,000 | 14,336 | 20.90 | 669 | 299,620 | 4,350 |
| 82-83 | 15,000 | 14,278 | 40.00 | 1,280 | 571,130 | 8,292 |
| 83-84 | 23,375 | 20,820 | 34.50 | 1,104 | 718,220 | 10,428 |
| 84-85[a] | 33,600 | 31,900 | 46.05 | 1,474 | 1,469,000 | 21,328 |

[a] 1984-85 data are preliminary.

Source: Maize and Oilseeds Production Project Office Records, Agriculture Corporation.

Table 2. Increase in Crop Production: Progress Toward Project Goals

| Crop and Year | Yield (lb/A) | Estimated Tonnage Due To: Yield M.T. | Area Harvested M.T. | Total Amount M.T. |
|---|---|---|---|---|
| **Maize** | | | | |
| 82-83 | 896 | 19,614.4 | -1,958.3 | 17,656.1 |
| 83-84 | 884 | 30,322.7 | 15,106.3 | 45,429.0 |
| 84-85 | 825 | 32,184.0 | 21,581.4 | 53,765.4 |
| Total | | 82,121.1 | 34,729.4 | 116,850.5 |
| Project Goal | | | | 228,000.0 |
| **Groundnuts** | | | | |
| 82-83 | 185 | 5,908.8 | 1,377.2 | 7,286.0 |
| 83-84 | 362 | 14,814.6 | 10,065.8 | 24,880.4 |
| 84-85 | 431 | 18,990.2 | 13,098.8 | 32,089.0 |
| Total | | 39,713.6 | 24,541.8 | 64,255.4 |
| Project Goal | | | | 87,000.0 |
| **Sesame** | | | | |
| 82-83 | 259 | 6,200.4 | -23.4 | 6,177.0 |
| 83-84 | 165 | 4,972.2 | 1,494.3 | 6,466.5 |
| 84-85 | 205 | 6,332.1 | 1,679.0 | 8,011.1 |
| Total | | 17,504.7 | 3,149.9 | 20,654.6 |
| Project Goal | | | | 25,000.0 |
| **Sunflower** | | | | |
| 82-83 | 611 | 3,958.2 | -17.6 | 3,940.6 |
| 83-84 | 435 | 4,109.2 | 1,968.1 | 6,077.3 |
| 84-85 | 805 | 11,651.3 | 5,331.4 | 16,982.7 |
| Total | | 19,718.7 | 7,281.9 | 27,000.6 |
| Project Goal | | | | 53,000.0 |

Notes: Calculated from data in Table 1 using yields in project years compared with yields in base year 1981-82 in project townships. Goals from Project agreement.

Table 3. Selected Crop Yield Data

| Crop | National Average 1970's decade | National Average 1980/81 through 1983/84 | MOPP Townships 3 years | High Technology Sites | Prize Winning Farmers |
|---|---|---|---|---|---|
| | (Pounds per acre) | | | | |
| Maize | 845 | 1,500 | 2,251 | 5,109 | 17,844 |
| Groundnut | 716 | 993 | 1,287 | 1,786 | 11,071 |
| Sesame | 175 | 232 | 451 | 542 | 2,409 |
| Sunflower | 554 | 788 | 1,317 | 1,811 | 7,137 |

The evaluation team believes that the Project Townships and generally comparable areas of Burma have a production potential for maize and oilseed crops far beyond current national averages or even project results to date. In part this view is based on observation of soils, topography and plant growth during the field tour, supported by data reviewed on rainfall, and on continuing low levels of application of fertilizers, irrigation, and other improved inputs. It may realistically be expected that good future programming can move crop yields upward from current national and MOPP averages, at least toward and eventually through the averages being obtained on the project's high technology sites. Opportunities to increase total output on the delta, on irrigated lands, and in other high potential areas through multiple cropping should be fully considered and exploited. However, all this would require major increases in provision of improved inputs on a sustained basis for many years. Experience shows that these requirements are difficult to achieve and administer in all developing areas, particularly on the stipulated sustained basis. Nevertheless, these observations are considered by the team to support the general validity of MOPP's approach. MOPP is clearly only a beginning, but its success will serve as an incentive to devise even more effective follow-on projects, and a spur for other, broader agricultural development programs.

While parts of the following cropwise discussion may be analytically frail due to time and data constraints, the general story of MOPP progress and success stands out at nearly every turn. The evaluation team urges MOPP staff, particularly those responsible for monitoring internal evaluation activity, to revise, extend and perfect some of this analysis in the final project months. The Agriculture Corporation and specifically the MOPP office have gathered a wealth of data. Internal progress and evaluation reports are, in our opinion, better than those found in a great majority of projects. However, the complexity of this project and the potential to do far more with so

many detailed data indicate a need for further attention to analysis. A really systematic and strong program analysis activity appears feasible. TDY assistance toward selecting and initiating a more advanced program of internal evaluation than now exists should be considered. By such action, MOPP could even seek to set a standard for other units of government activity. Also, prompt action of this kind would help to further develop data and enhance insights that should be very useful in preparing a better design for the proposed follow-on project.

a. Maize:

The project was designed to provide a broad range of activities to expand and improve maize production in selected intensive and extensive townships. Actions to increase yields have been to supply fertilizer, provide improved seed, extension, applied research and modest actions in pest management, etc. Since there really has been too little time for other actions to become effective, the results to date must be associated principally with fertilizer and extension plus a small amount of improved seed. Yields were rather steady in the three project years and may be averaged (Table 1). The yield increase achieved, of about 870 pounds per acre or 63 percent, is considered to be a remarkable achievement.

The maize program was targeted at six intensive townships in Sagaing, Mandalay and Irrawaddy divisions, with a target area of 105,000 acres, and at two extensive townships in Sagaing and Pegu Divisions targeted for 24,400 acres. The largest amount sown to date was 91,164 acres, in 1984-85.

It is necessary to mention the national situation, since yields and area harvested have increased generally. Appendix Table G1 shows a remarkably sharp and steady national increase of maize area and a substantial (but less steady) increase in yields. Yields in the three MOPP years averaged about 17 percent higher than in the base year 1981-82. This evaluation neither ignores the national increase nor probes its sources. It is considered probable that tangible development actions occured in other locations, not just in the MOPP townships. This does not discredit the MOPP program. To do so would require a thorough analysis of all kinds of programs, conditions and their results, and then results might support MOPP's contribution. This evaluation chooses instead to assert the positive and rational results of the MOPP program in its area. It considers that project actions were dominant in achieving the results observed.

The area planted and finally harvested in MOPP townships increased sharply. The area harvested rose from 51,387 in the base year to 85,980 acres in 1984-85, or an increase of 67 percent. Program actions

to increase acreage have included mainly extension education plus the supply of additional inputs to allow cultivation of more area. No attempt is made to isolate in the broad extension program the elements of training and demonstration from the general system of establishing national and local production targets for Divisions, States, Townships and village tracts. Agriculture Corporation activities through MOPP included the use of negotiated production targets as well as training and other technology transfer activities. This process and reasoning will be applied for all crops, but stated more briefly in those sections.

Yield and area differences are summarized in Table 2 and compared with the project target for maize. The estimated maize production increase from yield is 82,121 M.T., and the increase from area harvested is 34,729 M.T., or a total of about 117,000 M.T., all on a cumulative basis for the three Project years. This represents 51.2 percent of the project goal. This progress is regarded as a remarkable achievement in the short effective life of MOPP. Other sections of the evaluation will discuss the delays in some project inputs from the original project calendar, and cite unforseen complications and delays from causes external to the project.

Other sections will discuss the actual amounts of fertilizer and improved seed that have been made available for maize through MOPP. The MOPP office reported that the amount of improved seed distributed was 1,260,000 pounds in 1983-84 and 1,176,000 pounds in 1984-85.

Fertilizer distribution has been substantial; 11,202 tons of urea, 5,416 tons of triple superphosphate and 2,454 tons of potash for maize have been made available to MOPP Townships (Table 4). This was enough for nearly all the maize area in intensive Townships at 112 pounds of urea, 56 pounds of triple superphosphate (TSP) and 28 pounds of potash (MP) per acre, and for extensive townships at rates of 84 pounds of urea and 28 pounds of TSP per acre.

Concerning these data, one might fairly ask whether the base year used in the Project and in the evaluation is representative, or does its selection allow for easy "progress" because of unfavorable crop conditions. Divisionwise comparison of 81-82 with the preceding three years suggests that in fact a relatively "tough" standard may have been set by using 81-82 as the base year.

An attempt was made to estimate the portion of increased maize production that may have been due to fertilizer alone. Certainly the project design includes an implicit assumption there will be a direct and fairly powerful response to fertilizers. The team was unable to locate adequate data, based on controlled fertilizer trials in Burma, to enable a proper analysis of the situation. It did, however, have access to "rules of thumb" of experienced agronomists supported by their knowledge of chemistry. Thus it is estimated that urea is 46

percent N and maize is 8-9 percent N, and the recovery rate is perhaps 1 to 1.1 pounds N in maize seed per 2 pounds N in urea, with 11,202 tons of urea applied on MOPP Township maize. The several alternatives embodied in this statement translate into a theoretical potential of 28,600 to 35,400 M.T., if nitrogen is fully a limiting factor. Similar arithmetic applied to TSP would allow a further increase, and perhaps less for MP when appropriate recovery rates are used. Potash, however, is not generally considered so severely limiting. Applying this process of somewhat heroic assumptions, the fertilizer supplied by MOPP may theoretically be seen to account for at least 35-40 percent of the production increase due to yield. While this is not a satisfactory analytical basis for conclusion on a critical matter in Burma, it may be observed it is difficult to account for maize yield increases without crediting heavily the application of fertilizers.

An urgent program of well controlled fertilizer trials on maize is recommended, covering various significant production locations and soil types. This can readily be accomodated within MOPP and probable successor projects, and need not wait for effective implementation of the BARD project. The purpose is not only to guide agricultural programs internally, but to provide supporting data concerning investments in fertilizer facilities and for policy decisions concerning allocation of scarce foreign exchange to buy additional fertilizer.

Table 4. Fertilizer Distribution by Crops, Project Townships

| Crop | Year | Sown Acres | Tons Fertilizer: Urea | T-Superphosphate | Potash |
|---|---|---|---|---|---|
| Maize | 82-83 | 55,870 | 2,793 | 1,397 | 629 |
| | 83-84 | 84,530 | 3,991 | 1,879 | 824 |
| | 84-85 | 91,164 | 4,419 | 2,140 | 1,001 |
| Total | | 231,564 | 11,202 | 5,416 | 2,454 |
| Groundnuts | 82-83 | 71,940 | 695 | 1,799 | |
| | 83-84 | 92,665 | 844 | 2,316 | |
| | 84-85 | 102,300 | 931 | 2,558 | |
| Total | | 266,905 | 2,470 | 6,673 | |
| Sesame | 82-83 | 61,130 | 1,951 | 1,190 | |
| | 83-84 | 74,924 | 2,255 | 1,354 | |
| | 84-85 | 87,405 | 3,378 | 1,569 | |
| Total | | 223,459 | 7,584 | 4,113 | |
| Sunflower | 82-83 | 15,000 | 562 | 376 | |
| | 83-84 | 23,375 | 549 | 555 | |
| | 84-85 | 33,600 | 735 | 735 | |
| Total | | 71,975 | 1,846 | 1,666 | |
| All Crops | 82-83 | 203,940 | 6,001 | 4,762 | 629 |
| | 83-84 | 275,494 | 7,639 | 6,104 | 824 |
| | 84-85 | 314,969 | 9,463 | 7,002 | 1,001 |
| Total | | 793,903 | 23,103 | 17,868 | 2,454 |

Source: Maize and Oilseeds Production Project Office Records, Agriculture Corporation.

The farm value of the increased maize production reported above depends on what price estimates are used for the proportion sold to the Agricultural Farm Produce Trade Corporation and for the proportion sold on the free market. If the AFPTC price is K 20 per basket and half is sold on the free market at K 36 in 1982-83, and K 35 in 83-84 and 84-85, the increased output is valued at 127.0 million Kyat or about US$15.85 million converted at the successive annual exchange rates. This provides an indicator of the total contribution to farmers, and to the MOPP goal concerning farm income.

Finally, maize should be shown to pay at the farm level. An illustrative budget was prepared for Taze, Sagaing Division. (Table 5). It is clear that the farmer has an excellent incentive for maize production, given the highly-subsidized price of fertilizer, if the remainder of the series of estimates used in Table 5 is broadly correct. The farmer could even well afford to sell a major part of his crop at a controlled price to AFPTC. Pricing fertilizer at the full international cost absorbs most of the margin, however, and if internal handling cost were added, the farmer's margin might well disappear. It also follows, however, that government could better afford a higher controlled maize price if the fertilizer subsidy were reduced.

The MOPP program in maize can only be considered a great success. Further production increases are clearly available, especially through provision of more improved inputs, a continued and strengthened extension program guided by research findings, and other requirements. The question was not explored, whether Burma can afford to produce maize for export, for specific animal feed applications, or only for human food. The case likely is very close, or unfavorable to the extent imported fertilizer and at least some purchased motor fuels are employed in production for export. In any event, the present world price of maize probably provides no room for a higher price to farmers in Burma than the controlled price, if all handling costs related to export are recognized.

Table 5. Maize: Illustrative Farm Budget Intensive Program, Taze

Costs to Farmer

| | | |
|---|---|---|
| Seed 21 pounds x 40K/55 | K | 15.27 |
| Fertilizer - Urea 112 pounds | | 18.00 |
| - Phosphate 56 pounds | | 31.50 |
| - Potash 28 pounds | | 7.50 |
| Insecticides (Est.) | | 15.20 |
| Labor 41 days x 6K | | 246.00 |
| Bullocks 9 days x 15K | | 135.00 |
| Land Tax | | 2.00 |
| Total Cost | K | 470.47 |

Return

| | | |
|---|---|---|
| 40.79 baskets (average) = 2443 pounds | | |
| 50 percent to AFPTC x 20K | K | 407.90 |
| 50 percent free market x 35K | | 713.80 |
| Total return | | 1,121.70 |

Net return to farmer K 652 - 657
$US 77

Revised Return with Fertilizer
at International Cost

| | |
|---|---|
| Revised total cost | K 606.5 - 611.5 |
| Revised net return | 515.2 - 520.2 |
| | $US 61 |

Source: Calculated from staff estimates, Agriculture Corporation.

b. Groundnuts:

Planned MOPP actions for groundnuts/peanuts are the same as for maize except for the design to reduce the need for fertilizer, through rhizobium inoculation of seed. This will assist the plant in its normal leguminous action of nitrogen fixation. Groundnuts were targeted for three intensive Townships in Mandalay, Pegu and Irrawaddy Divisions, with a target area of 50,000 acres, plus five extensive Townships in Sagaing, Magwe, Mandalay, and Pegu Divisions with a target of 71,200 acres. The actual area planted in 1984-85 was 102,300 acres (Table 1).

The average yield of MOPP Townships increased from 967 pounds per acre in the base year to 1152 pounds in 1982-83, 1329 in 1983-84, and 1398 in 1984-85. The increases are 185, 362, and 431 pounds in the successive years, or 19, 37, and 44 percent. For comparison, national yields did not increase, except about 6 percent in 1984-85, and then only one percent if MOPP Townships are excluded.

The area planted and harvested increased substantially in the second and third MOPP years, from the base of 67,233 to 90,197 and 97,110 acres in 1983-84 and 1984-85, or about 34 and 44 percent. As with maize, program actions include extension plus the supply of more inputs, all in the general context of the national program of setting production targets.

Production increases for groundnuts are summarized in the second section of Table 2, and compared with the project goal. The estimated increase from yield is 39,714 tons, and the increase from area is 24,542 tons, totalling 64,255 tons, on a cumulative basis for the three MOPP years. The total to date represents 73.8 percent of the Project goal, and such progress is regarded as a remarkable achievement. Action to expand production of the rhizobium inoculant packets is underway. Undoubtedly this will further aid production.

The project target also involves increased groundnut production outside MOPP Townships through supplying inoculant packets more generally. The goal was 171,000 tons (as compared to the goal of 87,000 tons in project Townships). Some 217,210 inoculant packets were provided in 1984-85 for distribution beyond MOPP townships, according to Agriculture Corporation records. No attempt is made here to isolate the production result of inoculant distribution to date. Legume inoculants are discussed in a separate section. The effect of the distribution of legume inoculants was to drastically reduce the amount of urea used on groundnuts. The savings in urea (used on other crops) was approximately 4,200 tons over the three years.

As a result of using rhizobium inoculant, urea distribution for groundnuts has been rather small, 2470 tons in the three MOPP years. The amount of TSP, 6673 tons, was sufficient to provide about

52 pounds per acre. No fertilizer response data were located that allow estimates of the results of the fertilizer applied on groundnuts. As with maize, a good program of fertilizer trials is recommended. However, the increase in yield per acre is attributed mainly to the use of TSP, rhizobium inoculant and MP.

The farm value of increased groundnut production is estimated in the same manner as with maize. Using price data supplied by the Agriculture Corporation, and estimating that only 35 percent was sold to Cooperatives at controlled prices, the result is 308.9 million kyat, or about US$37.5 million converted at successive annual exchange rates.

An illustrative farm budget was prepared for Singu, Mandalay Division (Table 6). The estimates used in that budget indicate a powerful incentive for the farmer to produce groundnuts. Since rhizobium inoculum can be used as a partial substitute for imported nitrogen fertilizer, the question of fertilizer subsidy does not necessarily arise as a significant issue.

The MOPP program can be considered a solid success for groundnuts. Part of the yield increase appears generally available to the country, through the rhizobium program, as fast as it can be expanded. This spread effect is not yet really visible in national yield data, and indicates the critical need for TSP.

One MOPP target is to reduce the import of vegetable oil. The increased groundnut production in MOPP Townships, at an estimated extraction yield of 30-35 percent oil, provided 19,277 to 22,489 M.T. Just as an indication, if rhizobium contributed only five pounds to yield in 1984-85, this would amount to about 6.9 million pounds of groundnuts, or 1,025 to 1,208 M.T. of oil.

Table 6. Groundnuts: Illustrative Farm Budget Intensive Program, Singu, Mandalay Division

Costs to Farmer

| | | |
|---|---|---|
| Seed 8 baskets x 80 kyat | | K 640.0 |
| Fertilizer - Urea 28 pounds | | 4.5 |
| - Phosphate 56 pounds | | 31.5 |
| Rhizobium | | 1.0 |
| Insecticides (Est.) | | 24.0 |
| Labor 49 days x 6K | | 294.0 |
| Bullocks 10 pair days x 15K | | 150.0 |
| Land Tax | 5.0 | |
| Total Cost | | 1,150.0 |

Return

| | |
|---|---|
| 55 baskets = 1375 pounds | |
| 35 percent to cooperatives x 35K | 674.0 |
| 65 percent free market x 70 K | 2,502.0 |
| Total return | K 3,176.0 |
| Net return to farmer | K 2,026.0 |
| | $US 238.0 |

Source: Calculated from staff estimates, Agriculture Corporation.

c. Sesame:

Planned MOPP actions for sesame are the same as for maize. Sesame was targeted for one intensive Township in Irrawaddy Division, with a target area of 40,000 acres, four extensive townships in that Division, and two extensive townships in Mandalay Division, with a total target area of 54,000 acres. The actual area planted in 1984-85 was 79,405 acres (Table 1).

The average yield of MOPP Townships increased from 245 pounds in the base year to 504 pounds in 82-83, 410 pounds in 83-84, and 450 pounds in 84-85. A cumulative total of 17,505 tons increase is attributed to yield, and 3,150 tons to increased area, for a total of 20,655 M.T. This represents 82.6 percent of the MOPP target, with one crop year remaining.

Sesame often is grown on a double cropping basis in Burma, with a result that the crop is affected by rainfall and other variations in the secondary season. Thorough analysis of the program would require a somewhat detailed review of weather conditions in major growing areas, year by year. It should be noted that weather variations really are "the rule" in dryer areas, and/or secondary seasons. Thus, it will take a long time, and objective consideration, to really establish yield changes.

Fertilizer distribution for sesame has been substantial, 7,584 tons of urea, and 4,113 tons of TSP in MOPP Townships (Table 4). Rates of application have been 84 pounds of urea, and 56 pounds of TSP per acre in intensive townships, and 56 pounds of urea and 28 pounds of TSP in extensive townships.

Production increases for sesame are summarized in the third section of Table 2, and compared with the project goal. The estimated increase from yield is 17,505 tons, and 3,150 tons from increased area, totalling 20,655 tons on a cumulative basis for the three MOPP years. This represents 82.6 percent of the project goal. This once again is a remarkable achievement, and represents, primarily, a sharp yield increase from the low base level.

The farm value is estimated in the same manner as with maize. Using price data supplied by the Agriculture Corporation and a mid-1984 consulting report, with 35 percent sold to Cooperatives, the result is 125.6 million Kyat, or about US$15.4 million converted at successive annual exchange rates.

An illustrative farm budget was prepared for Moulmeingyun, Irrawaddy Division (Table 7). The estimates in that budget indicate a strong incentive for the farmer to produce sesame. It is suspected the yield estimates used tend to cover up the risk of failure due to weather variability. Further, the substantial allowance for insecticides proposed by Agriculture Corporation staff suggest a significant pest hazard. Nevertheless, these data, by themselves, suggest that sesame is a profitable crop to the farmer.

The MOPP target of reducing the need for vegetable oil imports must be considered. The increased sesame production, at an estimated extraction yield of 35 to 40 percent oil, provided 7,229 to 8,262 M.T. of oil.

Table 7. Sesame: Illustrative Farm Budget Extensive Program, Moulmeingyun, Irrawaddy Division

Costs to Farmer

| | | |
|---|---|---|
| Seed 6.5 pounds x 210K/54 | K | 25 |
| Fertilizer - Urea 56 pounds | | 9 |
| - Phosphate 28 pounds | | 15.75 |
| Insecticides (Est.) | | 50 |
| Labor 30 days x 6K | | 180 |
| Bullocks 9 days x 15K | | 135 |
| Total Cost | K | 415 |

Return

| | | |
|---|---|---|
| 8.4 baskets = 454 pounds | | |
| 35 percent to cooperatives x 120 | | 352.8 |
| 65 percent free market x 180 | | 982.8 |
| Total return | K | 1,335.6 |
| Net return to farmer | K | 920.0 |
| | $US | 108.0 |

Source: Calculated from staff estimates, Agriculture Corporation.

d. Sunflowers:

Planned MOPP actions for sunflowers are the same as for maize and sesame. Sunflowers were targeted for two intensive Townships in Mandalay Division plus one extensive Township in Sagaing and two extensive Townships in Pegu Division, with a total target area of 44,000 acres. The actual area planted in 1984-85 was 33,600 acres (Table 1). The average yield of MOPP Townships increased from 669 pounds in the base year to an average of 1286 pounds in the three project years.

Sunflowers are grown as a winter crop in Burma, with a result that the crop often is affected by rainfall and other variations in the dry season. As with sesame, weather variations actually should be considered "the rule" in dryer production areas, etc. Also, weather risk clearly is a severe problem for low-income farmers.

Sunflowers have received rather little of the MOPP supplied urea, only 1,846 tons, supplied at a moderate rate of 84 pounds per acre in intensive and 56 pounds in extensive Townships (Table 4). They also received 1,666 tons of TSP at 56 pounds per acre in intensive and 28 pounds in extensive Townships.

Production increases for sunflowers are summarized in the final section of Table 2, and compared with the project target. The estimated increase from yield is 19,719 tons, and 7,282 tons from increased area, totalling 27,000 tons, on a cumulative basis for the three years. This represents 51 percent of the MOPP target, with one year remaining. The increases in both area planted and yield are dramatic. Sunflowers are a relatively new crop in Burma.

The farm value is estimated in the same manner as maize. Using price data supplied by the Agriculture Corporation and a mid-1984 consulting report, with 35 percent sold to Cooperatives, the result is an increase of 110.2 million Kyat, or about US$13.3 million.

An illustrative farm budget was prepared for Pyawbwe, Mandalay Division (Table 8). The economic incentive to farmers to grow sunflowers is at least comparable to that of groundnuts, to the extent the estimates used in this budget are valid and apply more broadly.

Again, the MOPP target of reducing the import of vegetable oil must be considered. The increased sunflower production in Project Townships, at an estimated extraction yield of 28 to 34 percent oil, provided 7,560 to 9,180 M.T. of oil.

The cumulative amounts of vegetable oil from increased oilseed production are as follows:

| | | | |
|---|---|---|---|
| Peanuts | 19,277 to 22,489 M.T. | | |
| Plus hypothetical contribution from rhizobium outside MOPP Townships | 1,035 | 1,208 | |
| Sesame | 7,229 | 8,262 | |
| Sunflowers | 7,560 | 9,180 | |
| | 35,101 | 41,139 | M.T. |

With an estimated 3-year average vegetable oil cost of US$ 600 per ton, the value of the increased oil production would be US$21.1 to US$24.7 million, or K 179 to K 210 million, at K 8.5 per U.S.$. This represents 30.6 percent to 35.8 percent of the MOPP goal of

US$69 million or K 499 million. These estimates of the percentage of attainment of vegetable oil production targets are regrettably lower than the estimated attainment of oilseeds output. The team estimates of oil content of peanuts grown in Burma are below those evidently used in the project design, and moderately lower for sunflowers (less important). In addition, the inefficient extraction methods leave much oil in the oilcake, and sharply reduce the extraction yield of oil.

