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REPORT ON  
A REVIEW OF  
AGRICULTURAL RESEARCH  
IN  
THE SOCIALIST REPUBLIC OF  
THE UNION OF BURMA

USAID, RANGOON

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## SUMMARY AND RECOMMENDATIONS

Agriculture is the mainstay of the Burmese economy. The sector accounts for 45 percent of the GDP and employs 64 percent of the country's labor force.

Rice is the most important crop, accounting for 60 percent of the total net acres sown. A varietal rice improvement program started in the mid 70's drawing largely on research at IRRI, led to the release of high yielding varieties adapted to Burmese conditions which, along with an effective extension program, resulted in doubling production over the past decade. Successful expansion to other crops and other areas will be limited by the capacity of the agricultural research system to solve the many agronomic and economic problems that constrain production. This review was undertaken to provide an assessment of the overall agricultural research system in Burma and to determine the appropriateness and priority areas for any U.S. assistance for strengthening Burma's agricultural research capacity.

The Agriculture Corporation, in the Ministry of Agriculture and Forests is responsible for crop production, extension and research. The Corporation has a Managing Director, eight General Managers and two Deputy General Managers covering administration and various operating activities. This review was concerned primarily with research activities under the General Managers of the Agricultural Research Institute at Yezin and the Applied Research Division.

The Agricultural Research Institute (ARI) at Yezin and the Applied Research Division (ARD), headquartered in Rangoon but with a network of 19 central (research) farms and 21 seed farms, are responsible for conducting agricultural research. The distinction between the function of the two

is implied to be more basic research for ARI and applied research for ARD. In practice, however, their research activities are very much the same. The ARD, in addition to its research functions, is also responsible for seed production. The ARI also carries out certain service functions, including production of rhizobium and production and distribution of rodent bait.

The Team concludes that the single most limiting constraint to sustained growth in agricultural productivity is a general shortage of research staff, and particularly a shortage of adequately trained scientific staff. While top leadership at both ARI and ARD is strong, neither agency has enough well qualified scientific staff to meet Burma's agricultural research needs.

There are also serious deficiencies in research facilities at the ARI at Yezin and at the central research farms of ARD. Library facilities are very inadequate at the headquarter stations and virtually non-existent at the Central farms. A network of 19 central research farms and 21 seed farms have been established under ARD to service the major agro-ecological zones of the country. On those which the Team visited there are major deficiencies in water management and in equipment for proper seed bed preparation, planting, weed control and harvesting.

The Team concludes that the deficiencies in trained scientific manpower should, ultimately, be met primarily by Burmese institutions. The Institute of Agriculture at Yezin is now producing 300 BAgr degree graduates annually who are reportedly well trained for that level. Most of these are absorbed in an expanding extension service. The College has initiated an MSc program in six disciplines but has not, so far, granted any MSc degrees. Burma's requirements for scientific staff trained to the MSc and PhD levels will, therefore, need to be met by training outside Burma for several years. There will be a continuing need for staff members of the

Burmese research organizations to participate in short-term training abroad, particularly at the International Agricultural Research Centers where the training can also serve as an important means for strengthening linkages with the centers.

The Team concludes that there are opportunities for more efficient arrangements within the three primary functions of research, extension and seed production and other services. It is recommended that the research activities of ARI and that part of ARD which deals with research be combined as a Burma Agricultural Research Service (BARS). It is also recommended that two new units, one for on-farm water management and the other for farm mechanization, be established.

It is recommended that a new division of Seed Production Services (SPS) be created within the Agriculture Corporation with responsibility for producing, supervising quality control, and distributing seed. The central farms and seed farms should limit their seed activities to production of foundation seed (the first generation of the breeders seed). Breeders seed would be the responsibility of the plant breeders in BARS. To expand production of high quality seed it is recommended that highly successful farmers produce pure seed of the generations beyond foundation seed. This would be inspected, tagged, sealed and identified as certified seed by officials of SPS. The Seed Production Service could also be assigned responsibility for other services such as production of rhizobium cultures and rat poison.