Table 8. Sunflower: Illustrative Farm Budget, Intensive Program, Pyawbwe, Mandalay Division

Costs to Farmer

| | | |
|---|---|---|
| Seed 8 pounds x 56K/32 | K | 14 |
| Fertilizer - Urea 84 pounds | | 13.5 |
| - Phosphate 56 pounds | | 31.5 |
| Insecticides (Est.) | | 0 |
| Labor 22 days x 6K | | 132 |
| Bullocks 9 days x 15K (pair) | | 135 |
| Total Cost | K | 326 |

Return

| | | |
|---|---|---|
| 40 baskets = 1280 pounds | | |
| 35 percent to cooperatives x 45K | | 630 |
| 65 percent free market x 70K | | 1,820 |
| Total return | K | 2,450 |
| Net return to farmer | K | 2,124 |
| | $US | 288 |

Source: Calculated from staff estimates, Agriculture Corporation.

e. Soybeans:

Soybeans were included in the Project design on substantially a pilot basis. This has been a minor crop in Burma, with only 0.3 percent of total sown acreage in the base year 1981-82. There are two special reasons to at least widely test and promote soybeans. As a legume, the rhizobium inoculant strategy can be applied, as with groundnuts, allowing high production with little or no application of urea or other nitrogen fertilizers. Second, experienced agronomists warn of the danger of diseases and pests in sunflowers as the crop is grown more widely. It is wise to consider an alternate crop.

Fewer production and yield data were compiled for soybeans than the four main crops. The Agriculture Corporation has not as yet compiled separate data on soybean area, production and yield in the Intensive and Extensivie Townships. Since it is not formally a target crop, with specified Township programs, such data would be difficult. National area planted, harvested, production, and yield are reported in Table 9.

Table 9. Soybean Production in Burma

| Item | 1980-81 | 1981-82 | 1982-83 | 1983-84 |
|---|---|---|---|---|
| Area planted (A) | 63,319 | 69,442 | 70,350 | 70,381 |
| Area harvested (A) | 61,034 | 66,274 | 64,603 | 67,416 |
| Yield (baskets-72 pounds) | 8.64 | 8.90 | 9.30 | 10.02 |
| Pounds | 622 | 641 | 670 | 722 |
| Production (baskets) | 527,042 | 590,053 | 600,799 | 675,780 |
| Pounds | 37,947 | 42,484 | 43,258 | 48,656 |

These data show a moderate increase in area and a distinct yield improvement nationally, through 1983-84. Data for 1984-85 were not available. There is no way to make separate estimates of the MOPP contribution.

2. Institutional Development

Although MOPP is a production project, institutional development is an integral part of the project. The major basic (even though unstated) institutional requirement of MOPP is the capability to manage and execute a relatively complex agricultural production project. The Agriculture Corporation has performed impressively well in overall management. In this section each of the PP outputs relating to technology transfer and institution building will be addressed. Some, such as the seed farms and rhizobium inoculant production, include visible, physical aspects. Others, such as training and development of a farm management information system are mainly institutional. Progress to date toward quantitative aspects includes a functioning rhizobium inoculant plant and more than 60% of the seed farms buildings erected by the Burmese Government. On the other hand, Thitcho seed farm still needs an all-weather road and connection to electric power lines; no candidates for Ph.D. training have left the country. Overall, however, the project has contributed strongly to building of institutional capability in the Agriculture Corporation and these effects will continue long after the project terminates. Capability has been strengthened in applied research, technology transfer of improved production practices, seed production, production information, training and at the eminently successful rhizobium production plant.

a. Research Capability and Applied Research:

In addition to the target production increases, an improved national research capability in maize and oilseeds is expected to be established by the end of the project. On-going trials were expected to be conducted at central research facilities in Yezin and at the 40 field-level high technology sites within the eight intensive townships. The trials were to be on seed varieties, soils, fertilizer application rates, water control and other production variables affecting yields of maize and oilseeds.

On-going trials at Yezin are investigating the major production variables, and the research capability of ARI Scientists has been increased by MOPP through short-term training and the purchase of supplies and equipment as indicated elsewhere. Continued support of research at Yezin will be provided through the new BARD project. At the same time, the need for testing at several locations the most promising varieties, as well as fertilizer, water management and other input trials, was recognized by the MOPP management. Such trials provide information under different soil and climatic conditions. While the high production sites are excellent for widespread trials to

demonstrate the value of production packages, they are not very useful for screening crop varieties or for the detailed studies needed to determine optimum rates of inputs. (What farmer wants to have a poor variety or an area without fertilizer that looks bad on his farm?) Since the seed farms are large and space on them is available, MOPP management appropriately initiated well-designed applied research trials on those farms. The seed farms are located in geographically diverse areas and will be useful sites for evaluating crop varieties for many years.

Fertilizer trials are land-demanding as the residual effects of the fertilizer applications, especially at higher rates, persist for many years. New areas are required for each experiment. Properly designed fertilizer experiments in many locations are needed to determine economically optimum rates. Ideally, such experiments should be combined with soil and plant tests so correlations can be established and data developed for use in determining optimum fertilizer rates, and to predict specific fertilizer needs. Soil tests must be correlated with yield responses to fertilizer for each crop under local conditions before they can be used with assurance by the farmers. Many trials in many locations are needed. An excellent opportunity exists for cooperative studies between BARD and MOPP, as well as with the follow-on project to MOPP to develop soil tests.

MOPP has obtained promising varieties of the crops under study from a wide range of sources, such as international agricultural research centers, U.S. institutions and commercial seed companies, neighboring countries, and other countries. Performance of the varieties has been observed in trials at Yezin and at the seed farms. Cultivars from these trials that appear to be significantly better than the best locally used varieties have been used in the high production sites. Seed was either purchased or multiplied at the seed farms. This type of applied research is essential to crop improvement, and the research on the seed farms should continue to be conducted with proper correlation with the research at Yezin and other locations.

In Burma, the most needed input for increased crop production is fertilizer, but other inputs such as herbicides, insecticides, fungicides and nematocides, need to be evaluated. The seed farms are excellent locations for field-scale trials as well as some plot trials, to assess benefits and difficulties so that appropriate recommendations can be made to farmers. Water and soil management practices should also be tested before farmer use.

Since the High Technology Sites (HTS) are not designed for statistical analysis, they should be used primarily for demonstration trials. However, comparison of the yields on HTS against the township averages can indicate the benefits of the production package. Such comparisons indicate that fertilizer is the most beneficial input, even though it is costly. If water is inadequate, irrigation is costly, too.

A comparison of the HTS yields per acre with the township averages (MOPP review, Jan. 1985, Appendix H) for the three years 1982 to 1984 inclusive showed yield increases with all crops for the high technology practices (Table 10). When the values of the increased crop yields are calculated, they exceed the cost of the fertilizer used, even when "free" market prices are used for the fertilizer (Table 11). In other words, the farmer can make more money by using his allocation of fertilizer on his crop than he could by selling it on the "free" market. The value of the increased crop is at least three times as great as the cost of the fertilizer.

TABLE 10. Yield differences between high technology sites on farmer's fields and township averages.

| Year | HTS lb/A | Township lb/A | Increase lb/A |
|---|---|---|---|
| | | **Maize** | |
| 82-83 | 3,410 | 2,271 | 1,139 |
| 83-84 | 6,270 | 2,259 | 4,011 |
| *84-85 | 3,905 | 2,202 | 1,703 |
| Av (3yr) | 4,528 | 2,244 | 2,284 |
| | | **Sesame** | |
| 82-83 | 702 | 504 | 198 |
| 83-84 | 497 | 410 | 87 |
| *84-85 | 567 | 446 | 121 |
| Av (3yr) | 589 | 453 | 135 |
| | | **Groundnuts** | |
| 82-83 | 1,800 | 1,152 | 648 |
| 83-84 | 2,100 | 1,274 | 826 |
| *84-85 | 1,825 | 1,398 | 427 |
| Av (3yr) | 1,908 | 1,275 | 634 |
| | | **Sunflower** | |
| 82-83 | 1,744 | 1,280 | 464 |
| 83-84 | 1,856 | 1,104 | 752 |
| *84-85 | 2,240 | 1,473 | 767 |
| Av (3yr) | 1,947 | 1,286 | 661 |

* only monsoon crop; winter crop not available

Table 11. Value of yield increases of High Technology Sites (HTS) over Township (TWP) averages for three years, 1982 to 1984 inclusive.

| Crop | Yield Increase lb/A | Gross value of yield Increase[1] Kyat | Fertilizer Cost Subs[2] Kyat | Fertilizer Cost free[3] Kyat | Net Value of Yield Increases Subs Kyat | Net Value of Yield Increases free Kyat | Net Value of Yield Increases free $ |
|---|---|---|---|---|---|---|---|
| Maize | 2284 | 1028 | 40 | 171 | 988 | 857 | 98 |
| Sesame | 135 | 285 | 13 | 61 | 272 | 224 | 25 |
| Groundnut | 634 | 1420 | 98 | 355 | 1322 | 1065 | 122 |
| Sunflower | 661 | 1031 | 20 | 86 | 1011 | 945 | 109 |

1 Assumed prices: maize - K0.45/lb; Sesame-K 2.11/lb; groundnut-K 2.24/lb; sunflower- K 1.56/lb; K 8.7=$1

2 Subsidized fertilizer prices: Urea - K 0.18/lb; TSP - K 0.39/lb; MP - K 0.27/lb

3 "Free" market fertilizer prices: Urea - K 1.3/lb; TSP - K 1.3/lb; MP - K 0.9/lb

Fertilizer rate HTS above fertilizer rate for Township:
Maize: Urea - 56 lb; TSP - 56 lb; MP - 28 lb
Sesame: Urea - 28 lb; TSP - 0; MP - 28 lb
Groundnut: Urea - 28 lb; TSP - 168 lb; MP - 112 lb + 1 bag Rhizobium
Sunflower: Urea - 28 lb; TSP - 0; MP - 56 lb

Even recognizing the difficulties and errors in this type of comparison (for example, the HTS sit farmers are probably above average in general skill, and experiencing above average yields, the amount of animal manure applied is unknown, etc.), the indications are that the returns over fertilizer costs are very large with benefit/cost ratios ranging from about 2.5 to 8. Maize and groundnuts appear to have the highest benefit/cost ratio. These figures are not accurate enough to be very reliable, but are very useful in determining the need for properly designed trials on research stations, seed farms, or on farmer's fields to more accurately assess the optimum rates of fertilizer. These data support strongly the emphasis on making fertilizer available to the farmers.

Applied research on pest control by integrated pest management should be increased to find practical ways of controlling weeds, rodents, insects, diseases and other pests.

Applied research on water and soil management could pay large dividends in crop production. An assessment of the land areas where crops can be grown by subirrigation from the water table during the dry season, as well as the crops that are best adapted to this method of "irrigation", could provide information that would allow surface irrigation water to be used more efficiently and in appropriate places. Unless a soil impediment exists, several crops can use water effectively from a water table several feet below the suface. (A dry layer of soil can be as effective an impediment as an impervious layer).

In summary, the research capability of the scientists and their institutions are being strengthened considerably through this project. The opportunity to use the seed farms for Applied Research has been recognized and used, while the limitations in using the high technology sites on farmer's fields for research have been turned to advantage by encouraging the farmers to use their skills in maximizing production with the added inputs and production technology packages. The high technology sites have become extremely useful demonstration trials. Burmese scientists and the MOPP technical assistance team should develop a definite applied research program for the last two years of the project as a foundation for continuing research to improve technology for efficient increases in maize and oilseed crop production.

b. Technology and Production Practices:

A major output of the project is the introduction of improved maize and oilseed technology and production practices (seed, water, fertilizer, extension services). At the high technology sites (5 in each township targeted for that crop) a production package using improved varieties with seed provided by the project, rhizobia inoculant when appropriate, standardized fertilizer rates, planting density and desired planting date is an example. Tillage and water management practices were usually former practices, although raised beds were used in some cases. These sites provided a good test of the prescribed set of production practices, but did not test variations that might be beneficial, such as higher rates of fertilizer, different combinations of fertilizer, use of herbicides, insecticides, etc. Also, no control plots or strips were used, and no replications of plots made to assess the variability of the yields over the field. Weeds were not a problem in the fields visited or seen during the dry (winter) season, but it was reported that weed control was poor during the monsoon (summer) season. High fertility increases the growth of the weeds and the competition of weeds can limit yields severely.

The high technology sites are very useful to demonstrate the value of improved inputs and practices to farmers, and to assess the value of the production package. For field research trials, other sites are needed where the improved practices can be replicated on plots including check/control areas, and yield results can be measured meaningfully.

The present system of high technology sites is working well as a technology transfer device with about 5 sites in each of the 12 intensive townships. Other townships have requested inclusion as an intensive township. Would it be possible to reduce the size of the high technology sites and to increase the number of sites, and, possibly, the number of production packages tested? The high technology sites have demonstrated the value of the production packages for the different crops, but these production packages have not been incorporated as township and/or village production packages due to lack of inputs (seed, fertilizer, diesel fuel, etc.). However, some farmers said they were increasing their inputs (for example, buying more urea fertilizer) by purchases on the "free" market. Irrigation is not available on all high technology sites. Although some sites have been provided with pumps, others do not have an adequate water source, or power is not available.

c. Seed Production

To provide seed of improved high yielding varieties of maize and oilseeds, four fully equipped and staffed seed farms were planned. Two of these are to produce foundation seed on 70 acres for oilseeds and 110 acres for maize, using breeder seed developed by research in Burma or elsewhere, and two are to produce certified seed from the foundation seed, on 800 acres for oilseeds and about 3000 acres for maize. Each farm will have equipment necessary for drying, processing and bagging seed as well as producing and harvesting it.

The locations, acreage and kind of seeds for these farms are as follows:

1. Chaungmagyi, (Division of Mandalay, Township of Pyawbwe), with about 350 acres of land. Maize and groundnuts are the main crops to be developed for foundation seed.

2. Sebin, (Division of Mandalay, Township of Yamethin) with 340 acres of land. Sesame and sunflower are the main crops to be developed for foundation seed.

3. Kyaung Su, (Division of Pegu, Township of Kyauktaga), with 880 acres of land. Groundnuts and sunflower are the main crops to be developed in certified seed.

4. Thitcho, (Division of Pegu, Township of Nattalin), with 3,000 acres of land. Maize and sesame are the main crops to be developed for certified seed.

All the seed farms are under the auspices of the Agriculture Corporation (AC), Ministry of Agriculture and Forests, Extension Division. During the field trip to the above locations, done by the evaluation team, the following observations were made and comments are offered:

In all these farms, suitable infrastructure, buildings and equipment have been provided or are planned. A detailed description of the buildings and other facilities, as well as for the equipment and supplies, is given in the Inputs section of this evaluation report.

Data for each of the seed farms were collected on progress in land clearing, land leveling and land preparation.

| Seed Farm | | Gross area acres | Planned crop area acres | Finished 1/85 acres | Remaining 85/86 acres |
|---|---|---|---|---|---|
| 1. | Chaungmagyi | 350 | 304 | 180 | 124 |
| 2. | Sebin | 340 | 287 | 150 | 137 |
| 3. | Kyaung Su | 880 | 800 | 250 | 550 |
| 4. | Thitcho | 3,000 | 2,600 | 160 | 2,440 |

Concerning the acreage for the Kyaung Su seed farm, during our visit to the station, land leveling was taking place and it was planned to have under cultivation during the coming year, 500 acres of groundnuts, 100 acres for sunflower, 150 acres for soybeans and 150 acres for sesame.

At Sebin seed farm the following crops are programmed to be planted for this year:

In April-June-October: Sesame, 50 acres; Groundnuts, 50 acres; 100 acres of sunflower. (Evidently more land leveling and land preparation has to be done because only 150 acres are at present prepared).

As winter crops in October-April season: sesame 50 acres and sunflower 150 acres.

At Chaungmagyi foundation seed farm, the future planned acreage distribution is: for the monsoon crops, maize 100 acres, groundnuts 150 acres, cowpeas 50 acres; during the winter, maize 150 acres, groundnuts 100 acres, cowpeas 50. The planned foundation seed production for this farm is 490 MT of maize and 220 MT of groundnuts yearly.

The Thitcho certified seed farm is the largest, with 3,000 gross acres of land. The road to Nattalin (9 miles) has to be rebuilt. During our visit (January 14, 1985), the repair work had started. At present 500 acres are cultivated to maize with a good stand. Sunflower occupies 200 acres while 91 acres of groundnuts are being cultivated. Also trials of a soybean collection (inoculated with rhizobium) are being done with a good stand. The trials for both soybeans and sunflowers are done to test yields and pest resistance under local conditions.

According to the most recently published summary and progress review from MOPP (January 6, 1985), all seed farms are producing limited amounts of seed which is being distributed to farmers. On the seed farms in the period 1982-84 an average of only 29 percent has been produced of the amount planned. Considering that critical inputs were not available to the MOPP, the results can be understood.

The success of any project requires the availability of essential commodities on a timely basis. Gasoline and diesel are rationed, as well as cement and fertilizer. Although at some seed farms powerlines were close by, neither transformers or electrical wire were installed and connected. The equipment ordered for the seed farms was delayed because customs clearance is a slow process. From the time some of the equipment was ordered to the time it was received, almost 12 months have elapsed causing operational problems for MOPP.

Considering these difficulties, it has been remarkable that so much was achieved. In our visit to the seed farms many of the planned buildings had been built; field roads and canals were partially done. Much of the farm machinery ordered had arrived and some of the equipment was already in operation. The production on the foundation and certified seed farms from the start of the project (1982-83) up to this year (1984-85 period), with estimates for planned production in 1985-86 is detailed in Appendix I.

(1) Supply and Demand of Seeds

Table 12 illustrates the anticipated requirements for improved seed and the amount supplied from the seed farms. At present, most of the farmers are planting their own seed from a former crop, or purchase seed from other farmers.

The calculated percentages of the needs supplied from the seed farms are as follows:

| | 1982-83 | 1983-84 |
|---|---|---|
| Maize | 33.3% | 72.7% |
| Groundnut | 1.08% | 1.82% |
| Sesame | .04% | 1.66% |
| Sunflower | 25.6% | 20.4% |

If maize follows the same trend for 1984-85, the demand will be almost satisfied next year. The oilseed crops need an intense effort in order to supply all the requirements, most specially for groundnuts and sesame which are the two main crops for the country, following rice. Sunflower seed production also needs to be increased. At present the demand is not as great as for groundnuts and sesame, but if the Burmese market behaves in a similar manner to these did in other countries, sunflowers could have a demand as large as groundnuts in the very near future.

(2) Varieties

Selection of varieties is based on variety trials at Yezin (Appendix J) and other observations. The varieties already grown in the seed farms are:

Table 12. Seed Supply Requirement And Actual Distribution from 1982-83 to 1984-85

| Crop | 1982-83 | 1983-84 | 1984-85 |
|---|---|---|---|
| Maize - Acres | 57,000 | 75,000 | 91,000 |
| Seed required (basket) | 14,250 | 18,750 | 22,750 |
| Distribution (Basket) | | | |
| From seed farms | 4,750 | 13,625 | 8,465* |
| Groundnut - Acres | 37,500 | 45,000 | 46,500 |
| Seed required (basket) | 225,000 | 270,000 | 279,000 |
| Distribution (basket) | | | |
| From seed farms | 2,430 | 4,927 | 3,210* |
| Sesame - Acres | 34,000 | 36,000 | 38,000 |
| Seed required (basket) | 4,250 | 4,500 | 4,750 |
| Distribution (basket) | | | |
| From seed farms | 17 | 75 | 36* |
| Sunflower - Acres | 15,000 | 20,000 | 25,000 |
| Seed required (basket) | 3,750 | 5,000 | 6,250 |
| Distribution (basket) | | | |
| From seed farms | 960 | 1,020 | 120* |

* Seed distribution from monsoon crops.

Source: Records of Agriculture Corporation

Name of Crop Varieties Under

Multiplication at Seed Farms

| Crop | Variety | Origin |
|---|---|---|
| Maize | Shwewa 8 | CIMMYT Variety |
| | Shwewa 9 | |
| Groundnut | Magwe 10 | Local improved variety |
| | Sinpadetha 2 | ICRISAT variety |
| Sesame | Sin Yadana 1 | Local improved variety |
| | Hnanni 25/160 | |
| Sunflower | Sunfola 68-3 | Pacific Seeds Co., Australia. |
| | Tcernianka | USSR |

The yields so far are encouraging. Other varieties should be tested to see if better results can be reached. Also, fertilizer trials should be done in order to judge better the results.

(3) Personnel

The staffing at this stage of production seems reasonable. The farm managers that the evaluation team interviewed seem to have an adequate level of knowledge to take care of the operations. As problems have occurred, the MOPP administration has made necessary changes. One farm manager had been on the job less than 3 months, replacing a less effective manager. Consideration should be given to the growing complexity of the operations when more areas are planted, more machinery is working, and the jobs are becoming more demanding.

The following is a list of the present personnel:

Seed Farms Personnel

| Position | Chaungmagyi | Sebin | Kyaung Su | Thitcho |
|---|---|---|---|---|
| Farm Manager | 1 | 1 | 1 | 1 |
| Deputy Manager | 1 | 1 | 1 | 1 |
| Field Inspector | 2 | 1 | 1 | 1 |
| Field Man | 9 | 9 | 14 | 19 |
| Research | 2 | 2 | 2 | 3 |
| Seed Production | 5 | 5 | 10 | 13 |
| Seed Processing & distribution | 2 | 2 | 2 | 3 |
| Tractor Drivers | 2 | 2 | 3 | 5 |
| Office Staff | 1 | 2 | 3 | 3 |
| Total | 25 | 25 | 35 | 49 |

Some mechanics will be urgently needed unless the drivers are also mechanics. The number of laborers was not available.

(4) Farm Machinery and Electric Power

Maintenance and service of farm machinery and implements need to be improved with a regular maintenance schedule developed and followed. A training program for the personnel involved is considered a necessity.

Maintenance shops in the four seed farms should be developed as soon as possible, in order to perform the regularly scheduled maintenance, make necessary repairs and reduce the downtime. Most of the tools ordered have already arrived at the seed farms. Threaded steel rod in various diameters can be cut to replace a variety of bolts when nuts and lock washers are used.

Electrical power is already available to all the farms through diesel engine generators (130 KW) provided by USAID for emergency power. All the seed farms are located relatively close to a high voltage power line (33 KVA), but connection has been delayed by scarcity of wire and connection by the power company is anticipated in the near future.

Transformers for the seed farms are already purchased from Heavy Industries Corporation (HIC). Four transformers from 33 KVA to 11 KVA and four transformers from 11 KVA to 0.4 KVA are ready to be moved to the seed farms. The two groups of transformers have a capacity of 100 KVA and 60 KVA respectively. Apparently, permits to install the transformers in two seed farms have already been obtained.

Connecting wiring and poles should be installed as soon as possible. The scarce diesel fuel available should be used for farming operations and seed transportation with trucks rather than to generate electrical power. Diesel-generated power should be used only as a back-up system.

(5) Irrigation

All the seed farms have ground water available, but in unknown quantities. Wells have been drilled but the water flow has been inadequate for irrigation. Further drilling could be planned with an adequate hydrogeological survey. When good water flows are obtained, chemical analysis of the water found is also recommended prior to being used extensively for either irrigation and/or human consumption.

Improved water management practices are important if good crop yields are to be obtained. High crop yields are especially important for the seed farms. The water for irrigation has to be calculated either by using the consumptive use rate or the amount of soil moisture to be depleted from the soil. In our visit to the farms, we have seen small meteorological stations. An essential part, the evaporation pan, was missing. Evaporation pans should be installed in

each meteorological station in order to apply the irrigation water to the fields in a more efficient manner. The efficiency of irrigation is influenced by management, method of irrigation, and by leaching requirements.

MOPP already has a resident specialist on irrigation, and his expertise together with Burmese knowledge and appropriate consultant assistance will be very valuable in order to develop several irrigation
schemes, as well as how to use the probably scarce available water with a maximum efficiency.

Training courses on water management and water scheduling could be very valuable to the farmers for some potentially irrigable land areas. These courses are recommended to be given at the seed farms where the farmers can learn in a practical way.

(6) Land leveling

Land leveling in the seed farms needs improvement. The laborious method presently done using scrapers could be simplified with laser land leveling equipment. Purchase of two laser land levelers, with three scrapers each, might be considered. Such equipment could speed the operations as well as provide for high precision leveling. Savings in fuel and time are substantial using laser equipment.

(7) Seed Storage

In the near future when the MOPP seed farms will operate at full capacity, adequate storage will be needed, particularly when seed must be carried over from one season to the next. Proper storage should be planned ahead. Storage facilities as recommended by the previous seed consultancy are needed as soon as possible.

(8) Seed Trials and Analysis

In the PP it is stated that research should be conducted at a central research facility in Yezin and at 40 field level, high technology sites within 8 intensive townships. After visiting Yezin, as well as the four seed farms, we recommend that the trials on varieties, fertility tests, pest resistance, etc., be performed at Yezin and at the seed farms instead of the 40 high technology sites. These 40 sites can be used as the pre-test trial before a variety is released to the local farmers of a township.

It is very important for a successful oilseed crop operation to know the oil content in the seeds. Oil content not only varies with the crop, but also with each crop variety. Also, it varies as a response to the ecological conditions and to some extent, to agricultural practices, for example time of planting.

Increasing the yields per crop is important. When high yields of edible oil are the target, then the oil content of the seeds must have consideration. The varieties in trials should be selected according to high yields, pest resistance, and oil content in this order. A specialist in oilseed plant breeding is needed to train the professional personnel of the seed farms in plant selection. (We understand that MUCIA is trying to obtain such technical assistance currently.) Varieties of oilseeds can have a wide range of oil content, such as:

| | |
|---|---|
| Sunflower: | 35-42% |
| Safflower: | 31-45% |
| Groundnut: | 31-38% |
| Soybeans: | 18-23% |
| Sesame: | 40-47% |

Lower and higher values are recorded in the literature.

It is, therefore, recommended that a small laboratory with simple testing equipment be installed in each seed foundation farm, to perform analysis of oil content to aid in the selection of varieties.

The ecological conditions of some areas of the country would seem appropriate for the expansion of safflower and niger (nug). Safflower will do well in rice fields with soils of medium to heavy texture. Trials are necessary in different areas of the country to determine the best time for planting and row spacing. The water level in the field should be high enough to provide the necessary moisture for germination. The water table can slowly recede to a depth of about 60 cms (23.6 inches), when the plants are in the full flowering period.

In areas with a winter rainfall of 400 mm - 500 mm (15.7 to 20 inches), safflower is doing well. Also under irrigation in California, it has proven a successful crop, especially in deep, heavy textured soils. In its origin, safflower is a semi-desert plant and, water requirements are quite minimal. Besides it has a deep root system that can reach for water at a depth not reached by cereals. Therefore, safflower can use the water stored at low levels in some soils, particularly in some areas of a flat river valley. The deep root system becomes an advantage for intercropping with some cereals and pulses, by utilizing the water that these crops couldn't use.

Varieties have been developed in California (USA) which are resistant to Alternaria alternata and Fusarium. Resistance trials are necessary because the imported varieties could be susceptible to local species of Alternania, Fusarium, Ramularia and other pathogens. The varieties of safflower could be classified in two groups: spineless and with spines. The spineless varieties are more susceptible to pathogens and insects than the varieties with spines. Also the yields are higher in varieties with spines. We recommend that some varieties be imported to start a research program with this semi-desertic thistle. Varieties, such as Gila, US-10, Lethbridge, have given good results in other countries with similar climatic conditions as in Burma.

To handle the varieties with spines the farmers should use leather gloves, at the harvesting period. A small artisan factory could manufacture them, and possibly be included in the MOPP program. The spineless varieties should also be tested and perhaps the PI-306-822 has shown good results in countries with similar climatic conditions to Burma. Susceptibility test trials to pathogens and insects for the spineless varieties are considered necessary. The spineless varieties have less oil content.

Safflower oil is one of the healthiest because of its high content of polyunsaturated fatty acids. Safflower oil in its original variety is very high in linoleic acid, which as it is known, has a drying characteristic and can be used in paints and varnishes. Through research and breeding, varieties have been developed with a low linoleic acid content and a higher oleic acid, which gives excellent characteristics for cooking.

A strong research and breeding program is highly recommended, starting with a collection of varieties, in order to evaluate the best ones for several areas in Burma. The following steps in research should deal with cultural practices, like determining the best sowing and harvesting periods, row and plant spacing, etc, and finally, the best methods for harvesting and threshing. Cultural practices should be determined for both irrigation and dry land cultivation. The selection for threshing becomes important because some varieties are short with lots of branches and other varieties are taller, usually with few short branches at the top. Higher yields are obtained with the short type, which presents some threshing problems.

The Niger ("Nug" in Ethiopia) oilseed plant can be grown very well in the uplands of the country, since they resemble the high plateaus of Ethiopia, where this plant originates. The spectrophotometric analysis of this oil reveals a great similarity to olive oil. It is, therefore, recommended that trials with this plant should be done with relatively cool nights. Unfortunately, it is not known if some high yielding varieties can be obtained. A plant breeder could select plants with a good germ plasm and start an intense genetic program. Seeds for this purpose could come from Ethiopia. Inquiries are necessary in order to find out if research is being done on niger in other countries. Some small farmers in Ethiopia were obtaining maximum yields of about 800 kg/ha. The oil can be extracted by expellers.

There are other oilseeds from the Cruciferae family like rapeseed (Brassica sp.) and mustard (Eruca sativa) that could be considered as a future potential for the northern and cooler section of the country.

At this stage, MOPP should intensify research, multiplication and production on the oilseeds currently included in the program.

(9) Administration

It is our concern that the amount of information and technical data that has to be gathered, analyzed and classified, will become one of the most serious problems. It is recommended that a systematic methodology be developed for this task. If truthful and accurate records are not kept, statistically analysed and properly classified, the research trials on varieties for each crop, fertilizer trials for several varieties, pest resistance trials for varieties, become useless exercises.

For every seed farm, professional personnel should be selected and trained to keep records of all farm operations and their cost. It is considered of paramount importance to know the cost of one basket of seed sold to the farmers even if the official price is a policy matter set by the government. The seed farm should operate "economically" and efficiently. To do so, all the operations should be recorded considering input parameters (cost of diesel, seeds, fertilizers, pesticides and water), labor (skilled and unskilled), cost of farm machinery (amortization, fuel, lubricants, tires, spare parts, repairs, etc.) per hour of operation.

It is recommended that the professionals working in the seed farms get simple training courses on agricultural records and farm management, and develop a sense of performing the operations with increased efficiency, and that "time costs money." The Farm Management Information System included in the project design would provide assistance, and the above information would be very useful in this system. With such an approach, it is expected that in the near future, i.e., a 100 HP tractor will not be used when a certain operation can be done by a 60 HP tractor.

Not only machinery costs money to operate. Also, water for irrigation can become very expensive if not used with a sense of economy. In the above "irrigation" paragraph, a course on water management was recommended. This specific subject should be approached not only to obtain higher yields, but also to produce the same yield using only the necessary amount of water. Every gallon of water pumped carries the cost of diesel fuel (or KW if electrical motors are used), lubricants, amortization of the pump, maintenance, repairs, and spare parts. These costs can be very high when thousands of gallons have to be pumped for critical periods of certain crops. Over-irrigation is as bad a practice as under-irrigation. Only through training and developing an awareness of all the costs involved, can a successful operation be achieved.

Records of all these costs should be kept, by cultural operations for each crop and for every acre of the seed farms. Farm budgets, as well as general accounts, are extremely important and helpful for a systematic and periodical evaluation of the project, which is highly recommended. The above mentioned microprocessor could be very useful to simplify such tasks.

(10) Specific Constraints

Several constraints make it difficult to reach much higher yields than the ones that are obtained now. In our visit to the seed farms some observations were done with the local personnel involved, leading to some conclusions.

(a) Land leveling and land preparation. The land leveling system presently used is laborious, time consuming and therefore requiring many hours of tractor time. A more perfect and faster job can be done using laser leveling equipment.

Some of the stands of plants were not uniform. One of the reasons is because the soil was not properly tilled. Before planting, the soil must be in such a condition that seeds can be deposited by the planter all at the same depth. The necessary equipment to do a good land preparation was available at the farms. With a uniform germination, better yields can be obtained, because harvesting becomes more efficient.

(b) It was our observation that in some areas in the seed farms, the row spacing could be narrowed. In some other fields the opposite could have been recommended. Some trials in row spacing, time of planting, plant spacing, etc. should be done according to soil fertility. After all these parameters have been gathered, the plant population can be substantially increased, and evidently the yields can be higher. As a conclusion, these tests should be done at the seed farms, where, at least in theory, maximum yields should be obtained. This knowledge should be passed to the farmers through the extension service people.

(c) The quantity of the foundation seed and certified seed, judging by the yields recorded so far, can be improved, if compared with average yields in countries with similar ecological conditions as Burma.

As a conclusion, more trials with different varieties or cultivars should be done at the seed farms, as long as they are representative of the area where the crop finally should be planted for production. At present, some foundation seed is being multiplied. Also, production activities have provided for testing the equipment and most important for training the personnel involved. In spite of that, new trials with new varieties, or better testing the ones now available, should be done as soon as possible.

(d) In countries subject to heavy rains soil fertility perhaps is the most important factor if higher yields are to be obtained. Therefore, this is one of the most important constraints. Fertilizer trials, which in our visit were not frequently seen, should be done in every seed farm, with different varieties or cultivars.

From our observations from different fields, it can be concluded that most of the fields are deficient in soil nutrients. In order to advise the farmers of their fertilizer requirements, soil analysis sampling should be done, at least in a first phase in all "intensive" townships. It is our conclusion that higher yields can be only reached when a coordinated effort is done, integrated and synchronized, with soil preparation, adequate fertilization, proper time of planting, seeding at the right spacing, etc. If one of these steps is missing, the results are in jeopardy.

d. Farm Management Information Systems:

There is an excellent opportunity within MOPP, and a logical successor project, to develop a useful farm management information system. There are detailed Township data by crops, on area, fertilizer, improved seed, etc. Those data are kept in good order. Extension staff work closely with farmers, and can estimate production requirements.

The next step logically would be to refine these averages by separate ones for extensive and intensive Townships, and for the High Technology Sites, and to construct farm budgets for representative situations. Further, selected staff could be instructed to collect data on specified farm fields. These steps require careful organization to provide useful data.

The central point here is that much of the work is underway that would provide for a good farm management information system. Refinements and more analysis of the available data are recommended. Time still remains before project completion to carry through this refinement and analysis in the intensive districts, as included in project plans. Such analysis would add greatly to the substance of internal evaluation of MOPP and the successor project. The information generated would logically be used in adjusting the recommendations to farmers, and rates of inputs made available.

Key Agriculture Corporation staff are well aware of the processes of program monitoring and evaluation. The idea of farm management information approaches should be seen as a vital component in a production project. Prompt action is recommended, to capitalize on existing information, add to it as needed, and complete a useful

farm management information system. TDY assistance should be considered in elaborating this proposal, outlining needed actions, and providing follow-up.

e. Participant Trainees:

MOPP includes a substantial training component and a set of target outputs including 11 PhDs and 25 MS degrees completed, and 70 short-term training activities. Despite delays, many short courses have been completed. No degree courses will be completed during the MOPP project life, so that formal training will not really be an effective output during the project life. The effectiveness of long-term training should be realized during the proposed follow-on project. Thus, training is treated more fully in discussion of project inputs. The evaluation team places a very high priority on training.

f. Rhizobium Inoculant Production:

Properly nodulated legume crops do not require fertilizer nitrogen to produce high yields. Legume oilseeds include only two crops: groundnuts (1.2 to 1.5 million acres) and soybean (60 to 70 thousand acres). To be sure that these legume crops are able to obtain their needed nitrogen from the air by fixation, selected rhizobia should be supplied by appropriate inoculation with a legume inoculant.

In the Divisions of Magwe, Mandalay and Sagaing, peanuts are planted in May-June on soils that have been subjected to temperatures of 40°C during the dry season. In the Divisions of Pegu, Irrawaddy, Rangoon and some parts of Mandalay and Sagaing Divisions, peanuts are planted on alluvial soils after paddy. These soils have been subjected to flooding. High temperatures, drying and flooding drastically reduce the number of rhizobia in the soil, so annual inoculation may be needed.

Many farmers have applied urea fertilizer to legume crops to supply them with their requirement for nitrogen. The quantity of urea available is inadequate even for the optimum production of paddy, and increased yields of maize, sesame, sunflower, wheat and other non-legume crops depend also on greater use of urea fertilizer. In 1977-78 the Ministry of Agriculture and Forests of Burma became interested in developing alternate sources of nitrogen for Burma. Rhizobial research and inoculant production were developed at Yezin (ARI) under laboratory conditions. Rhizobia were isolated. Peat inoculum carrying these rhizobia produced significant increases in the yield of mung beans and chickpeas. Since 1978, inoculum production at Yezin has continued, and the output has increased each year (See Appendix K).

MOPP recognized the value of legume inoculants for production of peanuts and soybeans, and has assisted by providing needed equipment and supplies. The production program for peanuts has

substituted a bag of rhizobia inoculant for a bag of urea, with no decrease in yield. Use of rhizobia inoculant results in an actual saving, given current subsidies, of 8 Kyat per bag (9 Kyat per bag of urea vs. 1 Kyat per bag of inoculant), but represents a real savings of approximately 23 Kyat (25 Kyat per bag of urea less 2 Kyat per bag of inoculant when real costs are used.). With soybeans, many soils do not have the compatible rhizobia, so inoculation is essential for good production without urea fertilizer.

Since the project started, the legume inoculant facility has moved into its own building from the basement of the plant pathology building. Although the present facilities are inadequate to produce high quality inoculant, the production of satisfactory inoculant by means of ingenious use of locally available materials is to be commended. The rhizobial counts are from $10^6$ to $10^7$ per gram, while U.S. inoculants are $10^7$ to $10^8$ per gram and Australian inoculants exceed $10^9$ rhizobia per gram. The progress toward improved quality is significant and should be continued. The production of legume inoculant should be continued and expanded toward the project goal of 3,000,000 pounds per year. Current production is reported to be about 600,000 packets per year, which would provide inoculant for about 40 per cent of all legume oilseeds grown in the country. However, some of the inoculant is used (as it should be) on the 1.7 million acres of pulses. For example, chickpea is especially responsive to inoculation. A table showing legume inoculant production and use by crop should be included in future reports by the government of Burma.

A second legume inoculant production plant is planned at Maymyo because the present source of peat is at this location. While it is logical to have the production plant near the source of the peat, an assessment of the amount of peat available at Maymyo should be made. If 1,500 tons of raw peat are needed each year, how long will the deposit be able to supply the factories? (If 2 cubic yards are needed for a ton of dry peat, then about .7 acre to a depth of 3 feet would be needed each year.) If the peat from Heho valley is satisfactory, perhaps the inoculant produced at Yezin could use this source of peat. An assessment of available peat supply and quality could be made with the assistance of the BNF Resource Center in Bangkok. When the new plant is built, the same ingenuity should be used as was evidenced in the charcoal heated bag sealers at Yezin. These sealers are very effective and are not subject to breakdown due to electrical power outages. Similar considerations may make charcoal the fuel of choice for disinfesting the peat and sterilizing the rhizobia growth medium. Pressure type vessels would aid greatly in sterilization procedures.

The manager of the legume inoculant production facility is also to be commended for adopting quality assurance procedures, including a plant infection test. This test is essential because contamination of the rhizobia culture is an ever-present threat. The use of large amounts of inoculum in the fermentors helps to overwhelm the other organisms present. Current utilization of a non-specific test legume is useful, but a system of spot testing with the specific

host legume would increase confidence in the quality. From time to time, inoculant samples from the lab and from those distributed to the farm should be sent out for an independent evaluation and to ascertain how further improvements might be made. The Bangkok BNF Resource Center could provide such service.

AID/Burma is to be commended for making use of the NIFTAL personnel and training opportunities to help Yezin improve their inoculant production. Such assistance is very cost-effective, as short-term technical assistance (TA) is available to USAID for only transportation and per diem costs.

In summary, legume inoculant production should be continued, expanded and improved in quality. A second plant, at Maymyo, will be needed to reduce costs and to reach the target production of 3,000,000 packets of inoculant per year. Appropriate planning for proper storage and timely distribution has been initiated and will need to be implemented. ARI is to be commended highly for their innovative use of local materials and supplies in an effective way to produce useful legume inoculants at a current rate of 600,000 packets per year. The peat resources need to be assessed for both quantity and quality. The use of containers capable of handling pressures up to 100 lb./sq. inch and of being heated by charcoal fire would be useful in improving the quality of the inoculant.

g. Fertilizer Use:

It is clear that increased application of fertilizer is intended to play a central role in achieving production increases under MOPP. Table 4 provided data on the distribution of fertilizer in Project Townships: 23,103 tons of urea, 17,868 tons of TSP, and 2,454 tons MP.

The amounts of fertilizer applied to maize and oilseed crops are effective in increasing yields but are below the amount needed for optimum yields. Nitrogen fertilizer should not be needed for groundnuts and other legumes capable of nitrogen fixation, if properly nodulated. The project activity in legume inoculation provides assurance that legumes can fix nitrogen. Plant and soil scientists have established the principles involved, and the general range of nutrient requirements for crop production. For example, the USAID ADO estimates that a maize yield of 112 baskets (6160 pounds) per acre requires 334 pounds of urea to supply 150 pounds N; 109 pounds TSP to supply 50 pounds $P_2O_5$; and 250 pounds MP to supply 150 pounds $K_2O$. To achieve this yield, the soils must still provide additional amounts of these nutrients. It is unlikely that most Burma soils will contain enough of these elements to feed plants without added fertilizer at this high production level. A textbook source cited in the PP translates into a similar level of nitrogen application.

For groundnuts, the PP provides from a reference source the following requirements for 80 baskets (2,000 pounds): 165 pounds N (about 360 pounds urea if not supplied by nitrogen-fixing nodules), 38

pounds $P_2O_5$ (about 83 pounds TSP), and 91 pounds $K_2O$ (about 165 pounds MOP). All of these fertilizer estimates should be refined for Burmese soils by careful research.

Among the critical unknown data are the production limitations of other needed factors, and their interaction with fertilizer under specific Burmese conditions. The scarcity of production response data based on controlled field trials in Burma was discussed for maize in a preceding section. A similar situation exists for other crops; the MUCIA agronomist has been unable to locate statistically evaluated response data. The need for these data was discussed with agriculturists at the Agriculture Corporation. Response data based on replicated, properly designed field trials would be very useful to the Government of Burma for planning, but the evaluation team was unable to locate such data.

The only conclusion and recommendation can be to implement a program of controlled field trials at various field locations, and including at least maize, groundnuts, sesamum, and sunflowers. Testing with niger would also be desirable as it appears to be increasing in importance. This activity should have a high priority, in the view of the evaluation team. Burma is spending much scarce foreign exchange on fertilizer, both through imports and by expanding its own production capacity for urea. Agricultural strategies, including these financial and industrial aspects, deserve a stronger technical basis.

The MUCIA Team Leader reports he has initiated some field trials. We commend him and recommend that he continue his leadership and participation in this process, working alongside MOPP agriculturists, as well as to supply any needed technical guidance for scientists at ARI. Agriculture Corporation staff and MUCIA staff should work together to design and initiate field trials that will begin to generate needed data.

3. Project Inputs

A very rough, strictly quantitative measurement of project progress can be made by calculating the degree to which results correspond to targets set for input supply. Table VI of Appendix H provides such information, expressed in percentages. While the table tells only a small part of the inputs story, it nevertheless provides some useful data. One can see, for instance, that at the end of 1984, the third year of this five year project, AID has procured and delivered to Burma 88 percent of the fertilizers it is committed to supply, or that the Government of Burma has employed 81 percent of the local staff which it agreed to provide. One can also see that no Ph.D. candidates have been sent abroad for training although the targeted number is eleven, and that the provision of short-term specialists is far behind schedule. While care must be exercised in interpreting the table -- for project inputs are not programmed on a straight line -- the reader is encouraged to spend a few moments in studying the figures as a prelude to what follows.

a. Technical Assistance:

(1) MUCIA

MUCIA, the Technical Assistance contractor, was selected by AID and the Agriculture Corporation from among two Title XII consortia short-listed by the U.S. Board for Food and Agricultural Development (BIFAD). The project had earlier been designated as a Title XII activity and competition for the contract was limited to American universities and consortia. The contract calls for MUCIA to provide technical assistance, training and related services, including assistance in the procurement of equipment and materials. It was signed in February, 1982, four months after the Grant Agreement came into force. Texas A and M University (TAMU) is affiliated with MUCIA under the contract. Technical Assistance requirements of the Project Paper are in Appendix L.

The first long-term advisor provided by MUCIA, Dr. Donald Herr, arrived at post in December, 1982, eleven months after the contract signing, to serve as production agronomist and MUCIA chief of party. He departed for home in December, 1983, after a brief and somewhat controversial tenure. His replacement, Dr. Ervin Bullard, arrived the following month, January, 1984, and is currently on the job. Mr. George Otey arrived in Burma in January, 1983. He is the team's seed technologist and will be terminating his assignment to return home within a short time. The on-farm water management specialist, Mr. Ross Hagan, took up his duties in April, 1984, and is continuing at this time. Thus, the MUCIA team currently consists of two experts, Dr. Bullard and Mr. Hagan. As of this writing, no additional MUCIA long-term team members have been firmly scheduled for arrival. That situation may change after the Rangoon visit next month of the MUCIA Executive Director, Dr. William Flinn.

On the short-term consultancy side, thirteen specialists have worked on the project (see Appendix M). Of these, three have come through the MUCIA contract, ten having been arranged from other sources under AID-administered project funds or, at no cost to the project, from centrally-funded AID activities. Of the three arranged through MUCIA, only one is a faculty member at a MUCIA institution. (The comparable numbers for long-term experts are two from MUCIA faculties, two from outside -- Dr. Bullard and Mr. Hagan.) Four additional short-term consultants arrived in Burma during the evaluation team's visit: three U.S. farmers and one specialist in animal-drawn agricultural equipment. They will work at the four seed farms, helping to set up equipment and train local staff members in a variety of operational and maintenance techniques and procedures. This is an innovative approach to providing technical assistance and training, and the team encourages project leaders to monitor the effort carefully with a view to possible future applications. These consultants are provided through the MUCIA contract.

The evaluation team's consultations with Agriculture Corporation, USAID and MUCIA personnel have revealed a number of problems in the

technical assistance component of the project. First, MUCIA has apparently had difficulty in recruiting for and filling slots on its MOPP team, both long-term and short-term, from within its own institutional base. Given the size and stature of the universities concerned, this is unfortunate. It raises questions, as well, about the appropriateness of BIFAD's action in limiting competition and short-listing only two consortia. Part of the problems experienced may be related to the fact that some of the crops handled by the project typically are not grown in states of the MUCIA institutions.

Some MUCIA long-term advisors have apparently found Burma a difficult worksite and have (in two cases by indirect reports) experienced considerable difficulties and frustrations in getting set up to live and work under existing conditions. Trouble with import regulations and customs procedures, procurement of housing and furnishings, etc., and overly ambitious expectations of support by the Agriculture Corporation and USAID/Embassy, have caused considerable unhappiness. Dissatisfaction was also noted, however, with the level and timeliness of home office support and reporting feedback. Unfortunately, the team did not have the opportunity to discuss these matters with MUCIA home office representatives.

Having said the above, the evaluation team is of the opinion that the general situation with respect to the kinds of problems described above has ameliorated to an important degree. The team is particularly pleased to note the high proportion of work time that the water management specialist spends in the field -- almost fifty percent — and commends him for this. We note, too, that he has produced eight technical bulletins on various aspects of his subject matter. The Chief of Party has spent less time outside Rangoon, but has written a number of papers, including fertilizer response trials for testing with new crop varieties at the seed farms.

In general, the team finds that the technical assistance provided through the MUCIA contract has, with some exceptions, not been as effective and useful as it could, and should, be to a project of this sort. There has been too much time spent on status and procedural issues and not enough on substantive matters related to the accomplishment of objectives. The evaluation team is pleased, however, that increasing amounts of time and energy are being utilized on substantive project issues, and notes with appreciation a growing sense of confidence emerging between the parties concerned.

There appear to the team to be a number of steps which can, if taken, be important contributors to morale and relationships, thus strengthening the project's progress toward objectives. These will be addressed in Chapter IV, but note is made here of particularly cogent ones. Every reasonable effort should be made by USAID (and the Agriculture Corporation) to resolve problems associated with MUCIA team members' difficulties with customs regulations, housing, settling in to work, etc. At the same time, and for the same purpose, MUCIA should do a more comprehensive and thorough job of orienting or preparing and supporting its project team in Rangoon.

MUCIA should move to foster a wider understanding of Burma and the project among deans, department heads and other appropriate university officials, seeking support from key personnel in each institution in making available to the project a greater range of expertise than it now enjoys. The expert consultancy demands of the project are modest when compared to those of larger programs, and the evaluation team is distressed that the processes associated with fundings, recruiting, clearing and placing well-qualified and adaptable personnel loom so large. The short-term consultants brought in through other vehicles should, to the extent possible, be viewed not as replacements for unavailable MUCIA personnel but as supplemental resources for the project.

(2) USAID

USAID Mission personnel are not normally thought of as prime sources of project technical inputs. Their technical staff members are often weighed down with management and monitoring responsibilities to the extent they are unable to devote as much time as they would like to technical project matters. Burma is apparently an exception to this perception, at least in the case of its Agricultural Development Officer, who is the MOP Project officer. The team applauds the intense personal interest taken by Dr. Simkins in the scientific and technical aspects of the project and recognizes the values accruing to it from his very substantial, wide-ranging professional acumen. Our only concern is that his ability to cope with the heavy managerial dimensions of his position not be adversely affected by his extraordinary involvement in the substance of technical "consulting." We did not find any evidence that this is happening, possibly in part because of recognition of the problem and active support provided by the Program Officer and AID Representative.

b. Training:

(1) Long-term Overseas-

All the long-term overseas training is planned to achieve advanced academic degrees. Burma has an adequate undergraduate agricultural faculty and grants B.Sc. degrees at Yezin. A useful knowledge of English has been a limitation that is more acute among those under 40 years of age who were not instructed in English in their college courses. Recently, the age limit has been raised to 45 for long-term academic training.

The first group of students left for M.Sc. degree work in June 1983. Nearly two years of the five year project lapsed before long-term training began. As a result, the advanced degree training will not benefit this project, although some will return in time to participate in the follow-on project. This will contribute to research capability and institutional capacity in Burma when they complete their training. Of the 25 M.Sc. degree training opportunities planned in the project, 16 students, all from the Agriculture Corporation, are now studying appropriate subjects in the U.S.A. Course, names, and study location are given in Appendix N.

By January, 1985, no Ph.D. candidates have left the country, although five potential candidates have been identified by SRUB. Eleven Ph.D. training candidates were planned for the project.

Considering the need for well-trained agricultural scientists in the country to evaluate modern and traditional agricultural technology, to develop improved varieties and cultural methods, to utilize legume inoculants and fertilizers efficiently, to develop effective integrated pest control programs, to produce high quality improved seeds and legume inoculants, to distribute information and inputs effectively, to manage water more effectively, and to develop a productive agriculture that can be sustained for the forseeable future, the long-term training provided in this project is the minimum number that should be considered, and further training opportunities should be sought. Academic training of agricultural scientists is the foundation for the future of agriculture in Burma, although it will take many years to measure the full return. Education of agricultural scientists is the greatest gift that can be given to the next generation.

In short, less progress has been made in long-term training overseas than in any other project area. Forty percent of the total number of persons to be trained are now in training, i.e. about 60% of those planned at the M.Sc. level and 0% of those scheduled for Ph.D. study.

(2) Short-term Training Overseas

Forty-one persons have participated in short-term overseas training periods ranging from two weeks to six months in length. Subjects appropriately included project planning and implementation; tours of production areas for sunflowers, soybeans and groundnuts, sesame, maize, and cowpeas; rhizobium technology; micro-computer skills; and use of Azolla. Courses, dates, and participants are detailed in Appendix N.