The Agricultural Extension Service is doing a good job in training farmers. It is recommended that it also take on the responsibility for training farmers at the central farms, with assistance from the central farm staff, and that it turn over its seed production activities to the proposed Seed Production Service.

It is recommended that members of the research staff at the ARI at Yezin who have MSc and PhD degrees be granted courtesy titles in the Institute of Agriculture . This would permit the participation of ARI staff in guiding thesis research of graduate students at the College and further the research work of ARI.

It is recommended that working groups similar to the Working Group for Rice, with representation from research, extension and seed production, be appointed for planning and coordinating the work on other important crops.

The Assessment Team suggests some high priority areas for donor assistance, appropriate for USAID support, that would strengthen Burma's capacity to meet the research needs for sustained growth in agricultural productivity. These include:

(1) a project on crop production, focusing primarily on maize, oilseeds and selected food crops. It would go beyond the scope of the current AID supported Maize and Oilseeds Production Project to develop the capacity to solve the many economic and agronomic problems that will become more critical as agriculture becomes more intensive. The problems to be solved include inadequacy of farm equipment for requirements of double and triple cropping; the disease and pest problems associated with more intensive cultivation; harvesting and post-harvest handling of larger crops and modified cropping systems; on farm storage and storage problems at local and central terminals; and a host of marketing problems to guide adjustments to changing domestic and export market opportunities. Creation of an Agricultural Economics Unit within the research system to conduct a whole range of analysis, including marketing studies and other analyses to guide agricultural policy, is recommended.

(2) Water Management and Irrigation for winter crop production in the Delta. Delta lands are primarily used for rice production in the monsoon season. The goal of this project would be to bring these lands under cultivation during the dry season through improved water management and by increased irrigation. The project would train specialists in water management, crop production, crop processing and marketing of delta grown winter crops; employ experts in ground water analysis to provide estimates of the amount, location and costs of developing ground water in the delta; engage in agronomic studies to determine crops and crop varieties adapted to the delta during winter months; devise better systems and equipment to quickly prepare rice fields for winter crop production, with special attention to cultural practices using animal power; and discover and exploit use of winter adapted leguminous nitrogen fixing crops as a means of providing nitrogen for the next crop in the rotation.

(3) Training. A general shortage of adequately trained scientific staff pervades the research system. Assistance from bilateral and multi-lateral donors will be required. While the long-term needs for the next 20 years, as well as the near term needs should be considered, much of the training requirements can be met through production projects that take into account the short and long term needs for sustaining growth in agricultural production. The Team strongly recommends that the Agriculture Corporation carry out an Agricultural Research Manpower needs study covering the current 4-year plan plus the 20-year prospective plan periods. This should strengthen the Burmese Government in negotiating with donors when planning new projects. The study should be useful in planning for advanced degree training at the Institute of Agriculture at Yezin as well as for degree training abroad through external assistance. It is also recommended that specialized short-term training needs be identified and scheduled, with a high

priority given to such training at the international agricultural research centers.

## I. INTRODUCTION

Since the mid 1970's economic policy of the Government of the Socialist Republic of the Union of Burma has shifted emphasis from heavy industry to agriculture, recognizing the vital importance of improvements in agriculture for the overall development of the country. The current 4-year plan (1982/83-1985/86) allocates 20 percent to agricultural investment and targets an average of 4 percent annual real growth in agriculture over the plan period.

Prior to 1975, annual growth in agriculture averaged 2.3 percent, barely keeping pace with growth in population. A varietal rice improvement program started in the mid-seventies, drawing largely on research from IRRI, led to release of high yielding varieties adapted to local conditions. The new varieties, along with an effective extension service and increased use of fertilizer and other inputs, resulted in a remarkable increase in yields, doubling production of rice during the past decade. A similar strategy is being undertaken for several other crops.