Short-term training was initiated in May, 1982, and about 60% of the training planned has been completed. All these persons have returned to Burma by January, 1985, and nearly all are directly or indirectly involved in maize and oilseeds production. Quick action will be needed to utilize the 29 trainee programs available in 1985. Training in water management, seed processing and storage, and crop production are planned. Training in machinery maintenance and operation is more effectively achieved by bringing in technicians from U.S., Thailand or other countries to train several Burmese at once, and to demonstrate the procedures under Burmese conditions.

(3) In-country Training

In-country training is a continuous process and the total effect is difficult to document. The USAID agriculturists, Simkins and Weller, provide information and training each time they work with project personnel. They are to be commended for their regular,

frequent contacts with project personnel and visits to the outlying stations at least once each quarter. Consultants and other visitors add to the training activities. For example, an AID-sponsored Project Design and Evaluation Course was arranged for several MOPP and Agriculture Corporation staff, with some success. The consultants brought in specifically for this project are listed in Appendix M.

The MUCIA long-term advisors also provide a great deal of training. For example: Dr. Herr advised on production practices and crop variety trials. Dr. Bullard continued advice on production practices; designed and conducted variety and fertilizer trails at the four seed farms by working with the staff at each farm; prepared 4 bulletins on crop production; visited farms occasionally. Mr. Hagan works with the Burmese to design on-farm water structures, buildings, field layout; prepared 8 bulletins on soil and water management; is at farm sites about half the time. Mr. Otey prepared one bulletin on storage and seed processing.

At the MOPP office, senior Burmese staff spend at least half their time in training activities. For example, U Than Htay, Irrigation Specialist, works with young engineers; U Thaung Tin, Senior Extension
Specialist, works with young staff on extension and farm management. U Mya Maung, Project Director, lectures at the new Central Agricultural Development Training Center; and U Siang Uk, Deputy Project Director, instructs on data management and analysis, etc.

The USAID Project Manager has been adroit in using consultants that are relatively inexpensive, for example, using personnel from Mississippi State who were already in Thailand on another project; using centrally-funded project scientists who were located nearby or enroute through the area; and using Thai nationals. In many cases, the project only needed to provide travel from and to Bangkok, local travel and per diem.

In summary, the training activities under MOPP have been well planned with appropriate adaptations to meet needs. An example is the plan to bring U.S. farmers to Burma, to live at the seed farm and work with staff on use and maintenance of machinery, tillage, planting, harvesting methods, etc. The long-term training overseas is properly allocated to the achievement of higher degrees with a logical ratio between M.Sc. (25) and Ph.D. (11). Unfortunately, none of this training was initiated early enough to have the returned scientists participate in this project, but they will contribute to the agricultural science and technology capability of the country in the future, and could be important contributors to a follow-on project.

The short-term training has encompassed many facets of maize and oilseeds production, and 60 percent of the scheduled trainees have returned and are contributing to the success of the project. One example is the training in rhizobium inoculant production of U Hla Than at NIFTAL (nitrogen fixation project at U. Hawaii). After two months' training, he returned, reorganized his

production facilities, initiated quality assurance methods by measuring nodulation of test plants, and increased production of inoculant to 600,000 packets per year.

Often overlooked are the contributions to training by in-country personnel: the Burmese agriculturists, USAID staff, MUCIA contract staff, and consultants. In this project, the Burmese are providing the major part (probably over 80 percent) of the training, partly because they speak the language and communicate to many while the English speaking participants can usually communicate with only one or two persons (who understand English). One of the greatest strengths of this project is the enthusiastic participation of the Burmese. One gets the feeling that MOPP is <u>their</u> project (as it really is).

It would be difficult to overstate the contribution of the USAID Project Manager, who persists until work gets done, and is generally loved and respected by the Burmese. As the Managing Director of the Agriculture Corporation said in a meeting with the team, "He (Dr. Simkins) is one of us." We wish more USAID projects could attain such constructive relationships.

The MUCIA contract staff have been beset with problems, but the current staff are functioning well and are contributing to the training of the Burmese by personal contacts and by written guidelines. Special commendation goes to the water management specialist who works about half his time in the field, and who has also prepared 8 bulletins giving guidelines for better soil and water use and production practices.

The short-term consultants have been well-selected and generally have contributed very appreciably to the project. One exception was an electrical engineer provided by Stone and Webster Co., who was to provide specifications for electrical equipment but sent in a report with blanks unfilled. Since electrical services are supplied by the Burmese Electric Power Corporation, and they are constrained by availability and characteristics of locally produced equipment, the work was not hindered, but the training contribution was very little. On the other side, the PSA, Manring Corporation, has contributed considerably by his interest in the project, discussing needs and suggesting useful alternatives.

Overall, the in-country and short-term overseas training aspects of this production project are exceptionally useful.

c. Fertilizers:

The procurement of fertilizers by both parties has generally been on schedule per the Project Paper. Fertilizers have apparently been properly transported, stored and delivered when and where needed for project activities. To date, the Government of Burma has turned over for project use 18,583 tons (70 percent) of the estimated 26,700 metric tons of fertilizer it agreed to provide; this consists of 15,794 tons of urea and 2,789 tons of MP. AID's delivery in Burma has

reached 35,388 tons (88 percent) of its total commitment estimated at 40,000 metric tons. The AID contribution consists of approximately 25,388 tons of (TSP) and 10,000 tons of urea.

Both parties are to be congratulated on the high rate of success in this component to date. Long distances are involved and given the complexities of in-country logistics, this is a remarkable record. The team foresees no significant problems arising during the remainder of the project's life.

The role of fertilizer in MOPP strategy has been amply discussed, and Table 4 provided annual, crop by crop data on amounts of fertilizer provided. The procurement system described on pages 44-45 of the PP is reported still in effect in every essential aspect. Page 45A of the PP provides a flow chart. Essentially, the Agriculture Corporation plays the dominant commercial and managerial role. First, the requirements are compiled through an information flow from the village to national level, through the People's Council system. The Ministry of Agriculture and Forests and Ministry of Planning and Finance occupy the key policy roles. Once actions are decided, perhaps in March, they are implemented by the Agriculture Corporation.

The Agriculture Corporation procures urea from factories in Burma and additional fertilizer through imports. A "Movement Control Committee" assists in developing distribution plans. The Agriculture Corporation contracts with the Transport Corporation for internal movements to Agriculture Corporation warehouses. Final distribution to farmers is by the Village Tract units of the Agriculture Corporation, or in some cases the Village Cooperatives.

The PP cited storage as a potential bottleneck. Substantial actions have been taken to build additional warehouses, as was indicated by the PP. The exact number and capacity were not obtained. One action example is construction of four seed warehouses on seed farms alone, and additional new warehouses were observed. A German aid project has provided some assistance.

While the PP refers to Agriculture Corporation payment of customs duties, records and understanding of staff indicate that only sales taxes have been involved and paid.

The actual uses of MOPP fertilizer according to project plans and program decisions is a constant concern. The PP cites "controls inherent in the Burmese system" as the central basis for the needed confidence. It also refers to oversight by Village People's Councils as the best control. Discussion with Agriculture Corporation staff indicates these assurances remain in effect. Queries made to farmers, local officials and other informed people encountered during the team's field trips consistently elicited responses to the effect that fertilizers were indeed being delivered correctly according to requirements. The evaluation team understands an AID audit of fertilizer distribution and use is underway, and recognizes that AID will rely on its conclusions.

d. Equipment and Materials:

In our visit to the seed farms, farm machinery and the necessary equipment for agricultural operations was already operating. According to the initial list included in the PP, Annex B, pages 139-147, most of the items listed have recently arrived.

The tractors were protected with sheds. The implements, plows, discs, seeding machines, etc., in some of the farms, were outdoors. For the ongoing operations the equipment seems to perform well. The equipment that was not working was outdoors, unprotected and rusty.

Although time was not available to check the equipment piece by piece, it was the general feeling of the evaluation team that the equipment was neglected. Machine shops inside the seed farm compounds were not available, although tools and machine shop crates were in the warehouses.

From these observations some conclusions are valid:

Servicing and maintenance of tractors and farm implements should have top priority in farm management;

Machine shops should have been installed as quick as the tools have arrived at the seed farms. Having tractors and farm machinery running efficiently is a function of the service and maintenance they receive;

The personnel dealing with tractors and farm machinery should be trained in such a way, that before going in to the fields to perform agricultural operations in which tractors and their implements are used, a thorough check up must be done as a routine operation. A check list of essential points that should be inspected before starting an engine is considered an important part of the training of personnel;

Tractor drivers as well as mechanics must receive an intensive course in how to care for and operate the tractors and equipment that they are supposed to be operating in the seed farms. After the tractor and implements come back from the field they should be carefully checked and cleaned from dust and debris, before they are kept in the warehouse or in the sheds; and

The management of the farms should assign a mechanic to keep a list of the spare parts that are considered essential, and that can be worn out frequently. These spare parts should be in storage and periodically re-supplied.

To prolong the life of farm machinery is probably one of the most important activities in farm management. The longer the life of a farm machinery unit the lower become the costs of operating it. Therefore, the lower will be the production cost of the crop.

The total disbursements by AID related to farm machinery already distributed in the seed farms up until January 1985 is as follows:

1. CHAUNGMAGYI, foundation seed farm:

Including tractors, trucks, generator, spare parts, tools, pesticide and soils kits, pumps and other materials.....$ 186,301.43

2. SEBIN, foundation seed farm:

Similar items as above.....$ 480,369.88

3. KYAUNGSU, certified seed farm:

Similar items as above.....$ 165,374.76

4. THITCHO, certified seed farm:

Similar items as above.....$ 209,341.45

TOTAL $1,041,387.50

Some additional equipment has been received in the Rangoon warehouse but has not yet been distributed to the seed farms. This equipment and materials include:

Office supplies, spare parts and accessories, sunflower seeds (20MT), seed plant equipment, groundnut cleaner and elevator for a total of.....$ 979,2[illegible].00

Therefore, the total amount disbursed for equipment received for the seed farms is.....$2,020,617.50

The total amount allocated in the PP for seed equipment was.....$2,548,960.00
with 15% spare parts or.....$ 382,344.00
gives a grant total of:.....$2,931,304.00

Therefore, as an approximate measurement, progress in delivery of the equipment and materials to the seed farms is 68.93%.

The Burmese government has supplied several units of tractors and farm machinery which have been in use in the seed farms to help land preparation operations (see Appendix O). Also office materials as well as furniture to accomodate the personnel in some of the buildings were supplied by the Burmese government.

e. Buildings and Facilities:

In our visit to the seed farms, we observed that most of the buildings as well as facilities planned in the project were built. A brief description for every seed farm will help to realize the great effort expended in accomplishing so much in spite of the existing constraints.

(1) CHAUNGMAGYI, foundation seed farm (Mandalay Division, Township of Pyawbwe).

The following buildings have been completed:

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Farm Managers Office | 60 | 20 | 12 |
| Training Hall | 100 | 30 | 12 |
| Farm Manager's Residence | 50 | 24 | 12 |
| 2 Unit Quarters (4 Build) | 50 | 24 | 12 |
| 4 Unit Quarters (3 Build) | 80 | 24 | 12 |
| Fertilizer Warehouse | 60 | 20 | 12 |
| Pesticide storage | 60 | 20 | 12 |
| Workshop | 40 | 24 | 12 |
| Generator Housing | 24 | 20 | 12 |
| Diesel Ground Tank | 24 | 20 | 12 |
| Water Ground Tank | 40 | 20 | 8 |
| Groundnut and Maize Processing Plant | 100 | 50 | 20 |

The following buildings and facilities will be completed in 1985-86.

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Dining Hall | 60 | 24 | 12 |
| Barrack | 80 | 24 | 12 |
| Farm Officer's Residence (2 units) | 50 | 20 | 12 |
| 2 Unit Quarters (3 Units) | 50 | 24 | 12 |
| 4 Unit Quarters (3 Units) | 80 | 24 | 12 |
| Seed Store House | 150 | 50 | 14 |
| Tractor Shed | 50 | 30 | 14 |
| Machine Shop Store | 60 | 30 | 12 |
| Implement Storage | 60 | 30 | 12 |
| Cold Storage | 80 | 40 | 14 |
| Warehouse | 60 | 30 | 14 |

In addition, a 1.72 miles long canal was built with 0.5 miles already lined. A farm road 2.63 miles long is planned and one mile has been constructed. Of the structures of brick and concrete for canals, from 61 planned, only 5 could be finished because of cement shortages. The fencing with barbed wire has been completed. The water source for irrigation is the Chaungmagyi dam, approximately 7 miles away. Potable water is available and the electrical power is provided by a 130 kw diesel generator provided by USAID.

(2) SEBIN, foundation seed farm (Mandalay Division, Yemethin Township)

The following buildings have been completed:

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Farm Manager's Office | 60 | 20 | 12 |
| 2 Unit Quarters (4 Units) | 50 | 24 | 12 |
| Seed Storehouse | 150 | 50 | 14 |
| Pesticide Storehouse | 60 | 20 | 12 |
| Workshop | 40 | 24 | 12 |
| Tractor shed | 50 | 30 | 14 |
| Machine shop | 60 | 30 | 12 |
| Implement storage | 60 | 30 | 12 |
| Generator housing | 24 | 20 | 12 |
| Diesel Ground Tank | 24 | 20 | 8 |
| Water Ground Tank | 40 | 20 | 8 |

Buildings and facilities that will be completed in 1985-86:

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Training Hall | 100 | 30 | 12 |
| Dining Hall | 60 | 24 | 12 |
| Barrack | 80 | 24 | 12 |
| Farm Manager's Residence | 50 | 24 | 12 |
| Farm Officer's Residence (2 Units) | 50 | 20 | 12 |
| 2 Unit Quarters (3 Units) | 50 | 24 | 12 |
| 4 Unit Quarters (3 Units) | 80 | 24 | 12 |
| Sesame and Sunflower Processing Plant | 100 | 50 | 20 |
| Cold Storage | 80 | 40 | 14 |
| Warehouses | 60 | 30 | 14 |

A 3.04 mile canal is being built and 0.5 miles have already been lined. A farm road of 3 miles, of which 2 miles have already been constructed, is planned. Of 101 planned structures of brick and concrete for canals, only 10 have been completed. The fencing of barbed wire is 70% completed. The water source for irrigation is the Thitsone dam, approximately 7 miles away. Potable water is available and the electrical power is provided by a 130 KW diesel generator provided by USAID.

(3) KYAUNGSU certified seed farm (Pegu Division, Kyauktaga Division)

The following buildings have been completed:

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Farm Manager's Office | 60 | 20 | 12 |
| Training Hall | 100 | 30 | 12 |
| 2 Unit Quarters (4 Units) | 50 | 24 | 12 |
| Seed Storehouse | 150 | 50 | 14 |
| Fertilizer storage | 60 | 20 | 12 |
| Pesticide storage | 60 | 20 | 12 |
| Water ground tank | 40 | 20 | 8 |

Buildings and facilities that will be completed by 1985-86:

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Dining Hall | 60 | 24 | 12 |
| Barrack | 80 | 24 | 12 |
| Farm Manager's Residence | 50 | 24 | 12 |
| Farm Officer's Residence (3 Units) | 50 | 24 | 12 |
| 2 Unit Quarters (5 Units) | 50 | 24 | 12 |
| 4 Unit Quarters (4 Units) | 80 | 24 | 12 |
| Workshop | 40 | 24 | 12 |
| Tractor shed | 50 | 30 | 14 |
| Machine shop | 60 | 30 | 12 |
| Implement's storage | 60 | 30 | 12 |
| Generators housing | 24 | 20 | 12 |
| Diesel ground tank | 24 | 20 | 8 |
| Groundnut and maize processing plant (2 Units) | 100 | 50 | 20 |
| Cold Storage | 80 | 40 | 14 |
| Warehouse | 60 | 30 | 14 |

The surveying of the farm has not yet been completed. Canals, farm roads, and irrigation structures are still on the drawing board. There is no surface water for irrigation, although it is expected that ground water would be available and tubewells would be built. The average annual rainfall is 120 inches. Drainage will be necessary. Potable water is available and electrical power is produced by a 130 KW diesel generator provided by USAID. Fencing with barbed wire is only 50% completed.

(4) THITCHO, certified seed farm (Pegu Division, Nattalin Township)

The following buildings have been completed:

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Farm Manager's Office | 60 | 20 | 12 |
| Farm Manager's Residence | 50 | 24 | 12 |
| 2 Quarter Unit (4 Units) | 50 | 24 | 12 |
| Seed Storehouse | 150 | 50 | 14 |
| Fertilizer store | 60 | 20 | 12 |
| Pesticide store | 60 | 20 | 12 |
| Generator housing | 24 | 20 | 12 |

Buildings to be completed by 1985-86:

| | Dimensions (feet) | | |
|---|---|---|---|
| | L | W | H |
| Training Hall | 100 | 30 | 12 |
| Dining Hall | 60 | 24 | 12 |
| Barrack | 80 | 24 | 12 |
| Farm Officer's Residence (3 Units) | 50 | 20 | 12 |
| 2 Unit Quarters (10 Units) | 50 | 24 | 12 |
| 4 Unit Quarters (9 Units) | 80 | 24 | 12 |
| Workshop | 40 | 24 | 12 |
| Tractor shed | 50 | 30 | 14 |
| Machine shop | 60 | 30 | 12 |
| Implement's storage | 60 | 30 | 12 |
| Diesel Ground Tank | 24 | 20 | 8 |
| Water Ground Tank | 40 | 20 | 8 |
| Ground and maize processing plant (4 Unit) | 100 | 50 | 20 |
| Cold Storage | 80 | 40 | 14 |
| Warehouse | 60 | 30 | 14 |

Water for irrigation should come when the Monywa dam will be completed. In the meantime, tubewells should be built. A preliminary hydrogeological survey should be done before drilling. Potable water is available from a well. The annual average rainfall is 60 inches. Electrical power is available through a 130 KW diesel generator provided by USAID. Fencing with barbed wire is only 20% completed. Farm roads and canals have to be constructed. There is a 9 mile feeder road to Nattalin, in a very poor state. Recently, the rebuilding has been started and almost half a mile has been completed. Construction of structures and drainage still are not started.

f. Personnel:

The Grant Agreement stipulates that the Grantee shall, inter alia, provide sufficient well-qualified personnel to carry out the project "effectively and in a timely manner." The team is informed that a total of 618 staff positions of all kinds are listed as directly associated with MOPP on the roles of the Agriculture

Corporation and associated organizations, and that as of January 6, 1985, 499 (81 percent) of the positions were filled. The numbers do not include daily wage laborers hired at peak agricultural demand periods such as harvest.

Enquiries revealed that many of these positions are temporary in nature, particularly at the lower range of professional and non-professional classifications. These occupants leave for more permanent jobs as their training is valuable in other positions, resulting in considerable turnover and a greater load of training on the supervisors. This turnover results in benefits to Burma, but places an extra load on MOPP. Unless the occupants are absorbed as permanent positions become available, or are rehired for other work, they will leave the Agriculture Corporation at the time of the project's termination.

The MOPP roster includes some B.Sc. degree holders and some individuals with Certificates (two-year course) in agriculture and related fields. The team met many of these people during the course of the evaluation, both in Rangoon and on the field trips. We were pleased to note that many employees of the Corporation are female, even in the professional ranks.

g. Budget Expenditures:

Estimates of actual costs of AID activities under MOPP provide a summary of inputs that may be weighed against the project plan, and against progress to date toward goals. Low costs may reflect either economies or delays and cutbacks in project execution, etc. Concerning progress toward goals, less should be expected if less is spent; more if nearly all the planned funding is gone, etc.

The following tabulation summarizes AID sub-obligations through December 31, 1984:

| ITEM | AMOUNT |
|---|---|
| MUCIA | |
| TA less participants through 6/30/84 | $ 810,034.87 |
| Estimate of TA 7/1/84-12/31/84 | 310,000.00 |
| Participants through 6/30/84 | 161,023.36 |
| Estimate, LT participants 7/1-12/31/84 | 160,000.00 |
| Estimate, ST participants 7/1-12/31/84 | 251,000.00 |
| Participants outside MUCIA | 336,006.00 |
| Manring Corp. | 152,327.00 |
| Stone and Webster | 17,474.00 |
| Fertilizer | 9,944,077.24 |
| Seeds | 62,137.34 |
| Equipment | 4,858,173.75 |
| "Burma" equipment | 23,034.20 |
| TOTAL | $ 17,085,287.76 |

These amounts include actual billings seen by AID/Burma, amounts of PIO/C's as adjusted to date, and estimates of MUCIA costs for TA and participants. The total and most items are considered amply close to probable costs for evaluation purposes.

AID/Burma received a Project Financial Implementation Report (PFIR) during the progress of the evaluation. The total expenditures in that report were $14,149,916. The data from that report can be roughly reconciled with the preceding tabulation as follows. Equipment in the "AID sub-obligations" is nearly $2.7 million higher, representing large amounts of equipment PIO/C's outstanding (and shown as commitments in the PFIR), and seed orders of $38,500 that are not yet reported as expenditures. Technical assistance and training items differ by reasonable amounts representing primarily the excess of projections of accrued training costs over the expenditures on the PFIR (a PIO/P has been issued to cover such expenses of MUCIA, as accrued).

The MOPP office at the Agriculture Corporation provided data on Government of Burma expenditures through December 1984, as follows:

| Item | Amount in Thousands | |
|---|---|---|
| | Kyat | $ US |
| Fertilizer cost | - | 3,474.92 |
| Fertilizer movement | 9,272.59 | 1,287.86 |
| Construction | 16,854.22 | 2,340.86 |
| Equipment and movement | 11,130.29 | 1,545.87 |
| Office equipment and vehicles | 5,150.24 | 715.31 |
| Staff pay and other project costs | 12,997.74 | 1,805.24 |
| Total | K55,405.08 | $11,170.06 |

Kyat costs are converted to dollars at the rate of $US = K7.2 in this tabulation. The Government of Burma contribution to MOPP is seen to be very large, about $11.2 million. Several of these contributions were quite visible to the evaluation team: the buildings, farm equipment, vehicles, and staff assigned to the project. The fertilizer use is both amply documented and shows its probable result in increased crop output. One item commonly credited as a government contribution, land, does not show as an item or estimate in these data. Rather large areas have been set aside and improved as seed farms.

# CHAPTER IV

## FINDINGS AND CONCLUSIONS

This chapter summarizes the detailed findings and suggestions from the evaluation with respect to the outputs and inputs discussed in Chapter III. It lays out the evaluation team's major findings regarding the project operation. It discusses the central conclusions reached by the team. Major recommendations concerning ways and means to improve performance and facilitate the accomplishment of project objectives are listed. A brief section summarizing lessons learned through the evaluation brings the chapter to its end.

### A. SUMMARY OF OUTPUT FINDINGS

The evaluation team finds that the project is moving forward effectively and is making good progress toward meeting its intended purpose through the accomplishment of its objectives. Although achievements to date vary considerably over the range of project activities, with some components well ahead of schedule and others far behind, there is no question that the overall results will be such as to earn for the project a highly successful rating. This statement assumes that the future will see a continuation of the hard work evident in the past. The team sees no reason to believe things will slow down in the remaining 20 months.

#### 1. Crop Production Outputs

Project activities are leading to significant crop production increases in the areas covered. Progress to date in working toward the quantitative targets set for the project has been achieved primarily through yield increases, secondarily through expansion of cropped area. With a full 20 months remaining, 51.2 percent of the production target for maize has been achieved. Corresponding figures for the oilseeds crops are 73.6 percent for groundnuts, 82.6 percent for sesame, and 50.9 percent for sunflower. As project momentum is increasing with the coming on line of significant planned activities, the team believes that these targets, except for maize, will likely be met or even surpassed. We think maize production may come close to meeting the target.

The increased production of oilseeds has provided an estimated 35,101 to 41,139 M.T. of vegetable oil, using team estimates of oil content and extraction yield with the equipment and extraction practices currently in use. This amount represents 30.6 to 35.8 percent of the MOPP targets, lower percentages than for oilseeds output since the team uses lower estimates of oil content and extraction yield than implied in the project design.

Direct contribution to farm income is estimated at about 672 million Kyat or $US 82 million. Other benefits are realized in the farm communities and elsewhere through employment, improved nutrition, etc.

2. Institutional Development Outputs

The team finds generally good progress being made on the several goals established in the project documents, except for the Ph.D. element of the participant training program, where candidates have been identified far too late to benefit MOPP directly. In short, we have seen evidence that:

- Research capability is increasing, and applied research being conducted, while still weak on technical and organizational grounds, is moving forward at an accelerating pace. A planned program needs to be developed for research to be done.

- Technology and production practices are being applied more systematically and over a wider area than when MOPP began and there is improvement in their quality. The Township program is an excellent vehicle that is being implemented effectively through the Agriculture Corporation. The use of high technology sites demonstrates to the farmer and to the government that the improved inputs and practices produce increased crop production with a value several times greater than the cost of the inputs. The input amounts are generally too low to achieve optimum economic yields, but the low rates do bring about a greater return per unit of input. The use of intensive township and extensive townships spreads the limited amount of inputs over a wider area, but make the measurement of the effect more difficult. No change in the system is suggested for this project (MOPP), but future projects should consider: (1) whether the use of extensive townships should be continued and (2) the use of smaller (2 acres?) and more numerous high technology sites. A challenge for the future is for the Burmese government to devise ways to provide the necessary inputs to maintain the improved practices after the project (MOPP and the follow-on) have terminated.

- Seed production has been initiated by the establishment of four seed farms (two for foundation seed and two for certified seed). Seeds supplied from the seed farms in 1983-84 provided the following percent of the project seed needs: maize (73 percent), groundnuts (2 percent), sesame (2 percent) and sunflower (2 percent). Continuation of progress should lead to four fully functioning seed farms by the end of the project. Operations are hindered by delays in construction of buildings, farm roads and canals. Fifty-one (37%) of the 138 buildings planned have been completed with the greatest progress on the foundation seed farms. Electrical power is supplied by diesel generators until the connections to utility power lines are made in the near future.

Land clearing, leveling and preparation have progressed with about half of the acreage available for cropping because equipment did not arrive until recently. USAID has provided about $2 million worth of equipment with most of the remaining $900,000 worth on order. The Government of Burma has also made some tractors and machinery available.

Water supplies have been developed for household use, but the quantities needed for irrigation have not been found. Drainage and irrigation canals have been delayed.

- A farm management information system is evolving. Large quantities of data are being recorded and collected but much more analytical work needs to be done and the results communicated widely.

- Participant trainees include short-term training, averaging about four months, and long-term training leading to an academic degree of M.Sc or Ph.D. Forty one of the 70 planned short term trainees have returned to the project. Sixteen candidates of the 25 planned for the M.Sc are in the U.S. No candidates for the Ph.D. have left Burma, although 5 have been identified; 11 were planned.

- A rhizobium inoculant production facility is operational and producing 600,000 inoculant packages per year for distribution. The basis for expanded good quality production has been established.

- Fertilizer use has increased significantly in the 12 intensive townships and to a lesser extent in the 16 extensive, and is a major cause of the increased crop production noted above (also see Appendix H). Farmers are instructed on the proper application of the fertilizer. Typical fertilizer rates in the 12 intensive townships in MOPP were:

| | Maize lb/A | TSP lb/A | MP lb/A |
|---|---|---|---|
| Maize | 112 | 56 | 28 |
| Groundnuts | 28 | 56 | 0 |
| Sesame | 84 | 56 | 0 |
| Sunflower | 84 | 56 | 0 |

Typical fertilizer rates in the 16 extensive townships in MOPP were:

| | Urea lb/A | TSP lb/A |
|---|---|---|
| Maize | 84 | 28 |
| Groundnuts | 14 | 56 |
| Sesame | 56 | 28 |
| Sunflower | 56 | 56 |

Thus, while many crucial steps remain to be taken before the PACD, the team finds reason to be optimistic that laudable achievements will occur in most if not all of these specially targetted areas. The reader is referred to Chapter III, Section B.2. for justification of these capsule findings.

## B. SUMMARY OF INPUT FINDINGS

The evaluation team finds the planned inputs to the project to be appropriate for the accomplishment of its objective, and their programming (scheduling) to be well thought out in the Project Paper. Unforeseen difficulties in carrying out the planned schedule have generally been maturely handled by project officials and, where possible, appropriate adjustments have been made. (These difficulties are described in the itemized discussion provided below and in the later section on constraints.)

### 1. Technical Assistance

The team finds that the level of technical assistance is below what it ought to be in terms of numbers of consultants/advisors and in terms of frequency of visits, but notes that considerable improvement has occurred over the last year. Some of the long-term advisors provided through the MUCIA contract have not been well-suited to their assignments in Burma. Almost all of the short-term consultants have done creditable jobs, and a very positive TA contribution has been made by the USAID Project Manager. Given the several difficulties encountered in this component, the team is surprised and pleased that progress has nevertheless been made. Continuing close attention to contract administration, to locating, recruiting and assigning appropriate contract personnel - and solving the real problems they face in Rangoon - is essential to improvement in the overall picture.

The above points notwithstanding, the team finds that, while problematical in parts, the TA component has made a reasonably good contribution to the project. That contribution should, however, be excellent.

### 2. Training

The team finds a highly-commendable attitude toward the importance of training among the project leadership (of all parties) and notes that a vigorous in-country training program is going on, with many beneficiaries, including farmers. The short-term overseas training aspect is proceeding in a generally satisfactory manner, though it is somewhat behind schedule. The long-term aspect is seriously behind the plan's requirements, and the time remaining in the project insufficient to allow full accomplishment. While the in-country and short-term overseas training programs are definitely having a favorable impact on the efficiency and effectiveness of MOPP activities and on crop production, the institutional and public benefits of long-term overseas training must await the return of trainees.

3. Fertilizers

Fertilizer procurement and distribution have proceeded generally in accordance with original plans, and the team found no evidence of significant problems encountered in these lengthy and logistically complex operations. There have been adequate amounts of fertilizers available to meet stipulated needs in the project townships, and delivery to project sites has generally been planned and implemented on a timely trouble-free basis, with monitoring throughout the distribution system. The Government of Burma has provided MOPP with 15,794 tons of urea and 2,789 tons of MP (70% of the target). USAID has provided MOPP with about 10,000 tons of urea and 25,000 tons of TSP (88% of total commitment).

4. Equipment and Materials

Equipment and materials scheduled for procurement by USAID have to a very large extent either been delivered or ordered. Residual funds in the account are sufficient for additive purchases, if necessary. A sizeable proportion of USAID-provided equipment is not yet in use because facilities, power and other pre-requisites are still being prepared or arranged. The Agriculture Corporation has supplied much equipment, such as tractors and implements, not specifically required by the Grant Agreement. The team finds the procurement schedule to be well planned, and excellently executed by the PSA, Manring Corporation. We are concerned, however, that installation, assembly and usage training be done thoroughly and be accompanied by adequate maintenance training and facilities, including proper tools and storage.

5. Buildings and Facilities

The team finds that after some costly early delays, the schedule for acquisition of lands and construction of necessary buildings and facilities has been well-maintained. The bulk of these inputs relate to the four seed farms, and are crucial to their operations. Most of the planned activity has been accomplished, with the remainder of construction scheduled and budgeted for the next fiscal year. Remarkable progress has been made in clearing and leveling land at the seed farms, but much additional work remains to be done before seed production and processing can be efficiently accomplished. The team anticipates that planned building and facilities will be adequately completed and serviceable by the PACD.

6. Personnel

The team is very favorably impressed by the actual numbers of Agriculture Corporation's personnel assigned to MOPP functions. The quality of leadership is excellent; five hundred employees are assigned to positions in the project, and generally high levels of enthusiasm and understanding among personnel about the project and its purpose were noted. Many of these employees are in temporary as opposed to permanent positions, but the team is not unduly concerned that some move out to other positions as the expertise remains in Burma. Our expectation is that many employees eventually will be absorbed in other Agriculture Corporation projects, including the expected follow-on project to MOPP.

7. Budget Expenditures

Budgets prepared by the Agriculture Corporation and USAID, for the life of the project and for each fiscal year to date, are found by the evaluation team to be generally consistent with project needs. Expenditures for project inputs and activities appear to be keeping pace with planned schedules. Delays experienced in certain elements of the project are related not nearly so much to financing as to materials availability, as in the case of building construction where shortages of cement, diesel fuel, etc., have slowed progress. The team finds that MOPP has an excellent reputation in Burmese agricultural development planning circles and is consequently accorded priority in the allocation of resources by the government.

C. CONSTRAINTS

Many general constraints affect the progress of MOPP, just as they do the progress of other agricultural development programs and projects of the government. Many of these constraints also have a profound negative influence on agricultural productivity and production generally in Burma. Among the more obvious general constraints to agricultural growth are serious shortages of fertilizers, cement and construction materials, the lack of adequate budgetary resources and shortages of foreign exchange to purchase needed development materials otherwise unavailable in the country, a price structure far below international market rates, the lack of adequate irrigation systems, and the lack of an adequate transport system. MOPP, like every agricultural project in Burma, must operate within the context of these constraints and do its part in contributing to their alleviation and/or removal. On a project level, MOPP has done exceptionally well in being dynamic and effective in carrying out its assigned roles in maize and oilseeds production. Indeed, the team is concerned that its success in increasing production may place additional stress on the nation's antiquated and inefficient infrastructure for processing and storing the edible oils extracted from them. (Hopefully, the EOPD project will help ease this potential situation, but it can offer only a start on what must be a long road.)

There are, in the team's opinion, a number of constraints beyond the general kind referenced above. They are internal to the project and need to be dealt with on a priority footing in order to maximize the project's impact. Typical of these "lesser" but still very important constraints are two examples taken from team observations at the seed farms: (1) lack of adequate land leveling and land preparation to permit optimum production of high quality foundation and certified seed; (2) lack of adequate maintenance to insure longer life and greater utility of farm equipment. The project should be able to correct these deficiencies. While it will take time and a great deal of training and hard work, such constraints can probably be removed or, at least, their negative effects on project productivity reduced considerably.

A number of the specific recommendations made by the team in Chapter III are addressed to overcoming constraints such as those in the two examples used to illustrate the point. It should be noted, however, that such constraints do not often exist in vacuums. Frequently they are parts of a chain of factors affecting project progress. Efforts to deal with them usually require coordinated actions over time.

## D. MAJOR RECOMMENDATIONS

The text of Chapter III contains the many recommendations and suggestions being offered by the evaluation team. While these vary considerably in substance and in scope, the team believes they are all important, and worthy of consideration by the project's management team and other concerned parties. Some of the recommendations deal with issues of importance to the successful accomplishment of project objectives. These we have taken from the text for special mention here. They are:

- Continue crop production and general project activities as planned, with the same dedication and competence as already expressed.

- Plan a program of applied research for the remaining project life, drafted initially by MUCIA advisors and their Burmese professional colleagues, after full consideration of previous data and ongoing research in Burma. Applied research can be mainly at seed farms. Components may include variety testing, fertilizer trials to determine optimum rates, integrated pest control methods, water management, and soil management. Determine efficient irrigation methods and water needs.

- Continue urgently the development of the seed farms. Improve land leveling and preparation. Continue actions to develop irrigation and drainage systems for major parts of seed farms.

- Conduct tests of oil content as an integral part of all variety testing of oilseeds.

- Establish systematic maintenance and continuous training programs for all MOPP equipment: agricultural, irrigation, seed processing, vehicles, etc.

- Continue development of facilities and programs to produce and distribute rhizobium inoculant for legumes, with attention to quality as well as quantity.

- Demand that MUCIA thoroughly orient, prepare and support contract personnel, and that a greater effort be made to provide appropriate expertise. Continue support of contract staff, as far as possible, by AID/Burma and the Agriculture Corporation.

- Continue efforts by AID and Agriculture Corporation to provide for duty-free entry of project commodities and related goods, and to expedite customs clearances.

- Select and process personnel for appropriate short-term training as soon as possible, so their training can be useful during the remaining project life.

- Develop an operationally useful farm management information system based on the foundation of existing data. Use information for project monitoring and evaluation of the intensive-extensive township model. Strengthen internal project monitoring and evaluation through greater analysis of existing and additional data.

- The final project evaluation should be a joint Government of Burma-USAID activity and include a careful assessment of impact on maize and oilseeds producers, and include an assessment of the social and economic impacts on the non-farmers in the community.

## E. CONCLUSIONS

As is the case with the team's recommendations, many of its conclusions show up, explicitly or implicitly, in the discussion of Chapter III. There are a number of general conclusions which are articulated here. For the most part, they build on the more specific conclusions found at many points in this report, and serve essentially to consolidate and present the team's overall assessment of the project, its progress and importance.

First of all, the team concludes that the Maize and Oilseeds Production Project is properly given the priority accorded it by the Ministry of Agriculture and Forests, as well as by the U.S. Embassy and AID/Burma. It is an important project in terms both of its substance and direction. The team is confident that the project will have a strong impact on the problems it was intended to address, and is moving well in the direction of its several objectives.

Second, the team concludes that the problems it has identified and discussed in this report are not intractable and are amenable to solution, given the strengths we have observed during this evaluation and the cooperation of all concerned.

Third, we conclude that to an exceptional degree MOPP is considered a Burmese project, with AID/Burma supplying inputs needed to supplement those available in Burma. It is refreshing to note that the Agriculture Corporation fully accepts responsibility for the proper conduct and completion of the project.

Fourth, we conclude that the overall progress of the project is excellent and that, barring unforeseen obstacles, it is likely to accomplish most of its crop production objectives and many of its institutional development tasks.

Fifth, the design of the project is essentially sound and capable of being implemented effectively in the Burmese context. There are in the design no basic flaws which have seriously obstructed implementation. The Project Paper and, of equal importance, the Grant Agreement both carefully articulate purpose, goals and objectives and unambiguously outline the procedures to be followed in implementing the design.

Sixth, the BIFAD/Asia Bureau decisions to limit competition to Title XII institutions, and short-list only two consortia, were unfortunate and resulted in difficulties in obtaining qualified people who could adapt to working conditions in Burma.

Finally, we conclude that the project provides a sound basis for the design of a needed follow-on activity focussed on oilseeds production but with consideration given also to the cropping systems of which they are parts, and with close links to the two other Burmese oilseeds-focussed projects proposed for AID/Burma support and assistance.

## F. LESSONS LEARNED

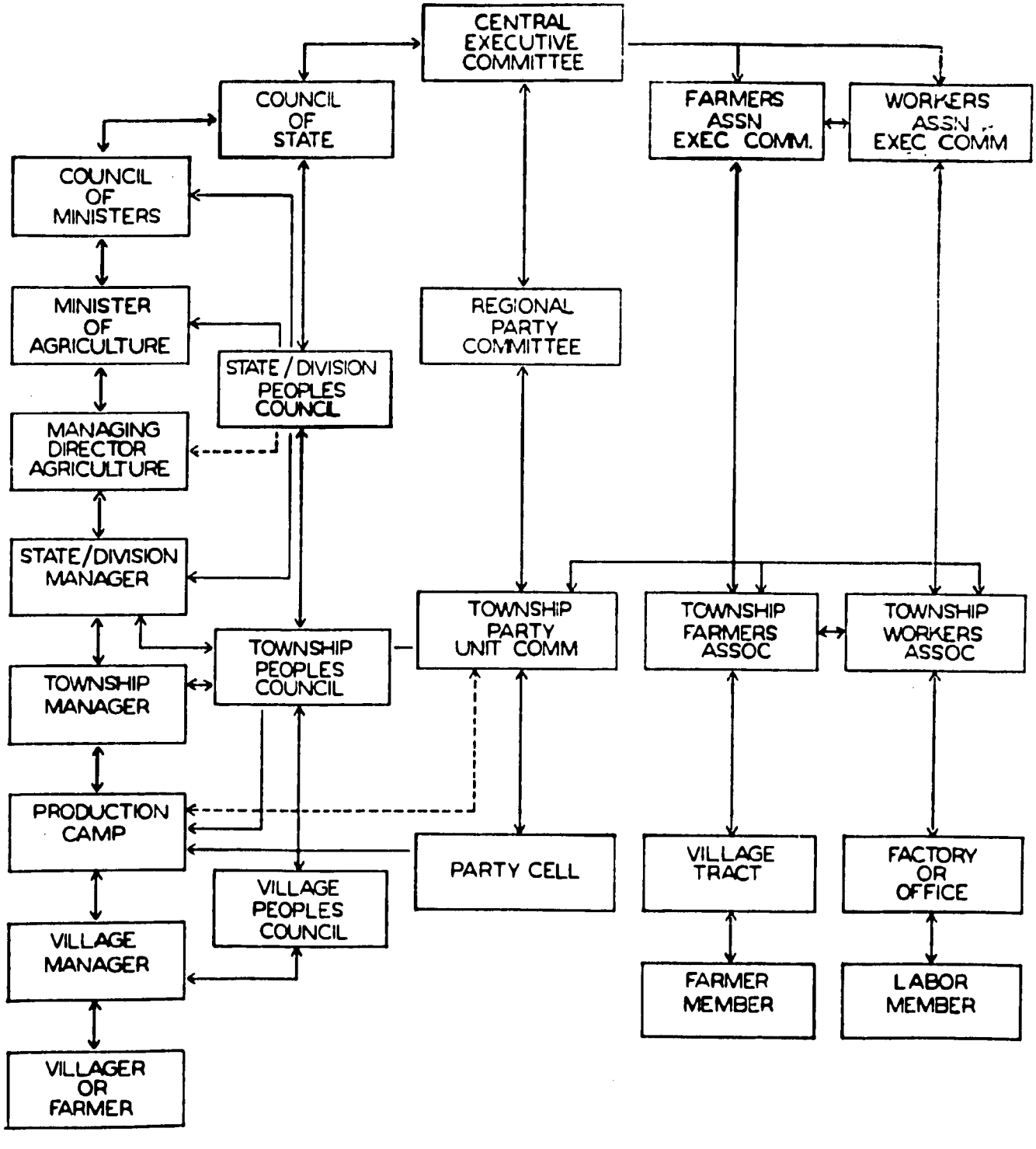
1. This project is successfully progressing on its intended course in spite of numerous difficulties, to a large degree because it was desired by the Burmese Government, meets the needs of Burma, and was jointly developed and implemented with able and dedicated Burmese agriculturists. AID-assisted projects need to be tuned to the desires and needs of host countries.

2. The project is as successful as it is because of the energy, commitment and technical and organizational skills of the AID/Burma Project Manager and the Burmese project directors. Well-trained, dedicated technical and managerial personnel can have a strong positive impact on project performance.

3. One of the largest obstacles to the timely implementation of the project has been a phrase in the Grant Agreement which says, with respect to taxes and duties, that equipment, materials and commodities imported into Burma for project implementation or for use by expatriate personnel performing project services financed under the Agreement, "shall either be exempted from payment or be paid by the Grantee". This phrase has cost the Agriculture Corporation large sums of money in unbudgeted expenditures and has created delays and morale problems for contract staff. Grant Agreements need to be very clear, precise and tuned to particular host country circumstances. Such expense and headaches are unnecessary as other bi-lateral donor countries have successfully negotiated duty-free agreements.

4. If a project is to benefit directly from long-term training abroad and also provide trainees with a productive work experience on their return, long-term participants going overseas should begin their studies within the first few months of implementation. Starting too late vitiates the intended purpose.

# S.R.U.B. POLICY AND IMPLEMENTATION STRUCTURE FOR AGRICULTURE



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# Evaluation Statement of Work

Evaluation of Burma Maize and Oilseeds Production Project (482-0005) and Development of a pre-PID concept paper for follow-on project, Maize and Oilseeds Production II Project (482-0007)

## 1. Background

The Maize and Oilseeds Production (MOP-I) project, initiated in FY 1982, was the first AID assisted agricultural project start in Burma following the resumption of U.S. development assistance to that country. The purpose of MOP-I is to bring about a rapid rate of adoption of high-yielding inputs and tillage practices by the producers of maize and oilseeds in the 28 townships comprising the project area. The project goal is to increase production of maize and oilseed crops in the project area with positive effects on rural income, employment, national food supply and the foreign trade balance. AID finances both short and long term technical assistance, participant training and agricultural commodities such as fertilizer and seed equipment.

A complementary project, the Edible Oil Processing and Distribution (EOPD) project (482-0006), is planned for a FY 1985 start. This project will increase the present low rates of oil recovery from oilseeds and improve the quality of edible oils through modern extraction and processing technologies. Yet another complemetary project which also focuses on maize and oilseeds--the Agriculture Research and Development (ARD) project (482-0012)--has been approved for a FY 1985 start. The PID for this project has been approved and it is now expected that the design team for preparing the PP will start work in August, 1984.

A follow-on project to MOP-I is currently envisaged (see pages 6-8, Burma FY ABS). Recent growth in maize and oilseeds yields, area and production suggests that substantial progress is being made under MOP-I. However, there are undoubtedly lessons to be learned from MOP-I which would be profitable to incorporate into a phase two project. Also by FY 1985, there will be three projects which focus on maize and oilseeds whereas there was only one such project when MOP-I was designed. Thus, if for no other reason, it is almost inevitable that the implementation of the two new projects will require some redesign of the follow-on project to MOP-I in order to maximize the complementarity of the three projects and to forestall duplicative efforts. The overriding purpose of the evaluation is to provide guidance in the planning of the follow-on project, MOP-II. The team that conducts the evaluation will also develop a pre-PID concept paper dealing with these issues and lessons learned from the evaluation, and focussed on considerations for the design of the follow-on project.



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2. Team Composition. The suggested team composition is as follows:

Rural Sociologist/Anthropologist and Team Leader (Douglas Pickett, ASIA/TR/ARD): Candidate's background and experience make him well-fitted for the combined tasks.

Agronomist/Seed Production and Processing Specialist: Candidate should have experience in tropical seed production and processing. He should also have experience in crop protection and knowledgeable about pest management systems.

Soil Microbiologist: Dr. Lloyd Fredericks, S&T/AGR, is well-known scientist with special expertise in Rhizobium inoculum production and a top agronomist.

Agricultural Economist: expertise in assessing economic impact of project to date as well as analysis of project organization and management.

3. Generalized Approach - Evaluation

The approach summarized below closely follows the Evaluation Guidelines in AID Handbook 3, Appendix 12B, pages 12B-1 to 12B-7 (henceforth, Guidelines). The evaluation team should use the Guidelines for additional guidance and detail.

A. Assessment of changes in project setting (Guidelines, pages 12B-1 and 12B-2). The evaluation team will assess changes in project setting to determine whether project is still relevant or adjustments in its design are needed to coincide with current host country and AID policies and priorities.

B. Clarification of project design (Guidelines, pages 12B-2 and 12B-3). The design team should recheck/reexamine the project design, including the logical framework matrix, in light of better understanding of the project setting and experience with implementation.

C. Assessment of progress and search for causes (Guidelines, pages 12B-3 - 12B-6). While a mid-term evaluation, aggregate production data suggests that progress is being made with respect to goal achievement. Planned (unquantified) project inputs and outputs as identified in the project paper are summarized below, as are generalized, qualitative indicators of project purpose and sector goal achievement. The team will assess project progress with respect to achieving project purpose and sector goal and in meeting the input and output targets. Progress will be assessed (impressionistically in some cases) on the basis of the implementation schedule, targets and progress indicators and extrapolations. The team will identify significant problems if they exist, and those elements which

have performed especially well; ascertain the causes/reasons for those cases where progress has been slow and also where performance has been exceptionally good; and assess the extent to which performance has been due to the project and/or factors exogenous to the project. Planned inputs and outputs and purpose and goal indicators are:

1) Project Inputs (see, e.g., p. 15, PP for levels of planned inputs)

---Technical assistance

---Training

---Fertilizer

---Agricultural equipment/machinery/supplies (for seed farm, seed processing, rhizobium production, research and demonstration, and for pumping water)

2) Project Outputs (see, e.g., p. 14, PP for levels of planned outputs)

---Research: Improved national research capability in maize and oilseeds

---Cultural practices: Improved maize and oilseed technology and production practices.

---Seed farms: Four fully-equipped and staffed maize and oilseeds seed farms which are integrated with seed processing/storage facilities.

---Farm management information: An operational farm management information system monitoring farm-level production practices and providing feedback to research and extension centers.

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

---Inputs to farmers: Inputs supplied to farmer participants (fertilizer, seed, pest management inputs, agricultural equipment and rhizobium inoculum).

---Rhizobium production: A functional rhizobium production facility.

3) Project Purpose

---Rapid growth of high-yielding inputs and tillage practices for maize and oilseed crops (see, e.g., p.13, PP, for specific quantified indicators).

4) Sector Goals

----Increased production of oilseed crops and maize in 28 townships resulting in: enhanced rural income and employment, increased national food supply and improved nutrition; and improved foreign trade balance from expanded oilseed cake export and reduced edible oil imports (see, e.g., p.13, PP for specific quantified indicators).

5) Other. The design team will:

---look for any unplanned or unexpected effects, establish causes, and assess implications for project progress, project purpose and goal attainment and for the design of the project.

---make an assessment of whether inputs and outputs are adequate and suitable to achieve project purpose and whether attainment of project purpose will lead to attainment of goal.

---identify lessons learned, especially those bearing on planning and designing the follow-on project.

4. <u>Pre-PID Concept Paper for follow-on project (MOP-II)</u>

The team will develop a concept paper for the MOP-II project. Because MOP-II is to be a follow-on to MOP-I, the PP for the latter can be used as the planning frame for the MOP-II concept paper. (also see pages 6-8, Burma FY86 ABS) This concept paper would take account of the evaluation findings and recommendations; the components, activities, scope, and objectives of the ARD and EOPM projects; a changed project setting, if any, including priorities of the Burmese; and achieving better conformance with Agency/Bureau policies/strategies and AID/Burma strategy.

5. <u>Assignment of specific tasks to team members</u>

The evaluation and PID concept paper development are to be a joint Burmese-AID effort. In order to address problems from a multidisciplinary viewpoint, the effort is to be a team effort, integrating the expertise residing in the team members. Thus, the assessment of progress and analysis of causes will in many instances require the expertise of more than one team member. However, the particular combination of expertise required to analyze problems cannot be specified until particular problems are identified. We consequently believe it best to leave the assignment of specific tasks, including write-ups for indicated portions of the evaluation report and the PID concept paper, to the team leader. He would leave enough flexibility to modify assignments as developments/findings warranted during the process of evaluation and concept paper development.



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6) Reports. The team will prepare:

A) An evaluation report which:

---comments on the appropriateness of the design of MOP-I;

---assesses project progress with respect to achieving project purpose and sector goal and in meeting the input and output targets;

---identifies significant problems if they exist, and those elements which have performed especially well;

---identifies the causes/reasons for those cases where progress has been slow and also where performance has been exceptionally good;

---assesses the extent to which performance has been due to the project and/or factors exogenous to the project;

---identifies unplanned or unexpected effects, establishes causes, and assesses implications for project progress, project purpose and goal attainment and for the design of the project;

---makes an assessment of whether inputs and outputs are adequate and suitable to achieve project purpose and whether attainment of project purpose will lead to attainment of goal;

---contains analyses and recommendations on other areas the team considers important;

---indicates lessons learned, especially those bearing on the planning and designing of the follow-on project;

---contains a list of prioritized recommendations on how to improve project performance and, most importantly, a discussion of what the team considers to be important considerations in planning the follow-on MOP-II project.

B) a Project Evaluation Summary (see AID 1330-15A (3-78) for format and content).

C) A pre-PID concept paper for MOP-II. Since the latter is a follow-on project to MOP-I, pages 6-8, Burma FY86 ABS and the MOP-I PP will serve as the frame for the concept paper, but modified to take account of MOP-I evaluation findings and the other AID/Burma projects so as to maximize complementarity among them.