Successful expansion to other crops and to other areas will be limited to a large extent by the capacity of the research system to solve the many agronomic and economic problems that constrain production.

Economic studies in many countries and on many commodities have shown that returns realized on investments in agricultural research have been extraordinarily high. They have shown that costs of producing agricultural growth through research investments are a small fraction of the costs of achieving growth through alternative means.

In this assessment of the agricultural research system of Burma we attempt to identify the kinds of investments needed to develop research capability to solve Burma's agricultural production problems and to sustain production in the future.

## II. THE AGRICULTURE SECTOR

Burma is well endowed with natural resources. It has a substantial area of arable land and significant water resources. Of the total land area of 676,588 square km, half is in forests and about 27 percent is considered suitable for cultivation; however, only 40 percent of this is under cultivation due to low rainfall and limited availability of water. Burma has vast irrigation potential but less than 15 percent of the area cropped is irrigated, and only 15 percent of the irrigated areas is double cropped. Because of the relatively low population density of 148 people per square km of arable land, one of the lowest in Asia, there has been little pressure for expansion of cultivation onto new land areas.

The agriculture sector accounts for 45 percent of the Gross Domestic Product and employs about 64 percent of the country's labor force. In 1981-82 the sector accounted for 57 percent of the country's foreign exchange earnings.

With the introduction of measures designed to give tenure to actual tillers of the land, the number of farmers with large holdings has declined while the number of small land holders has increased substantially. Holdings of 10 acres or less now take up 55 percent of the total acreage and are held by 85 percent of the farming population. The remaining 45 percent of land in farms of 10 acres or more are held by 15 percent of the farmers. Less than 3 percent of the farmers have holdings of 20 acres or more.

Rice is, by far, the most important crop, accounting for about 60 percent of the total net area sown. A variety of subsidiary crops are grown, primarily in unirrigated areas. Increased domestic demand for food has led to more double cropping of crops after paddy. Yet, cropping intensity remains at only 120 percent due in great part to the limited actual acreage under any form of irrigation.

Burma is composed of seven divisions and seven states, which include 314 townships (27 urban and 287 rural). Agricultural production can be divided into two regions, Upper Burma and Lower Burma. Upper Burma, a flood plain created by the Chindwin and Irrawaddy rivers, include the Divisions of Mandalay, Sagaing and Magwe. South of Mandalay, the flood plain narrows for about two hundred miles before it opens again into a second major flood plain known as Lower Burma. While Upper Burma averages only 30 inches of rainfall annually, Lower Burma normally receives 100 inches per year.

Agricultural policy, including research, is laid down by the Burma Socialist Program Party and Council of State and then translated into strategic plans by the Agriculture Study Group under the chairmanship of the Minister of Agriculture and Forests. The research plans are prepared by the Agricultural Science Research Committee of the Agricultural Science Research Division. On this Committee sit representatives of the Agriculture Corporation and the Universities and university level Institutes of Agriculture and Forests.

Overall responsibility for managing and implementing agricultural activities rests with the Ministry of Agriculture and Forests, which consists of seven Departments and three Corporations (Figure 1). The Agriculture Corporation, under its Managing Director, is responsible for all aspects of crop research, development and production. Forestry activities fall under separate departments or corporations.

The organizational structure of the Agriculture Corporation is depicted in Figure 2.