7) Relationships and Responsibilities

The team leader, an AID/W DH, will report to and maintain a close liaison with the AID/Burma Rep. The team leader will explain evaluation objectives and approach to the host country project manager and counterparts and other team members. He will make assignments to and allocate tasks among the team members and coordinate their activities. With inputs from team members, he will be responsible for the writing of the evaluation report and the concept paper, both of which are to be completed in final draft prior to his Burma departure from Burma.

Team members consultants will report to the team leader and will work in close collaboration/cooperation with him.

The team will rely heavily on the AID/Burma ADO for general advice/counsel about the project setting, the country, its people and their cultures and values. The ADO or his designee will suggest officials to see and sites to visit, as well as make arrangements for appointments and site visitations.

-The AID/Burma ag economist will work with the contractor ag economist.

8. Terms of performance

Work will commence o/a January 6, 1985 and continue until about February 1, 1985, or for four calendar weeks. All time except that in international travel is to be spent in Burma.

9. Work Days ordered.

Twenty-two (22) work days are ordered for each consultant. For budgetary purposes, one work day is assumed during international travel. A 6-day work week is authorized.

# MID-TERM EVALUATION - MAIZE AND OILSEEDS PRODUCTION PROJECT
## TENTATIVE SCHEDULE

| | | |
|---|---|---|
| Sunday, January 6 | - | Team arrives Burma 222, 1845 hours. Strand Hotel |
| Monday, January 7 | - | 8:00 a.m. AID/Burma offices, US Embassy, Travel arrangements and orientation, discussion of schedule, meeting with AID Rep and Program Officer.<br><br>10:00 - 11:45 a.m.: Meeting at MOPP offices for briefing and project discussion.<br><br>2:30 p.m.: Meeting with Managing Director, Agriculture Corporation and staff: a) evaluation, b) second phase of project.<br><br>Night: Strand Hotel |
| Tuesday, January 8 | - | 7:00 a.m.: Travel to Daik U - Pegu Township. Winter production groundnuts, intensive township, discussion with farmers and township officers.<br><br>12:00 p.m.: Lunch at Kyaung Su Seed Farm. Certified seed of groundnut and sunflower.<br><br>1:00 p.m.: Visit of farm and discussions.<br><br>2:00 p.m.: Resume travel to Yezin. Arrive Yezin at 7:00 p.m.<br><br>Night: ARI Guest House. |
| Wednesday, January 9 | - | Yezin: Discussion ARI research, visit experimental sites, evaluation of rhizobium production activities.<br><br>Night: ARI Guest House |
| Thursday, January 10 | - | 7:00 a.m.: Travel and visits to Sebin and Chaungmagyi Seed Farms. Sebin - Sesame and Sunflower foundation seed. Chaungmagyi - Maize and groundnut foundation seed.<br><br>Night: Mandalay |
| Friday, January 11 | - | 7:00 a.m.: Travel to Singu Township. Intensive peanut production area. Discussion with farmers and township officers. Lunch and return to Mandalay.<br><br>Night: Mandalay. |

| | | |
|---|---|---|
| Saturday, January 12 | - | Maymyo: Discussion with division officers and township officers at horticulture station (coffee, etc.) and visit peat bog and new inoculant production factory site.<br><br>Night: Mandalay |
| Sunday, January 13 | - | Travel Mandalay to Nyaung Oo to Magwe<br><br>Night: Magwe |
| Monday, January 14 | - | Magwe to Natallin to Thitcho. Visit Thitcho Seed Farm.<br><br>Night: Thitcho |
| Tuesday, January 15 | - | Thitcho to Rangoon<br><br>Night: Strand Hotel |
| January 16- January 20 | - | Discussion and preparation of evaluation, Strand Hotel. |
| January 21,22,23 | - | Trip to Wakema Township. Sunflower production, intensive groundnut production, irrigation project. |
| January 24 - January 29 | - | Completion of evaluation report and report to USAID, and Agriculture Corporation. Development of Concept Paper. |

# CONTACTS BY EVALUATION TEAM

A. Persons met at Agriculture Corporation in Rangoon

| | | |
|---|---|---|
| 1. | U Khin Win | Managing Director |
| 2. | U Tin Hlaing | General Manager (Extension) |
| 3. | U Hla Myint Oo | General Manager (Planning) |
| 4. | U Aung Khin | General Manager (ARI) |
| 5. | U Mya Maung | Project Director, MOPP |
| 6. | U Siang Uk | Deputy Project Director, MOPP |
| 7. | U Than Htay | Deputy Project Director, MOPP |
| 8. | U Thaung Tin | Deputy General Manager, MOPP |
| 9. | U Ba Thaung | Deputy General Manager,, MOPP |
| 10. | U Hla Than | Deputy General Manager, (Planning) |
| 11. | U Nyi Nyi | Deputy General Manager, (Planning) |
| 12. | U Kyaw Win | Asst: General Manager, MOPP |
| 13. | Dr. Ervin T.Bullard | Team Leader, MOPP |
| 14. | Mr. George W. Otey | Seed Technologist, MOPP |
| 15. | Mr. Ross E. Hagan | Water Management Specialist, MOPP |

B. Persons met in travel

Jan. 8, 1985

Place = Daik U Township, Production Camp, Pegu Division

| | Name | Title |
|---|---|---|
| 1. | U Myint Oo | Divisional Manager, Pegu Division, Agr. Corp. |
| 2. | U Than Myint | Chairman of Township Project Implementation Committee, People's Council, E.C. |
| 3. | U Hla Myint | Township Manager, Agr. Corp. |
| 4. | U Shwe Htoo | Deputy Township Manager Agr. Corp. |
| 5. | Extension Staff | 15 Nos. |
| 6. | Farmers | 10 Nos. |

Kyaungsu Seed Farm

| | | |
|---|---|---|
| 1. | U Thaung | Farm Manager |
| 2. | U Maung Maung | Deputy Farm Manager |
| 3. | Other Farm Staff | |

Jan. 9, 1985

Place- Agriculture Research Institute, Yezin.

| | | |
|---|---|---|
| 1. | U Aung Khin | General Manager, ARI |

| | |
|---|---|
| 2. Dr. Tun Saing | Deputy General Manager, Head of Cereal Crops Division. |
| 3. U Pe Maung Thein | Deputy General Manager Head of Food Legume Division. |
| 4. U Saw Win Kyi | Deputy General Manager Head of Oil Crops Division. |
| 5. U Myo Nyunt | Sunflower Breeder, ARI. |
| 6. U Hla Than | Deputy General Manager Head of Plant Pathology Division. |
| 7. Other ARI Staffs | |

Jan. 10, 1985

Sebin Seed Farm

| | |
|---|---|
| 1. U Tin Myint | Farm Manager |
| 2. U Soe Tin | Deputy Farm Manager |
| 3. Mr. Ross E. Hagan | Agr. Engineer |
| 4. U Than Htay | Irrigation Engineer |
| 5. Farm Staffs | |

Chaungmagyi Seed Farm

| | |
|---|---|
| 1. U Ko Lay | Farm Manager |
| 2. U Sein Win | Deputy Farm Manager |
| 3. Other Farm Staffs | |

Jan. 11, 1985

Singu Township, Mandalay Division

| | |
|---|---|
| 1. U Sein Win | Divisional Manager, Agr. Corp. |
| 2. U Than Myint | Deputy Divisional Manager |
| 3. U Bo | Township Manager, Agr. Corp. Singu. |
| 4. U Ohn Maung | Deputy Township Manager, Agr. Corp. Singu |
| 5. Agriculture Extension Staff and Farmers | |
| 6. U Than Maung | Chairman of Township Party Unit |
| 7. U Sein Tu | Chairman of Township Inspectorate |
| 8. Major Ye Myint | Chairman of Township People's Council |
| 9. U Win Kyaing | Chairman of Township PIC; EC member of people's council. |
| 10. U Tin Swe | Chairman of Farmers Association. |

Jan. 12, 1985

May Myo Township

| | |
|---|---|
| 1. U Myat Thar | Township Manager |
| 2. U San Myint | Deputy Township Manager |
| 3. U Kyaw Than | Farm Manager (Horticulture) |
| 4. U San Hla Baw | Farm Manager (Sericulture) |
| 5. U Ohn Maung | Officer-in-charge for Peat Soil Transportation |

Jan. 13, 1985

Nyaung Oo

| | |
|---|---|
| 1. U Than | Farm Manager (Horticulture) |
| 2. U Tin Maung | Township Manager |

Jan. 14, 1985

Magwe

| | |
|---|---|
| 1. U Hla Toe | Deputy Divisional Manager |
| 2. U Aung Myaing | Township Manager, Magwe |
| 3. U Kyauk Yin | Township Manager |
| 4. Daw Khin Nyo | Deputy Farm Manager |
| 5. Other Extension staff | |

Jan. 15, 1985

Thitcho

| | |
|---|---|
| 1. U Soe Win | Farm Manager |
| 2. U Than Tun | Deputy Farm Manager |
| 3. U Thaung Myint | Assistant Farm Manager |
| 4. U San Win | Field Inspector |

Jan. 22, 1985

Wakema Township

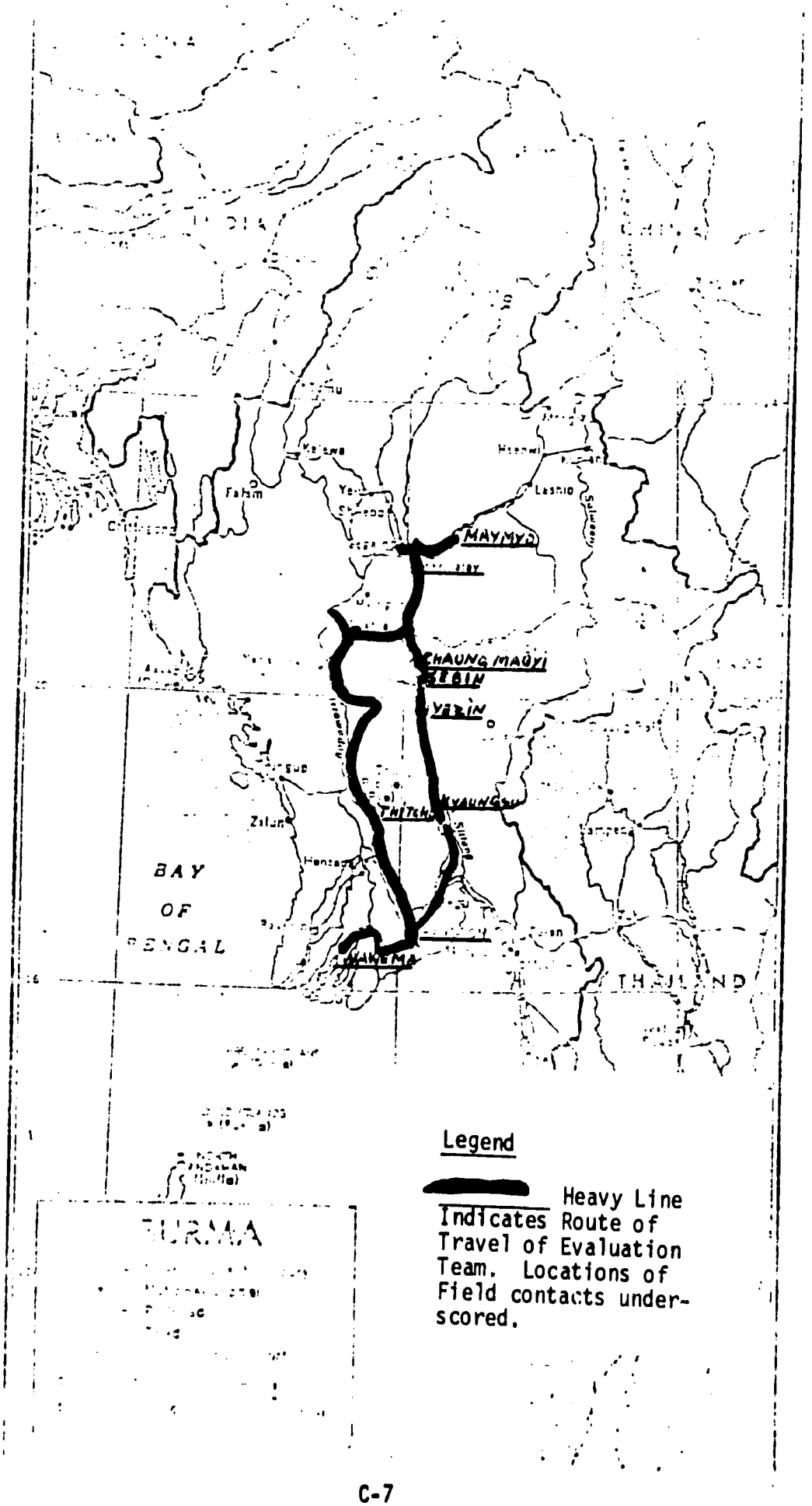
| | |
|---|---|
| 1. U Win Maung | Dy. Divisional Manager Irrawaddy Division Agriculture Corporation |
| 2. U Mya | Township Manager, Wakema, Agr. Corp. |
| 3. U Hla Myo | Dy. Township Manager, Wakema, Agr. Corp. |
| 4. U Saw Antony | Farm Manager Seed Multiplication Farm, Shwe Laung |
| 5. U Aung Kyi | Officer in charge for Electric pump irrigation scheme. |

6. Agri. Corp. Extension staffs - 15 Nos.

7. 20 Farmers.

Jan. 23, 1985

1. U Aye Thein — Township Manager, Agr. Corp.
2. U Tin Aye — Dy. Township Manager, Agr. Corp.
3. Extension staffs from Production cap. 5
4. 43 Farmers.


MAYMYO
CHAUNG MAUNG
BAY
OF
BENGAL
Legend
Heavy Line Indicates Route of Travel of Evaluation Team. Locations of Field contacts underscored.

# 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.<br><br>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:<br><br>1. Groundnut production up: 173,400 MT's (Direct - 45,900 MT's; Spread 127,500 MT's)<br><br>2. Sesamum production up: 17,000 MT's)<br><br>3. Sunflower production up: 24,700 MT's<br><br>4. Soybean production up: 9,700 MT's<br><br>5. Gross farm income up: K1,760 million ($244.4 million equivalent).<br><br>6. Exports of oil cake, soybean and maize up: $100.9 million<br><br>7. Foreign exchange value of increased vegetable oil availability of $94.5 million.<br><br>8. Per capita intake of vegetable oil up by 30 percent from approximately 2.8 Kgs. to 3.8 Kgs. | Items 1-4 - a) Crop reporting statistics of SRUB.<br>b) Project reports of Agriculture Corporation<br>c) Routine reports Township and Village Tract Councils and Agriculture Corporation Managers<br><br>Item 5 - a) Reports of prices, home consumption and marketing of project commodities of farmer participants at the township and village tract levels.<br>b) Annual SRUB statistics on GDP contribution by state/division.<br><br>Items 6 - 8 a) Bimonthly economic reports of the GSRUB on exports.<br>b) Bimonthly SRUB reports on imports.<br>c) Estimated domestic production of edible oils by the Ministry of Planning & Finance, Statistics Division. | 1. That weather will be normal average throughout life of project.<br><br>2. That economic, political and social conditions will remain stable permitting the farmers to plant and harvest on schedule.<br><br>3. That no unexpected difficulties will be encountered in marketing of production.<br><br>4. That policies with respect to distribution of income remain essentially as at present.<br><br>5. That price relationships between vegetable oil and other food at retail are approximately as at present. |

# PROJECT DESIGN SUMMARY
## LOGICAL FRAMEWORK

Project Title & Number: _____

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

PAGE 2

| NARRATIVE SUMMARY<br>Project Purpose: (B-1) | OBJECTIVELY VERIFIABLE INDICATORS<br>Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2) | MEANS OF VERIFICATION<br>(B-3) | IMPORTANT ASSUMPTIONS<br>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:<br><br>Direct Impact from Project<br><br>Maize 383,200 acres<br>Groundnuts 388,000 acres<br>Sesamum 312,200 acres<br>Sunflower 115,400 acres<br><br>Total 1,188,800 acres<br><br>Indirect-Spread Effect<br><br>Groundnuts 1,500,000 acres<br>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.<br><br>2. That acceptable economic incentives for adoption are provided.<br><br>3. That inputs and technical information can be delivered as planned in acceptable form and in the townships selected.<br><br>4. That weather conditions are near normal. |

AID 1020-25 (10-79)
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 township. | 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. | |
| 5. 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 (5-70)
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 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:<br>- Fertilizer - 70,000 MT's<br>- Seed - about 9,000 MT's<br>- Pest management inputs - (exact mix to evolve from project).<br>- Agriculture equipment - Approx. $5 million.<br>- Inoculum - 8 million pounds. | | |
| | 7. Local inoculum production of 3 million ~~ms~~ pounds per year by fifth year of project. | | |

AID 1020-20 (5-70)
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)<br>**AID Funding**<br>1. Technical assistance .... $2.4 million<br>2. Participant training ..... $3.0 "<br>3. Commodities ... $20.0 "<br>4. Contingency/ Inflation ..... $4.5 "<br>5. Evaluation..... .1 "<br>Sub-total $30.0 million<br><br>**SRUB Funding**<br>1. Fertilizer ... $10.0 million<br>2. " Distribution 2.0 million<br>3. Other local costs including personnel, facilities and supplies (K equivalent in US$) 6.0 million<br>Sub-total $18.0 million<br>TOTAL $48.0 million | Implementation Target (Type and Quantity) (D-2)<br>**AID** - ($30.0 million)<br>1. **Technical assistance**<br>a) 156 person months of long-term TA (13 PY's x 12 mos.)<br>b) 70 person months of short-term technical assistance<br>2. **Participant Training**<br>a) 11 PhD degrees at 4 yrs each--(44 PY's or 528 PM's).<br>b) 25 MS degrees at 2 yrs each--(50 PY's or 600 PM's)<br>c) 70 short-term training programs at average of 4.5 months (315 PM's)<br>3. **Commodity Procurement**<br>a) Fertilizer ($15.0 million)<br>TSP -30,000 MT (Approx.<br>UREA 10,000 MT (Approx.<br>b) Machinery, equipment, parts and supplies ($5.00 million)<br>(1) Seed farms with farm production, processing & storage facilities ($2.70 million) | (D-3)<br>**AID** -<br>1. - Contractor refords and quarterly reports; AID-financed documents (vouchers, etc.)<br>2. - Contractor records & quarterly reports; GSRUB project records; AID/Burma participant training records,<br>3. a. - AID/W procurement & shipping records; AC procurement, shipping, unloading records and monthly inventory reports,<br>b. - Contractor procurement reports. AID/W financial records AC records and reports.<br>4. All of above depending on allocation and use of contingency reserve.<br>**SRUB**<br>1 & 2. Agriculture Corporation Procurement Division records and monthly reports.<br>3. SRUB project records. and quarterly reports. | Assumptions for providing inputs: (D-4)<br>**AID** -<br>1. That the project is approved on schedule and that funds are provided as scheduled on an annual basis.<br>2. That contractor selection and procurement and staffing proceeds on schedule.<br>3. That participants are named, qualified and processed on schedule.<br>4. That commodity procurement proceeds as planned and accommodities are shipped, cleared and moved to project sites expeditiously.<br>5. That the contingency allowance for escalation in costs of TA, training and commodities proves adequate to meet needs.<br>**SRUB** -<br>1. That SRUB budget resources are released on schedule.<br>2. That unusual difficulties are not encountered by the GSRUB, AID or the contractor in making needed procurement and imports.<br>3. That SRUB staff personnel and AID contractors can be assigned and remain in the project as planned. |



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AID 1020-20 (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)<br>(3) Laboratory equipment publications and related research needs at ARI/Yezin ($0.10 million)<br>(4) Equipment & materials for extension information demonstration on farm use ($1.10 million)<br>(5) Procurement costs, shipping, handling, etc. ($0.85 million)<br><br>4. <u>Contingency</u><br>20% 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.<br><br><u>SRUB</u> - ($18.0 million)<br>1. Fertilizer ($10.0 million)<br>UREA 26,000 MT (Approx.)<br>MOP 4,000 MT (Approx.)<br>2. Fertilizer handling, transport and distribution from Rangoon port to township<br>(over) | | 4. That complementary facilities and equipment can be constructed, developed or purchased locally to meet project requirements. |

AID 1020-25 (3-70)
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) level godowns (K28.0 million or 4.0 million)<br>8. 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.<br>(Kyat 57.6 million or $ 8.0 million)<br>(at K 7.2 = $1 U.S.) | (D-3) | Assumptions for providing inputs (D-4) |

Appendix E

GRANT AGREEMENT

Annex 1.

## MAIZE AND OILSEEDS PRODUCTION PROJECT

### Amplified Description of the Project

The purpose of the Maize and Oilseeds Production Project is to increase production of oilseed crops (principally groundnut, sesamum, and sunflower) and maize in an estimated 28 townships of rural Burma, with positive effects on rural income, on national food supply, on nutrition and on the balance of trade.

The Project will apply at least ten means 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 techniques; (8) weed control; (9) timely harvesting; and (10) irrigation/water management practices. This will be accomplished through a comprehensive program including technical assistance, training, provision of agricultural machinery and equipment, and fertilizer procurement, as further summarized in this Annex.

### Quantitative Goals

The following total production targets in the project area are considered reasonable during the life of the project:

(1) To increase maize production by 228,000 MT.

(2) To increase groundnut production by 258,000 MT, of which 87,000 MT will be directly attributable to Project acres included in intensive and extensive townships and an additional 171,000 MT attributable indirectly to other groundnut acreage throughout Burma through the spread of rhizobium inoculation technology.

(3) To increase sesamum production by 25,000 MT.

(4) To increase sunflower production by 53,000 MT.

(5) To increase soybean production by 12,000 MT.

(6) To increase gross farm income by K1,273 million ($177.0 million).

(7) To increase production and possible export of oil cake and related products by K373.0 million ($52.0 million).



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(8) To increase the value and reduce possible imports of edible oil by K499.0 million ($69.0 million).

(9) To improve nutrition by an increase in availability of edible oil by 30% from approximately 2.8 kg. to 3.8 kg. per capita.

Project Area

The Project will focus on increases in crop production during four crop years in Burma, corresponding to 1982-83, 1983-84, 1984-85, and 1985-86. Estimated total acreage planted to maize, groundnut, sesamum, and sunflower in the 28 townships will reach 388,600 acres by the 1985-86 crop year, as illustrated in Table 1. In addition, by the 1985-86 crop year an estimated 20,000 acres will be planted to soybean, which will be a fifth crop introduced in the Project on a pilot basis.

Table 1 lists the "intensive" and "extensive" townships selected for participation in the Project. Eight (8) intensive townships, identified as having the highest potential for increased agricultural production, will receive concentrated inputs of fertilizer, improved seed and intensified services of extension personnel. Where needed, special emphasis will also be given to irrigation and/or water management. Within each intensive township, there will also be approximately five (5) high technology sites or a total of approximately forty (40) such sites. Each site will have access to about five acres chosen from among participating farm units, or about 200 acres in all eight intensive townships. Extension staff of the Agriculture Corporation, assisted by researchers from the Agricultural Research Institute in Yezin, and with technical guidance from AID experts, will use the high technology sites for on-farm field testing of new technologies, and to analyze benefits, costs and implementation constraints at local levels.

In addition to the intensive townships, twenty (20) extensive townships, identified as also having high potential for maize and oilseeds, will receive lesser amounts of inputs and services. While improved seed will be available for these townships, limits on fertilizer availability will require that the rate of fertilizer application be reduced by approximately one-half on Project acres in the extensive townships. Also, fewer extension personnel, trained specifically in the Project crops, will be available. Nevertheless, these townships are included in the Project and will receive special attention, particularly for first-spread diffusion of proven new technology where resources permit.

Project Outputs

In addition to targeted production increases, the following outputs are expected to be established by the end of the project:

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



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(2) Introduction of improved maize and oilseed technology and production practices (seed, water, fertilizer, integrated plant protection). Newly developed technology farm-tested at high technology sites will result in township and/or village specific production packages for each crop.

(3) Four (4) fully-equipped and staffed seed farms. Two foundation seed farms of approximately 70 acres for oilseeds and 110 acres for maize plus two certified seed farms of approximately 800 acres for oilseeds and 3,000 acres for maize will be established by the Project. All four will be operational and will be integrated with seed processing facilities for drying, bagging and storing an estimated 3,500 MT per year of maize, groundnut, sesamum, sunflower and soybean seed. (The locations selected for the seed farms are listed in Table 2.)

(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 the eight intensive townships.

(5) Returned participant trainees in place within the research, extension, seed farm and fertilizer distribution elements of the Project. After training, it is anticipated that returned Burmese participant trainees will occupy positions directly or indirectly involved with maize and oilseed production.

(6) A functional rhizobium production facility (inoculum for groundnut and soybeans). Local nitrogen-fixing inoculum production of an estimated 3 million pounds per year is planned by year five of the 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.

Project Inputs

Inputs supplied by the Project to carry out the above activities will involve total expenditures of $51 million, including $30 million of AID Grant funds, (subject to the availability of funds to AID for the Project and to the mutual agreement of the Parties), $10 million worth of fertilizer contributions by the Grantee, and K79.2 million ($11.0 million equivalent) provided by the Grantee for local costs of Project. Major project inputs are as follows:

(1) Technical assistance: Approximately 13 person-years of long-term technical assistance and 50 person-months of short-term consultants.

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

(3) Fertilizer: Approximately 70,000 MT supplied during the life of the Project, with approximately 40,000 MT supplied using AID Grant funds and approximately 30,000 MT using Grantee resources.

(4) Agricultural equipment: Approximately $5 million of Grant-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 related equipment, extension demonstration equipment, and costs of procurement.

(5) Local costs: Approximately $11 million in Grantee-funded costs for Project operations, including necessary existing and incremental personnel assigned to the Agriculture Corporation; support for the Project Team; construction of seed farms, seed processing facilities and the rhizobium inoculum facility; salaries/allowances for participant trainees while overseas, local staff training, and English language training when necessary; and costs of fertilizer transport and distribution from Rangoon to township-level godowns.

Financial Plan

Detailed plans of financial contributions to the Project by AID and the Grantee are included in Tables 4 and 5. These are broken down by Project input and, in the case of the A.I.D. contribution, by the amount obligated in the first year, as well as the amounts anticipated in future years of the Project.

Project Implementation

Administrative Arrangements: The Agriculture Corporation, under its Managing Director, will be directly responsible for the Project and will coordinate as necessary with other Departments and Corporations within the Ministry of Agriculture and Forests as well as other government Ministries.

The organizational structure of the Project is depicted in Table 6. Because the Project calls for a multi-disciplinary team of specialists and counterparts to accomplish objectives involving several divisions within the Agriculture Corporation, the Project Team as described herein 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 of the Agriculture Corporation 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.

It is expected that the Project Team will consist of up to six (6) representatatives, equally balanced between the Agriculture Corporation and U.S. advisors financed by the Grant. 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 over-all management and administration of the Project in addition to technical responsibilities.

As part of its local cost contribution to the Project, the Agriculture Corporation will arrange for office space, equipment, support staff, and transportation for the Project Team.

Field-level project implementation will be accomplished via three principal contact points.

First, in each of the townships involved in the Project, the Agriculture Corporation 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 crops chosen for emphasis in each 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 rhizobium inoculum (for groundnut), participation in other data collection, and evaluation of results in terms of yield and production increases achieved in each township (See Table 7).

The second contact point in the project area follows the same channel through Agriculture Corporation 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.

The third field-level contact point for the Project is the Agricultural Research Institute at Yezin. Project personnel will coordinate as necessary with activities at Yezin, particularly those that relate to strengthening research and extension capabilities, focused on maize and oilseeds.

Technical Assistance: AID will enter into a contract using Grant funds for the provision of necessary technical assistance and training required by the Project, assisting in Project-related procurement of agricultural equipment, and other responsibilities to be detailed in the contractor's scope of work. This will include an average of three long-term experts during an approximately 4 1/2-year period, or approximately 13 person years of long-term technical assistance. In addition, a total of 50 person months of short-term consultants are anticipated for specialized technical services of 1-2 months duration each during the course of the Project. Representatives of the Agriculture Corporation are expected to participate in the selection of the contractor, which will be accomplished in accordance with AID's competitive selection procedures.

Procurement Plan: Agricultural Equipment. All equipment financed under the grant will be procured by AID on behalf of the Grantee in accordance with applicable AID regulations and procedures. This will include approval by the Grantee of final equipment lists and final commodity specifications prior to procurement actions.

Procurement Plan: Fertilizer. Because of the critical timing of fertilizer procurement, AID will on behalf of the Grantee take responsibility for the purchase of the fertilizer. The following procedures will be used for procuring Grant-financed fertilizer during the course of the Project:

- The Grantee will approve fertilizer and bagging specifications before the start of the procurement process;

- AID will take responsibility for the procurement and will tender for the fertilizer on an FOB basis;

- AID will arrange for publication of the advertisement for fertilizer;

- AID will distribute the Invitations for Bid (IFB) through its Office of Commodity Management and issue freight tenders;

- The bid opening will take place in Washington including participation by Grantee representatives;

- The evaluation of offers and coordinating of freight offers with commodity awards will be done by AID;

- Commodity awards will be made by AID, with concurrence of the Grantee;

- Award notices will be issued by AID, on behalf of the Grantee;

- Shipment to Rangoon will be arranged by AID on behalf of the Grantee;

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

- The Grantee will take responsibility for domestic movement of fertilizer from port to township warehouses.

Environmental Assessment

The current use of pesticides in Burma on maize, groundnut, sesamum, sunflower and soybean was thoroughly analyzed during the appraisal of the Project. It has been agreed to continue the use of endrin, aldrin, lindane and DDT on maize and oil crops in the Project area until the local farmers can become familiarized with the new names, physical characteristics, application procedures and efficacy of more environmentally acceptable substitutes, and to initiate 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. Responsibility for monitoring and reporting on the phase out of these pesticides will rest with the Agriculture Corporation.



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## 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 order, 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 schedule, 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 reimburse 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 (inc. 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

## 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.

APPENDIX TABLES

APPENDIX G

Table G1. Maize Area and Production - National

| Year | Area | | Yield per Acre | | Production | |
|---|---|---|---|---|---|---|
| | Sown | Harvested | Baskets | Pounds | Baskets | Pounds |
| | (Acres) | | (55 lbs) | | | (000) |
| 77-78 | 207,513 | 195,500 | 15.43 | 849 | 3,016,095 | 165,885 |
| 78-79 | 224,498 | 205,716 | 14.97 | 823 | 3,079,509 | 169,373 |
| 79-80 | 250,591 | 247,341 | 20.50 | 1128 | 5,070,491 | 278,877 |
| 80-81 | 374,327 | 357,021 | 18.68 | 1027 | 6,667,826 | 366,730 |
| 81-82 | 380,684 | 347,347 | 23.78 | 1308 | 8,259,951 | 454,297 |
| 82-83 | 422,034 | 335,828 | 28.55 | 1570 | 9,588,071 | 527,344 |
| 83-84 | 513,358 | 446,766 | 27.77 | 1527 | 12,408,265 | 682,455 |
| 84-85* | 602,962 | 526,556 | 27.36 | 1505 | 14,422,760 | 793,252 |

*84-85 data estimated

Source: "Annual Plans and Actual Production of Maize and Oilseed Crops in Burma (1977-78 to 1982-83)", Agriculture Corporation, Maize and Oilseeds Production Project, March 1983. Other MOPP reports and records, including revised 82-83 data.



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Table G2. Groundnut Area and Production - National

| Year | Area | | Yield per Acre | | Production | |
|---|---|---|---|---|---|---|
| | Sown | Harvested | Baskets | Pounds | Baskets | Pounds |
| | (Acres) | | (25 lbs) | | | (000) |
| 77-78 | 1,481,263 | 1,391,822 | 29.42 | 736 | 110,946,284 | 1,023,657 |
| 78-79 | 1,377,715 | 1,290,866 | 26.65 | 666 | 34,406,188 | 860,155 |
| 79-80 | 1,200,379 | 1,126,123 | 26.80 | 670 | 30,177,200 | 754,430 |
| 80-81 | 1,271,131 | 1,209,940 | 31.89 | 797 | 38,591,019 | 964,775 |
| 81-82 | 1,477,687 | 1,372,283 | 36.82 | 920 | 50,532,711 | 1,263,318 |
| 82-83 | 1,411,695 | 1,334,716 | 36.34 | 908 | 48,498,064 | 1,212,451 |
| 83-84 | 1,384,603 | 1,294,238 | 36.22 | 906 | 116,878,607 | 1,171,965 |
| 84-85* | 1,597,466 | 1,532,185 | 38.37 | 959 | 58,786,162 | 1,469,654 |

*84-85 data estimated

Source: "Annual Plans and Actual Production of Maize and Oilseed Crops in Burma (1977-78 to 1982-83)", Agriculture Corporation, Maize and Oilseeds Production Project, March 1983. Other MOPP reports and records, including revised 82-83 data.

Table G3. Sesamum Area and Production - National

| Year | Area | | Yield per Acre | | Production | |
|---|---|---|---|---|---|---|
| | Sown | Harvested | Baskets | Pounds | Baskets | Pounds |
| | (Acres) | | (54 lbs) | | | (000) |
| 77-78 | 2,696,095 | 1,496,651 | 3.03 | 164 | 4,535,868 | 249,473 |
| 78-79 | 3,086,408 | 2,366,609 | 3.62 | 195 | 8,555,435 | 470,549 |
| 79-80 | 2,563,013 | 1,558,520 | 2.88 | 154 | 4,488,462 | 246,865 |
| 80-81 | 3,230,821 | 1,761,810 | 3.64 | 200 | 6,416,160 | 352,889 |
| 81-82 | 3,385,471 | 1,909,184 | 3.84 | 211 | 7,340,196 | 403,711 |
| 82-83 | 3,402,776 | 2,311,822 | 3.50 | 189 | 8,087,486 | 436,724 |
| 83-84 | 3,308,366 | 1,901,801 | 4.44 | 240 | 8,441,648 | 455,849 |
| 84-85* | 3,603,720 | 2,226,200 | 4.26 | 230 | 9,473,339 | 511,603 |

*84-85 data estimated

Source: "Annual Plans and Actual Production of Maize and Oilseed Crops in Burma (1977-78 to 1982-83)", Agriculture Corporation, Maize and Oilseeds Production Project, March 1983. Other MOPP reports and records, including revised 82-83 data.

Table G4. Sunflower Area and Production - National

| Year | Area | | Yield per Acre | | Production | |
|---|---|---|---|---|---|---|
| | Sown | Harvested | Baskets | Pounds | Baskets | Pounds |
| | (Acres) | | (32 lbs) | | | (000) |
| 77-78 | 89,105 | 84,295 | 15.92 | 509 | 1,341,980 | 42,943 |
| 78-79 | 136,158 | 122,183 | 12.81 | 410 | 1,565,000 | 50,080 |
| 79-80 | 83,474 | 54,656 | 16.64 | 532 | 909,476 | 29,103 |
| 80-81 | 142,740 | 121,163 | 18.70 | 598 | 2,266,343 | 72,523 |
| 81-82 | 257,930 | 229,175 | 21.23 | 679 | 4,866,306 | 155,722 |
| 82-83 | 271,293 | 226,762 | 21.46 | 687 | 4,868,580 | 155,776 |
| 83-84 | 347,135 | 315,537 | 24.81 | 794 | 7,828,907 | 250,525 |
| 84-85* | 396,656 | 356,474 | 28.28 | 905 | 10,079,421 | 322,541 |

*84-85 data estimated

Source: "Annual Plans and Actual Production of Maize and Oilseed Crops in Burma (1977-78 to 1982-83)", Agriculture Corporation, Maize and Oilseeds Production Project, March 1983. Other MOPP reports and records, including revised 82-83 data.

Appendix H

# SUMMARY AND PROGRESS REVIEW

## AGRICULTURE CORPORATION

## MAIZE AND OILSEEDS PRODUCTION PROJECT (MOPP)

## A.I.D. Project Number 482-0005

January 6, 1985

### Summary of the Project

1. Name of Project — Maize and Oilseeds Production Project

2. Duration of Project — October 1981 to September 1986 (5 years)

3. Project Budget

| | |
|---|---|
| U.S.AID | $ 30 million |
| G.O.B | $ 21 million |
| Total | $ 51 million |

| Components | A.I.D. ($M) | G.O.B. ($M) | TOTAL ($M) |
|---|---|---|---|
| Technical Assistance | 2.4 | - | 2.4 |
| - Long term | 1.6 | - | 1.6 |
| - Short term | 0.8 | - | 0.8 |
| Equipment | 24.5 | 11.5 | 36.0 |
| - Expendible (Fertilizer and Seed) | 15.0 | 10.0 | 25.0 |
| - Unexpendible (Agricultural & Office Equipment) | 9.5 | 1.5 | 11.0 |
| Training | 3.0 | - | 3.0 |
| Local Costs* | - | 9.5 | 9.5 |
| Evaluation | 0.1 | - | 0.1 |
| Total | 30.0 | 21.0 | 51.0 |

*Local Costs includes fertilizer handling and distribution, seed farm construction and project operating costs.

4. Objective of the Project:

(a) Purpose: The purpose of the Maize and Oilseeds Production Project is to increase the production of oilseed crops and maize in 28 townships of rural Burma, with the positive effects on rural income, on national food supply and nutrition.

(b) Quantitative Goals: The following increases in production are expected during the life of the project.

- To increase maize production by 228,000 MT.
- To increase peanut production by 258,000 MT. (87,000 MT in project area)
- To increase sesame production by 25,000 MT.
- To increase sunflower production by 53,000 MT.
- To increase soybean production by 12,000 MT.
- To increase gross farm income by K 1,273 million ($177 million)
- To increase production and possible export of oilcake and related products by K 373 million ($52 million)
- To reduce imports of edible oil by K 499 million ($69 million)
- To improve nutrition by an increase in availability of edible oil by 30%.

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5. **Project Area**

(a) 12 Intensive Townships: They receive concentrated inputs. (See Table 1)

Table I

| Sr. No. | Crop / Township | Division | Acreage (,000) |
|---|---|---|---|
| | Maize | - | 105 |
| 1. | Taze | Sagaing | 30 |
| 2. | Tatkon | Mandalay | 15 |
| 3. | Pyinmana | Mandalay | 25 |
| 4. | Lewe | Mandalay | 15 |
| 5. | Zalun | Irrawaddy | 15 |
| 6. | Maubin | Irrawaddy | 5 |
| | Peanut | - | 50 |
| 7. | Singu | Mandalay | 18 |
| 8. | Daik U | Pegu | 17 |
| 9. | Nyaungdone | Irrawaddy | 15 |
| | Sesame | - | 40 |
| 10. | Moulmein-gyun | Irrawaddy | 40 |
| | Sunflower | - | 30 |
| 11. | Pyawbwe | Mandalay | 13 |
| 12. | Yamethin | Mandalay | 17 |
| | | Total | 225 |



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(b) 16-Extensive Townships: They receive less inputs. (See Table II)

Table II

| Sr. No. | Crop / Township | Division | Acreage (,000) |
|---|---|---|---|
| | Maize | - | 24.4 |
| 1. | Kanbalu | Sagaing | 20.0 |
| 2. | Letpadan | Pegu | 4.4 |
| | Peanut | - | 71.2 |
| 3. | Myaung | Sagaing | 14.8 |
| 4. | Magwe | Magwe | 30.0 |
| 5. | Natmauk | Magwe | 14.4 |
| 6. | Tatkon | Mandalay | 6.0 |
| 7. | Kyauktaga | Pegu | 6.0 |
| | Sesame | - | 54.0 |
| 8. | Kyaukse | Mandalay | 12.5 |
| 9. | Myittha | Mandalay | 7.5 |
| 10. | Kyaunggone | Irrawaddy | 4.0 |
| 11. | Wakema | Irrawaddy | 16.0 |
| 12. | Maubin | Irrawaddy | 8,0 |
| 13. | Henzada | Irrawaddy | 6.0 |
| | Sunflower | - | 14.0 |
| 14. | Budalin | Sagaing | 5.0 |
| 15. | Okpo | Pegu | 3.0 |
| 16. | Kyauktaga | Pegu | 6.0 |
| | | Total | 163.6 |



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6. Project Progress

(a) Technical Assistance (Long term)

- Dr. Donald E. Herr served as Team Leader (Agronomist) for one year. (December 9, 1982 to December 8, 1983). Dr. Ervin T. Bullard replaced Dr. Donald E. Herr as Team Leader (Agronomist) from February 11, 1984.

- Mr. George W. Otey is serving as Seed Technology Specialist from January 10, 1983 and his assignment (for 2 years) will be terminated by January 10, 1985.

- Mr. Ross E. Hagan is serving as Water Management Specialist from April 8, 1984 to date.

(b) Short term consultants

| | |
|---|---|
| - Seed Technology | 2 months |
| - Rhizobium Specialist | 1 month |
| - Irrigation Specialist | 4 months |
| - Electrician | 1 month |
| - Sunflower Production Specialist | 1 month |
| - Corn Production Specialist | 1 month |
| Total | 10 months |

Note: Financial aid received from other sources for 3 man months.



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(c) Participant Training

- 11 Ph.Ds degree training to be identified and selected in 1985.

- 25 M.S. degree. 16 students are now studying in U.S.A. Additional 8 candidates have been selected and English training will be given beginning February 1985.

- Study Tour and Short term training
  Trainees sent abroad.

| | | |
|---|---|---|
| 1982-83 | = 14 | persons |
| 1983-84 | = 6 | " |
| 1984 | = 21 | " |
| Total | = 41 | persons |

(d) Procurement

- About US $2.4 million worth of Seed Farm Equipment, Implements and Office equipment had been procured and distributed to Seed Farms and Townships concerned.

- Fertilizer Procurement, as follows:

From USA

| | | |
|---|---|---|
| 1982-83 | T.S.P | 10,000 MT |
| 1983-84 | Urea | 10,388 MT |
| 1984-85 | T.S.P | 15,000 MT |
| | Total | 35,388 MT |

G.O.B Contribution

| | | |
|---|---|---|
| Urea | 15794 | MT |
| MOP | 2789 | MT |
| Total | 18583 | MT |



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(e) Crop Production (See Table III & IV)

Table III

| Crop | Year | Sown Acres | Yield/Ac (lb) | Production MT | Increase Overbase Year (MT) |
|---|---|---|---|---|---|
| Maize | 1981-82 Base Year | 57,000 | 1380 (25BK) | 32,050 | - |
| | 1982-83 Actual | 55,870 | 2271 (41BK) | 49,700 | 17,650 |
| | 1983-84 Actual | 84,530 | 2259 (41BK) | 77,483 | 45,443 |
| | 1984-85 Estimate | 91,164 | 2202 (40BK) | 85,804 | 53,754 |
| Peanut | 1981-82 Base Year | 70,700 | 967 (38BK) | 29,500 | - |
| | 1982-83 Actual | 71,940 | 1152 (46BK) | 36,874 | 7,284 |
| | 1983-84 Actual | 92,665 | 1274 (51BK) | 52,117 | 22,617 |
| | 1984-85 Estimate | 102,300 | 1398 (56BK) | 61,558 | 32,058 |
| Sesame | 1981-82 Base Year | 59,000 | 245 (4.5BK) | 5,891 | - |
| | 1982-83 Actual | 61,130 | 504 (9.3BK) | 12,058 | 6,167 |
| | 1983-84 Actual | 72,291 | 410 (7.6BK) | 12,342 | 6,451 |
| | 1984-85 Estimate | 87,405 | 446 (8.3BK) | 15,227 | 9,336 |
| Sunflower | 1981-82 Base Year | 15,000 | 669 (21BK) | 4,349 | - |
| | 1982-83 Actual | 15,000 | 1280 (40BK) | 8,290 | 3,941 |
| | 1983-84 Actual | 23,375 | 1104 (35BK) | 10,425 | 6,076 |
| | 1984-85 Estimate | 33,600 | 1473 (46BK) | 21,823 | 17,474 |

Table IV

| Crop | Increase in Production (MT) Target | Estimate up to 1984-85 | % |
|---|---|---|---|
| Maize | 228,000 | 116,847 | 51 |
| Peanut | 87,000 | 61,959 | 71 |
| Sesame | 25,000 | 21,954 | 88 |
| Sunflower | 53,000 | 27,491 | 52 |

(f) High Technology Site (HTS) (See Table V)

Table V

| Crop | Year | Number of Site | Sown Acres | Average Yield/Ac Lb | Baskets |
|---|---|---|---|---|---|
| Maize | 1982-83 | 18 | 90 | 3410 | 62 |
| | 1983-84 | 22 | 190 | 6270 | 114 |
| | 1984-85 Monsoon | 20 | 100 | 3905 | 71 |
| Peanut | 1982-83 | 10 | 50 | 1800 | 72 |
| | 1983-84 | 23 | 150 | 2100 | 84 |
| | 1984-85 Monsoon | 6 | 30 | 1825 | 73 |
| Sesame | 1982-83 | 3 | 15 | 702 | 13.0 |
| | 1983-84 | 9 | 45 | 497 | 9.2 |
| | 1984-85 Monsoon | 4 | 20 | 567 | 10.5 |
| Sunflower | 1982-83 | 4 | 20 | 1744 | 54 |
| | 1983-84 | 8 | 40 | 1856 | 58 |
| | 1984-85 Monsoon | - | - | - | - |

(g) Establishment of Seed Farm

- Selection of Farm Sites

| Farm | Total area | Total cultivable area |
|---|---|---|
| Chaungmagyi F.S.F* | 350 acres | 314 acres |
| Sebin F.S.F | 345 acres | 290 acres |
| Kyaungsu C.S.F* | 880 acres | 800 acres |
| Thitcho C.S.F | 3111 acres | 2200 acres |
| Total | 4686 | 3604 |

*F.S.F = Foundation Seed Farm

*C.S.F = Certified Seed Farm

- Farm Development

All seed farms producing limited production of seeds for farmers.

Chaungmagyi, F.S.F. basic farm structure scheduled for completion by 1985 and full seed production to begin monsoon crop 1985. The remaining seed farms to be operational by 1985-86.

(h) Electrical and Irrigation Pumping System

Electrical installation and irrigation system for Chaungmagyi, F.S.F. and Sebin, F.S.F. are going on and expected to complete by 1985. Remaining two seed farms, Kyaungsu and Thitcho, to start construction in 1986-87.

Out of 2000 acres pilot electric pump irrigation scheme in Wakema Township, installation of electric pumps for 420 acres have been completed and 400 acres of Sesame and 20 acres of Sunflower being planted in Winter 1984-85.

PROJECT PROGRESS

**Table VI**

| Sr. No. | Project Components | | Project Progress |
|---|---|---|---|
| | DURATION | 5 Yrs. | 1982 1983 1984 1985 9/1986 |
| 1. | **Technical Assistance** | | |
| | (a) Long term | 13PY | |
| | | 5PY | ---------- 38% |
| | (b) Short term | 50PM | |
| | | 10PM | ---------- 20% |
| 2. | Training | | |
| | (a) Long term Ph.Ds degree | 11P | |
| | M.S. degree | 25P | |
| | | 16P | ---------- 64% |
| | (b) Short term training | 70P | |
| | | 41P | ---------- 59% |
| 3. | Fertilizer (MT)-AID | | |
| | USAID Estimated MT | 40,000 | |
| | Actual MT | 35,388 | ---------- 88% |
| | GOB Estimate | 26,700 | |
| | Actual MT | 18,583 | ---------- 70% |
| 4. | Equipment (AID) Procured | $9.5 M | |
| | | $2.4 M | ---------- 25% |
| 5. | Seed Farm (Nos.) | 4 | |
| | Development | 4 | ---------- 50% |
| 6. | Local staff total | 618 | |
| | (Nos.) | 499 | ---------- 81% |
| 7. | Project Cost ($M) | 51 | |
| | Total estimated expenditure | 24.2 | ---------- 47% |
| | -AID ($M) | 30 | |
| | Estimated expenditure | 14.0 | ---------- 47% |
| | -GOB ($M) | 21 | |
| | Estimated expenditure | 10.2 | ---------- 49% |

APPENDIX I

## SEED PRODUCTION BY MOPP SEED FARMS

### A. Seed Production by Foundation Seed Farms

1. Chaungmagyi

| Year | Crop | Sown Acres | Harvested Acres | Yield/ac Baskets | Total Yield (bsk) |
|---|---|---|---|---|---|
| 1982-83 Actual | Maize | 35 | 25 | 28.00 | 700 |
| | Groundnut | 45 | 36 | 30-39 | 1094 |
| 1983-84 Actual | Maize | 60 | 50 | 38.40 | 1920 |
| | Groundnut | 90 | 75 | 36.40 | 2730 |
| 1984-85 Estimate | Maize | 65 | 51 | 41.25 | 2104 |
| | Groundnut | 40 | 35 | 34.34 | 1202 |
| 1985-86 Plan | Maize | 250 | 230 | 40.00 | 9200 |
| | Groundnut | 200 | 185 | 40.00 | 7400 |

2. Sebin

| | | | | | |
|---|---|---|---|---|---|
| 1982-83 Actual | Sunflower | 102 | 68 | 17.79 | 1210 |
| | Sesame | 20 | 9 | 2.44 | 22 |
| 1983-84 Actual | Sunflower | 110 | 61 | 15.26 | 931 |
| | Sesame | 20 | 16 | 5.44 | 87 |
| | Groundnut | 50 | 38 | 20.00 | 760 |
| 1984-85 Estimate | Sunflower | 110 | 74 | 31.35 | 2320 |
| | Sesame | 65 | 29 | 5.03 | 146 |
| | Groundnut | 50 | 23 | 10.00 | 230 |
| 1985-86 Plan | Sunflower | 250 | 225 | 40.00 | 9000 |
| | Sesame | 100 | 90 | 8.00 | 720 |
| | Groundnut | 50 | 47 | 40.00 | 1880 |

## B. Seed Production by Certified Seed Farms

### 1. Thitcho

| Year | Crop | Sown Acres | Harvested Acres | Yield/ac Baskets | Total Yield (bsk) |
|---|---|---|---|---|---|
| 1982-83 Actual | Maize | 292 | 261 | 20.28 | 5293 |
| | Groundnut | 110 | 62 | 23.53 | 1459 |
| 1983-84 Actual | Maize | 850 | 692 | 22.67 | 15688 |
| | Groundnut | 75 | 69 | 30.61 | 2112 |
| 1984-85 Estimate | Maize | 1050 | 884 | 32.15 | 28419 |
| | Groundnut | 190 | 162 | 35.68 | 5786 |
| 1985-86 Plan | Maize | 2000 | 1860 | 40.06 | 74520 |
| | Groundnut | 400 | 380 | 40.01 | 15205 |

### 2. Kyaungsu

| Year | Crop | Sown Acres | Harvested Acres | Yield/ac Baskets | Total Yield (bsk) |
|---|---|---|---|---|---|
| 1982-83 Actual | Groundnut | 37 | 24 | 25.42 | 610 |
| 1983-84 Actual | Groundnut | 110 | 80 | 22.90 | 1832 |
| | Sunflower | 65 | 40 | 8.75 | 350 |
| 1984-85 Estimate | Groundnut | 127 | 119 | 39.75 | 4730 |
| | Sunflower | 14 | 13 | 40.00 | 520 |
| 1985-86 Plan | Groundnut | 500 | 475 | 40.00 | 19000 |
| | Sunflower | 200 | 190 | 40.00 | 5140 |

NOTE: One basket of Maize, weights 55 lbs
" " Groundnut " 25 lbs
" " Sesame " 54 lbs
" " Sunflower " 32 lbs

Source: Data providied by Agriculture Corporation.



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# VARIETY TRIALS

## Groundnut Variety Trial at the Chaungmagyi Seed Farm Monsoon 1984.

| No. | Variety | Shelled Groundnuts | | Unshelled Groundnuts | |
|---|---|---|---|---|---|
| | | Baskets per Acre | Pounds per Acre | Baskets per Acre | Pounds per Acre |
| 1. | Tainan 9 | 5.11 | 258.25 | 15.52 | 287.99 |
| 2. | Panjab | 4.00 | 202.24 | 12.35 | 308.68 |
| 3. | RCM - 387 | 3.63 | 183.57 | 12.69 | 317.25 |
| 4. | Tainung - 2 | 3.57 | 180.46 | 10.80 | 270.09 |
| 5. | Taiwan MH 026 | 3.32 | 168.02 | 9.52 | 237.94 |
| 6. | Moket | 2.46 | 124.46 | 8.06 | 201.50 |
| 7. | Natal Common | 2.28 | 115.12 | 7.63 | 190.78 |
| 8. | M-10 | 1.54 | 77.79 | 4.97 | 124.33 |
| 9. | Yeain - 2 | .80 | 40.45 | 2.49 | 62.16 |
| 10. | No. 15626 | .12 | 6.22 | 1.11 | 27.87 |
| | LSD 5% | 1.17 | 59.12 | 3.29 | 82.17 |
| | LSD 1% | 1.54 | 77.79 | 4.44 | 110.97 |

## Groundnut Variety Trial at the Sebin Seed Farm - Monsoon 1984

| No. | Variety | Shelled Groundnuts | | Unshelled Groundnuts | |
|---|---|---|---|---|---|
| | | Baskets per Acre | Pounds per Acre | Baskets per Acre | Pounds per Acre |
| 1. | Yezin | 7.97 | 403.00 | 24.67 | 616.79 |
| 2. | M-10 | 7.72 | 390.13 | 24.14 | 603.50 |
| 3. | Panjab | 5.51 | 278.67 | 17.34 | 433.50 |
| 4. | Natal Common | 5.09 | 257.23 | 17.85 | 446.23 |
| 5. | Tainung - 2 | 4.49 | 227.22 | 18.36 | 459.00 |
| 6. | Taiwan MH026 | 3.73 | 158.64 | 15.29 | 382.16 |
| 7. | Tainan 9 | 2.54 | 128.62 | 7.65 | 191.25 |
| 8. | Moket | 1.61 | 81.46 | 5.27 | 131.75 |
| 9. | RCM 387 | 1.36 | 68.59 | 4.93 | 123.25 |
| 10. | No. 15626 | 1.10 | 55.73 | 4.80 | 119.93 |



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## ANNEX 1. INSTOY SOYBEAN VARIETY YIELD TRIAL

Date: 1982-83

Location: Latitude 19°10' North
Yezin

| | Variety | Mean Yields | | |
|---|---|---|---|---|
| | | Pounds/Acre | Baskets/Acre | Kilograms/Ha. |
| 1. | Ecuador | 2136 | 29.7 | 2392.3 |
| 2. | Williams 82 | 2041 | 28.3 | 2285.9 |
| 3. | Jupiter | 2037 | 28.3 | 2281.4 |
| 4. | IGH 23 | 1886 | 26.2 | 2112.3 |
| 5. | ICAL 125 | 1823 | 25.3 | 2041.7 |
| 6. | Alamo | 1782 | 24.8 | 1995.8 |
| 7. | M.P. Pelican | 1777 | 24.7 | 1990.2 |
| 8. | UFV - 1 | 1762 | 24.5 | 1973.4 |
| 9. | SIATS A 194 | 1686 | 23.4 | 1888.3 |
| 10. | ICAL 125 | 1683 | 23.4 | 1884.9 |
| 11. | Bossier | 1593 | 22.1 | 1784.1 |
| 12. | IGH 24 | 1544 | 21.4 | 1729.3 |
| 13. | ICAL 124 | 1481 | 20.6 | 1658.7 |
| 14. | ISRA 44A/73 | 1430 | 19.9 | 1601.6 |
| 15. | ICAL 109 | 1429 | 19.8 | 1600.5 |
| 16. | 7138 | 1022 | 14.2 | 1144.6 |



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## YIELD DATA FROM SOYBEAN VARIETY

## TRIAL AT YEZIN - ARI - 1981-82

| NO. | VARIETY | POUNDS PER ACRE | BASKETS PER ACRE |
|---|---|---|---|
| 1 | 20280-11-11 | 920 | 12.8 |
| 2 | 50106-4-7 | 643 | 8.9 |
| 3 | 7207-1 | 518 | 7.2 |
| 4 | 7024-2 | 482 | 6.7 |
| 5 | Clark 63 | 402 | 5.6 |
| 6 | 11-4 | 286 | 4.0 |
| 7 | Multivar 80 | 214 | 3.0 |
| 8 | 7024-3 | 179 | 2.5 |
| 9 | UPL-S4-2 | 125 | 1.7 |
| 10 | 30050-2-17 | 89 | 1.2 |

1982-83

| NO. | VARIETY | POUNDS PER ACRE | BASKETS PER ACRE |
|---|---|---|---|
| 1 | AGS 129 | 1263 | 17.5 |
| 2 | AGS 130 | 1171 | 16.3 |
| 3 | G. 2261 | 1158 | 16.1 |
| 4 | G. 9646 | 1132 | 15.7 |
| 5 | AGS 17 | 764 | 10.6 |
| 6 | Shwemyaingpale | 655 | 9.1 |
| 7 | AGS 62 | 446 | 6.2 |
| 8 | AGS 66 | 194 | 2.7 |

## YIELD DATA FROM SOYBEAN VARIETY

## TRIAL AT YEZIN - ARI - 1982-83

| NO. | VARIETY | POUNDS PER ACRE | BASKETS PER ACRE |
|---|---|---|---|
| 1 | 30290-11-11 | 881 | 12.2 |
| 2 | Shwemyaingpale | 864 | 12.0 |
| 3 | 7024-2 | 786 | 10.9 |
| 4 | Soyae-Bali | 768 | 10.7 |
| 5 | 11-4 | 668 | 9.3 |
| 6 | 50106-4-7 | 647 | 9.0 |
| 7 | Clark-63 | 618 | 8.6 |
| 8 | 7207-1 | 461 | 6.4 |
| 9 | 7024-3 | 402 | 5.6 |
| 10 | KB Soybean | 267 | 3.7 |
| 11 | Multivar 80 | 248 | 3.4 |
| 12 | UPL-S4-2 | 231 | 3.2 |

## YIELD DATA FROM SOYBEAN VARIETY

## TRIAL AT THE ARI IN YEZIN

## 1982-83

| NO. | VARIETY | POUNDS PER ACRE | BASKETS PER ACRE |
|---|---|---|---|
| 1 | Jupiter | 1148 | 15.9 |
| 2 | ACC. 2120 | 1109 | 15.4 |
| 3 | AGS-2 | 1013 | 14.1 |
| 4 | Shwemyaingpale | 908 | 12.6 |
| 5 | ST.2 | 906 | 12.6 |
| 6 | Orba | 890 | 12.3 |
| 7 | I-4 Tropicana | 878 | 12.2 |
| 8 | Improved Pelican | 868 | 12.1 |
| 9 | AGS-120 | 835 | 11.6 |
| 10 | Soybean (Red) | 632 | 8.8 |
| 11 | Soyae Bali | 623 | 8.7 |
| 12 | Tunia | 621 | 8.6 |
| 13 | ICAL-109 | 471 | 6.5 |
| 14 | 40142-0-54 | 452 | 6.3 |
| 15 | AGS-135 | 413 | 5.7 |
| 16 | Soybean (Lashio) | 361 | 5.0 |
| 17 | " " | 342 | 4.8 |
| 18 | " " | 328 | 4.6 |
| 19 | L-114 | 317 | 4.4 |
| 20 | G-9925 | 284 | 3.9 |
| 21 | AGS-130 | 284 | 3.9 |
| 22 | Shwewarlonethay | 280 | 3.9 |
| 23 | Soybean (Black) | 260 | 3.6 |
| 24 | G-9946 | 244 | 3.4 |
| 25 | G-9846 | 228 | 3.2 |
| 26 | 50269-7-6 | 209 | 2.9 |
| 27 | G-9645 | 175 | 2.4 |
| 28 | AGS-66 | 168 | 2.3 |
| 29 | AGS-62 | 145 | 2.0 |
| 30 | G-2261 | 80 | 1.1 |

## YIELD DATA FROM SOYBEAN VARIETY

## TRIAL AT THE ARI IN YEZIN

### 1982-83

| NO. | VARIETY | POUNDS PER ACRE | BASKETS PER ACRE |
|---|---|---|---|
| 1 | Jupiter | 1520 | 21.1 |
| 2 | AGS-135 | 1119 | 15.5 |
| 3 | AGS-124 | 1013 | 14.1 |
| 4 | AGS-19 | 1004 | 13.9 |
| 5 | AGS-79 | 977 | 13.6 |
| 6 | AGS-65 | 900 | 12.5 |
| 7 | AGS-160 | 876 | 12.2 |
| 8 | Williams 82 | 840 | 11.7 |
| 9 | AGS-167 | 789 | 11.1 |
| 10 | AGS-162 | 750 | 10.4 |
| 11 | AGS-66 | 725 | 10.1 |
| 12 | AGS-143 | 659 | 9.2 |

### 1983-84

| NO. | VARIETY | POUNDS PER ACRE | BASKETS PER ACRE |
|---|---|---|---|
| 1 | Jupiter | 1699 | 23.6 |
| 2 | AGS-129 | 1348 | 19.1 |
| 3 | G-9645 | 1168 | 16.2 |
| 4 | Shwemyaingpale | 1114 | 15.5 |
| 5 | AGS-2 | 1080 | 15.0 |
| 6 | G-9946 | 1068 | 14.8 |
| 7 | Williams | 1045 | 14.5 |
| 8 | AGS-12 | 987 | 13.7 |
| 9 | Improved Pelican | 982 | 13.6 |
| 10 | Williams 82 | 864 | 12.0 |
| 11 | AGS-130 | 842 | 11.7 |
| 12 | AGS-135 | 815 | 11.3 |
| 13 | G 9925 | 811 | 11.3 |
| 14 | AGS-58 | 807 | 11.2 |
| 15 | AGS-62 | 737 | 10.2 |
| 16 | G-9646 | 691 | 9.6 |
| 17 | AGS-66 | 650 | 9.0 |
| 18 | G-2261 | 624 | 8.7 |
| 19 | AGS-17 | 620 | 8.6 |
| 20 | Soybean (Lashio) | 302 | 4.2 |

INTSOY SOYBEAN VARIETY YIELD DATA

Planted: Dec. 11, 1983

Harvested: March 4, 1984

Cooperator: U Aung Kyaw Myint

Location: 17°N Latitute

Ingapu Township

| No. | Variety | Mean Yields | | |
|---|---|---|---|---|
| | | Pounds/ Acre | Baskets/ Acre | Kilograms/ Hectare |
| 1. | Statsa 194 | 684.0 | 9.5 | 777.32 |
| 2. | Braxton | 555.6 | 7.7 | 631.38 |
| 3. | Jupiter | 536.5 | 7.0 | 609.66 |
| 4. | AGSB | 478.4 | 6.6 | 543.69 |
| 5. | F75-9207 | 467.8 | 6.5 | 531.56 |
| 6. | SH1274 | 467.4 | 6.5 | 531.19 |
| 7. | EGSY 91-7 | 457.5 | 6.4 | 519.85 |
| 8. | DAVIS | 364.3 | 5.1 | 413.96 |
| 9. | ICA L-109 | 351.8 | 4.9 | 399.79 |
| 10. | 71-38 | 301.1 | 4.2 | 342.15 |
| 11. | IAC-6 | 286.9 | 4.0 | 326.07 |
| 12. | UFV-1 | 273.7 | 3.8 | 310.98 |
| 13. | IMPROVED PELICAN | 270.3 | 3.8 | 307.19 |
| 14. | ICA L-129 | 259.8 | 3.6 | 295.27 |
| 15. | ISRA/IRAT 44A/73 | 250.4 | 3.5 | 284.52 |
| 16. | IAC-8 | 197.5 | 2.7 | 224.38 |
| | LSD 5% | N.S. | N.S. | N.S. |

APPENDIX K

# RHIZOBIUM PRODUCTION AND UTILIZATION

# IN BURMA

Hla Than, Deputy General Manager,
Plant Pathology Division,
A.R.I., Yezin

## Introduction

Burma cultivates annually more than 3.4 million acres of peanuts and food legumes. This production is carried out in several land areas of different agro-climatic and ecological conditions. In the divisions of Magwe, Mandalay and Sagaing, peanuts are planted in May-June on soils which have been subject to temperatures of 40·C. In the divisions of Pegu, Irrawaddy, Rangoon and some parts of Mandalay and Sagaing Divisions, peanuts are planted on alluvial soils after paddy. Peanuts are also cultivated on lands which have been subjected to flooding during the monsoon season. The cultivation of food legume crops is initiated in the middle of August and continues till November. The time of seeding depends on the crop. Many farmers in Burma are applying urea fertilizer to these legume crops in order to supply them with their requirement for nitrogen.

## Production of Peat Inoculum

Urea is the main source of nitrogen fertilizer for agricultural production in Burma. the quantities available to farmers is inadequate even for the cultivation of paddy. In 1977-1978 the Ministry of Agriculture and Forestry of Burma became interested in developing alternate sources of nitrogen for Burma. This interest lead to the development of a project for rhizobial research and production at the Agricultural Research Institute in Yezin. Researchers at Yezin were successful in isolating cow-pea-rhizobium and under laboratory conditions peat inoculum was produced. This inoculum was tested on mung beans and chick peas. Significant increases in yield of these crops was obtained through rhizobium inoculation. Since 1978, inoculum production at Yezin has continued and the output has been increased to more than one hundred (100) metric tons annually.

## The Production of Rhizobium at Yezin

The facilities and materials used for production of inoculum at Yezin has been largely improvised by staff at the Institute for Agricultural Research. Due to the wide acceptance of the inoculum, the Agricutural Research Institute has continued to increase the production of rhizobium at Yezin. This has been done despite the fact that staff at Yezin recognize that present facilities may not allow for efficient production of rhizobium.

Presently the inoculum is produced in the following manner:

1. Peat drying the sterilizing.

Raw peat from either Maymyo in Mandalay Division or from the valley of Heho in Shan State are sun dried and ground. After grinding, the peat is sterilized in a baking room at 300-400·C. for one hour. Alternatively, the peat may be steamed for three hours at 125·C.

2. Fermentation.

During the development of rhizobium production in Yezin, different types of fermention have been used. Bottles, culture flasks, plastic bottles and G.I. sheets have been used to produce broth inoculum. During the 1982-1983 crop season, a drum-type fermentor has been developed and utilized by the project staff.

3. Medium Production.

For research purposes, yeast manitol extract either alone or impregnated with Congo Red or Bromethyl Blue is used. For commercial production, chick pea broth made of seventy-five (75) grams of chick pea seed, 1.5 grams of cane sugar, and 1,000 ml. of water are used.

4. Mixing of Rhizobium with Peat.

Five days after multiplying Rhizobium in the fermentor, it is aerated and the suspension is mixed with sterilized peat in a minitype concrete mixer. Blending is done in the ratio of 3 grams of peat and one ml. of suspension. No curing is carried out.

5. Packaging.

Inoculum is weighed and put into packages of 250 grams. This packet is sufficient for inoculation of one acre of legume seeds. The packets are then stored at 17-20·C in an air-conditioned room and the rhizobium is distributed to township offices of the Agriculture corporation. The Agriculture Corporation is responsible for distribution and sale to farmers.

## Strain Identification

Time, personnel and facilities have not allowed for a great deal of research in the identification of strains of rhizobium. Soil microbiologists from Australia have been kind enough to furnish the Agriculture Research Institute of Yezin with the Israelian strain 297/A which is used for groundnuts, mung beans and lima beans. The strain CC119Z is used for chick peas.

## Impact of Rhizobium Inoculation

There has been a significant acceptance of rhizobium inoculum by Burmese farmers. During the 1981-1982 crop season, more than sixty (60)

metric tons of groundnut and fifty-five (55) metric tons of chick pea inoculum were distributed to farmers. Most farmers and township managers reported increased plant growth and yield as a result of inoculation.

## Research on Rhizobium

To date little research has been carried out in Burma relative to rhizobium. Most of the efforts in Burma have been focused on developing facilities for rhizobium production. It is recognized that there are specific rhizobium research needs for Burmese farmers. These needs include the effectiveness of different rhizobium strains, the quality of rhizobium inoculum, constraints to effective rhizobium use, and those problems associated with production, storage, and distribution of rhizobium. Burma has had to rely in the past on borrowed technology. Efforts must be expanded to enable Burma to seek answers to her problems in Burma.

## Technical Assistance Requirements

### A. Long-Term

| Specialty | 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 |

### B. Short-Term

| 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 |
| 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 |

C. Long-Term TA Scopes of Work

1. 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 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.

2. 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.

d. 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.

3. 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 patterns are developed.

f. Farm management experience 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.

Source: Project Paper, PP 80-85.

APPENDIX M

## LIST OF CONSULTANTS

| | |
|---|---|
| Gaylord V. Skogerboe, Irrigation Engineer<br>Irrigation and drainage | 13 June to 4 August 1982 |
| Robert J. Davis, Soil Microbiologist<br>Rhizobium technology, inoculant | May 1982<br>12 to 26 February 1983 |
| Richard J. Isert, Service Mgr, John Deere<br>Weerachit Sirikul, CPAI, Serv. Sup.<br>Ampol Boon-oua, CPAI, Sen. Mech.<br>Equipment set-up and maintenance | 16 to 30 August 1984<br>1 - 23 March 1985 (planned) |
| M. D. Robinson, Elec. Eng.<br>Electrical rqts and distribution systems | February 1983 |
| Bill Gregg, Seed Technologist<br>Location oif seed farms, seed handling and processing | 10 to 24 December 1981 |
| James C. Delouche, Seed Technologists<br>Edgar Cabrera<br>G. Burns Welch<br>William Boyd | 3 wk April-May 1982<br>March 1983 |
| Chamnon Chutkaew, corn breeder | 2 wks September 1984 |
| A. Ben Manring, PSA | about once each year<br>2 to 18 August 1984 |

Planned: 3 farmers, 1 agricultural mechanic, 1 animal traction machinery

## LONG TERM TRAINING, COURSES, AND TOURS

### LONG TERM TRAINING FOR MSc. DEGREE UNDER MUCIA CONTRACT - NO. ASB-0005-C-00-2046-00

| Course | Dates | Participants | University |
|---|---|---|---|
| Agricultural Extension | June 13, 1983-Aug. 31, 1985 | U Than Htay | Ohio State |
| Soil Science | June 13, 1983-Aug. 31, 1985 | U Kyaw Soe | Ohio State |
| Plant Pathology | Aug. 18, 1983-Aug. 31, 1985 | U HLa Myint | Texas A & M |
| Agriculture Economics | Aug. 18, 1983-Aug. 31, 1985 | U Tin Htut Oo | Ohio State |
| Agriculture Economics | Aug. 18, 1983-Aug. 31, 1985 | U Soe Win Maung | Ohio State |
| Water Management | Aug. 18, 1983-Aug. 31, 1985 | U Hoke San | Colorado State |
| Maize Breeding | Aug. 25, 1983-Sept.10, 1985 | U John Ba Maw | Ohio State |
| Groundnut Agronomy | Aug. 25, 1983-Sept.10, 1985 | U Tin Win | Georgia |
| Groundnut Breeding | Aug. 25, 1983-Sept.10, 1985 | U Saw Thet Swe | Georgia |
| Agronomy | May 28, 1984-June 3, 1986 | U Kyaw Moe | Texas A&M |
| Extension & Rural Development | May 28, 1984-June 3, 1986 | U G. Thang Khan Mung | Texas A&M |
| Crop Breeding | May 28, 1984-June 3, 1986 | U Tin Nwe | Texas A&M |
| Seed Technology | June 12, 1984-June 15, 1986 | Daw Htay Htay Win | Georgia |
| Seed Technology | June 12, 1984-June 15, 1986 | U San Nyunt | Oregon State |
| Seed Technology | June 12, 1984-June 15, 1986 | U Mya Than | Oregon State |
| Seed Technology | Aug. 22, 1984-Sept. 22, 1986 | U Thein Hoon | Mississippi State |

MAIZE AND OILSEEDS PRODUCTION PROJECT (482-0005)

| Title of Course/Location | Dates | Participants |
|---|---|---|
| Agricultural Project Planning and Analysis (TC 140-2), Washington, D.C. | May 17, 1982-July 23, 1982 | U Sann Myint<br>U Thaung Tun Hlaing<br>U Kyaw Myint |
| Agricultural Project Implementation (TC 140-16), Washington, D.C. | July 26, 1982-Sept. 3, 1982 | - ditto - |
| Development and Operation of Agricultural Extension Programs (TC 110-5), Univ. of Missouri | June 7, 1982-Aug. 6, 1982 | U Khin Maung Aye<br>U Maung Maung<br>U Aung Soe Myint |
| Keys to Agricultural Development at the Local Level (TC 140-32) | Aug. 9, 1982-Aug. 20, 1982 | - ditto - |
| **8-MEMBER Summer Extension Study Tour** | | |
| (1) Sunflower Team | Aug. 9, 1982-Oct. 1, 1982 | U Tun Shwe<br>U Kyaw Kyaw Nyein |
| (2) Soybean/Peanut Team | Aug. 23, 1982-Oct. 1, 1982 | U Siang Uk<br>U Ba Thaung |
| (3) Sesame Team | Aug. 23, 1982-Oct. 1, 1982 | U Kyaw Khin<br>U Hla Myo |
| (4) Maize Team | Aug. 23, 1982-Oct. 1, 1982 | U Chit Saing<br>U Aye Myint Tun |
| Agricultural Project Planning and Analysis (TC 140-2), Washington, D.C. | April 18, 1983-June 24, 1983 | U Mya Maung<br>U Hla Oo<br>U Aung Sann |

MAIZE AND OILSEEDS PRODUCTION PROJECT (482-0005) Cont'd

| Title of Course/Location | Dates | Participants |
|---|---|---|
| Agricultural Project Implementation (TC 140-16) Washington, D.C. | June 27, 1983-Aug. 5, 1983 | U Mya Maung<br>U Hla Oo<br>U Aung Sann |
| NIFTAL Training Course in Legume/ Rhizobium Technology, Bangkok | Nov. 11, 1982-Dec. 10, 1982 | Daw Khin San Wai<br>Daw Nwe Nwe Aung |
| NIFTAL Training Course in Rhizobium Technology, Hawaii and US Mainland | May 1, 1983-July 31, 1983 | U Hla Than |
| Micro-Computer Training, BUCEN, Washington, D.C. Carbondale, Illinois | Sept. 6, 1983-Dec. 24, 1983 | U Kyi Win<br>U Maung Maung Yi |
| Applied Use of the Nitrogen-fixing Aquatic Fern Azolla, Bangkok, Thailand | Jan. 22, 1984-Feb. 4, 1984 | U Thein Win<br>U Sein Win |
| Technical and Economic Aspects of Soybean Production, TC 120-6 Champaign, Illinois | May 28, 1984-Aug. 31, 1984 | U Tun Thein<br>Daw Shirley Smellie<br>Daw Nyunt Nyunt Wai |
| Maize, Groundnut & Sunflower Production (Study Tour), Ohio State U. | June 27, 1984-Dec. 15, 1984 | U Than Tun |
| World Cowpea Research Conference & Study Tours, IITA, Ibadan Nigeria; ICRISAT, Hyderabad, India; and Kasetsart Univ., Thailand | Nov. 4, 1984-Dec. 15, 1984 | U Siang Uk<br>U Pe Maung Thein |

MINISTRY OF AGRICULTURE SHORT TERM OBSERVATION & STUDY TOUR UNDER MUCIA CONTRACT NO. ASB-0005-C-00-2046-00

| Course | Dates | Participants |
|---|---|---|
| Sunflower Production | July 14, 1984-Oct. 19, 1984 | U Sein Win |
| " | " | U Htwe |
| " | " | U Win Myint |
| " | " | U Kyaw Maung |
| Maize Production | " | U Tun Yi |
| " | " | U Aye Thein |
| " | " | U Hla Kyi |
| " | " | U Soe Win .....(8) |
| Sesame Production | Aug. 16, 1984-Nov. 15, 1984 | U Tun Than |
| " | " | U Mya |
| " | " | U Mya Tha |
| " | " | U Ko Lay |
| Peanut Production | " | U Hla Toe |
| " | " | U Bo |
| " | " | U Myint Thein .....(7) |

Maize and Oilseeds Production Project
List of Farm Equipment (SRUB contribution)

| Sr. No. | Name | Chaungmagyi | Sebin | Kyaungsu | Thitcho |
|---|---|---|---|---|---|
| 1. | Zwe Tractors | 4 | 3 | 5 | 10 |
| 2. | Power tiller | 5 | 5 | 5 | 15 |
| 3. | Pumps (Low Lift) | - | - | 1 | 3 |
| 4. | Pumps (High Lift) | 5 | 4 | 2 | 5 |
| | Disc plough | 1 | 2 | 2 | 2 |
| | Harrow | - | 2 | 2 | 4 |
| | Trailers | 5 | 3 | 4 | 10 |
| 5. | Corn Sheller | 1 | - | - | 2 |
| 6. | Power Sprayer (ADM) | 4 | 5 | 5 | 17 |
| 7. | Knapsack Sprayer (A-8) | - | - | - | 54 |
| 8. | Bullock | 10 | 10 | 17 | 30 |
| 9. | Plough (Animal drawn) | 5 | 5 | 5 | 10 |
| 10. | Harrow (Animal drawn) | 5 | 8 | 18 | 10 |
| 11. | Plant Junior Plough (Animal drawn) | 3 | 3 | 9 | 18 |
| 12. | Seeder (Animal drawn) | 2 | 4 | - | - |
| 13. | Bullock cart | - | 1 | 2 | 8 |