Figure 1

ORGANIZATION  
OF  
THE MINISTRY OF AGRICULTURE & FORESTS

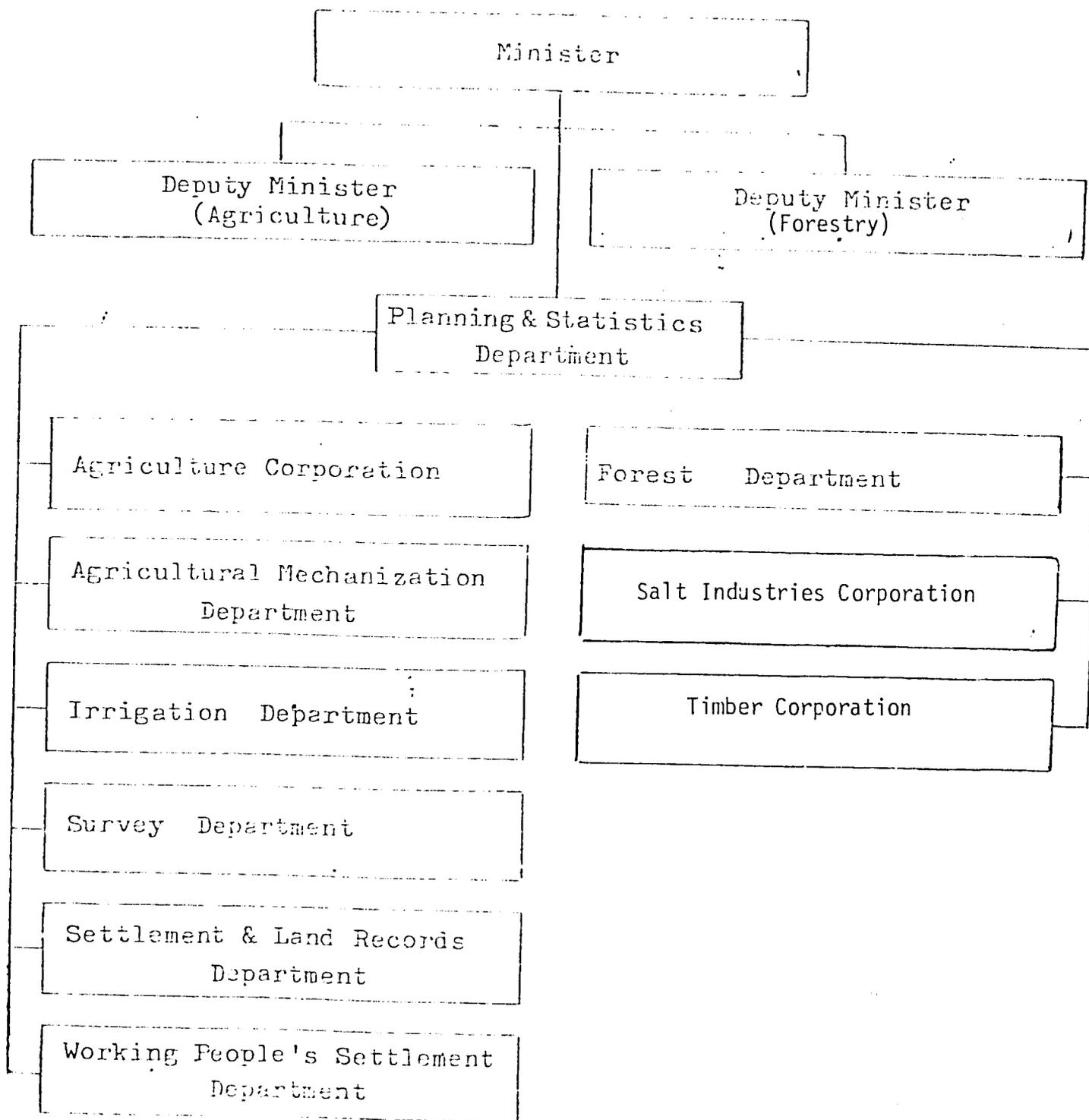
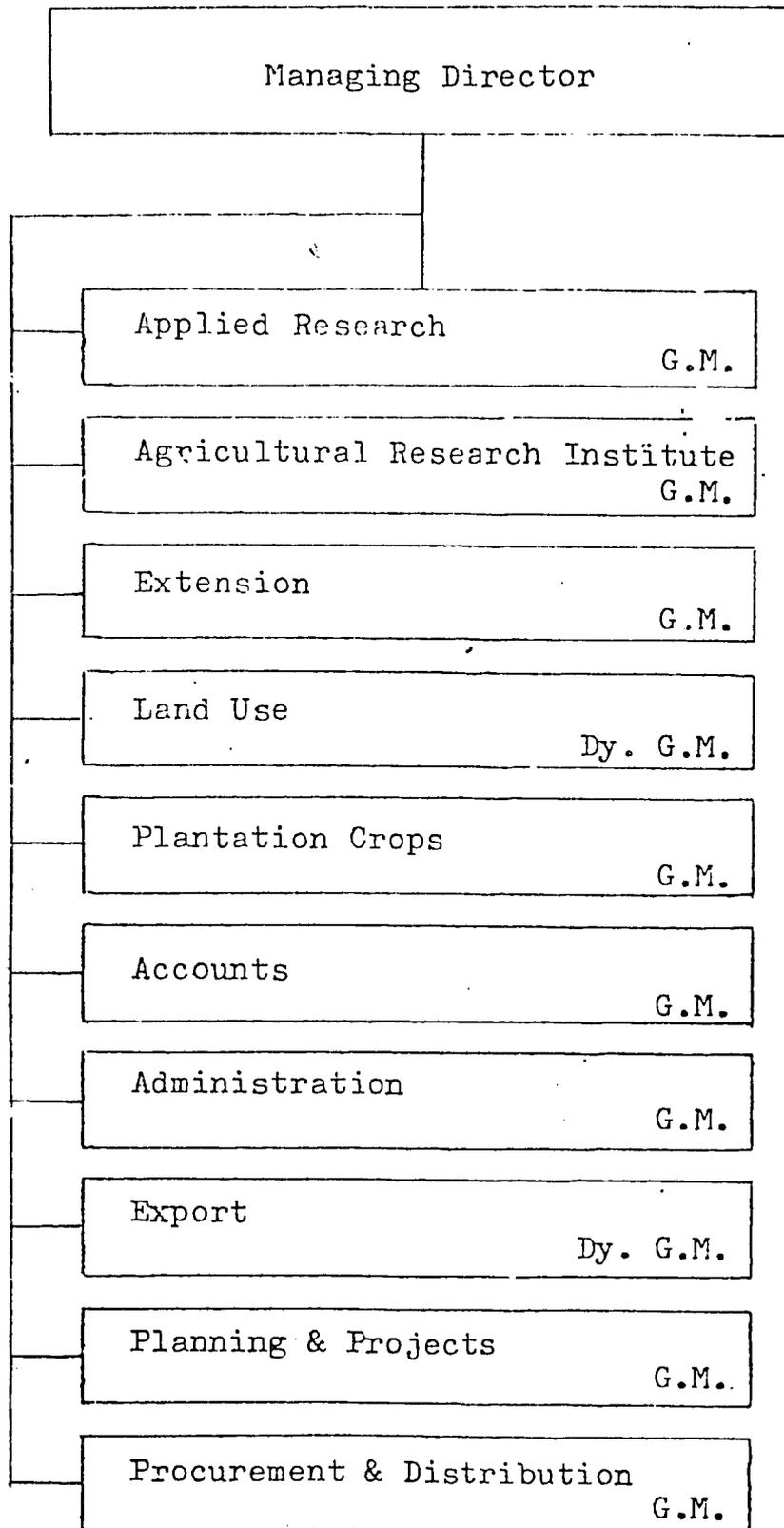


Figure 2

OF  
THE AGRICULTURE CORPORATION



### III. THE AGRICULTURAL RESEARCH SYSTEM

#### 1. Structure and Organization

The structure of the agricultural research system of Burma is rather complicated because there are two research agencies whose activities are overlapping. Both are branches of the Agriculture Corporation.

The Agriculture Corporation is the agency of the Ministry of Agriculture and Forests given responsibility for crop production, extension, and research as well as other activities outside the concern of this review. The Corporation has a Managing Director, eight General Managers and two deputy General Managers covering administration and its various operating activities. The three General Managers of interest to this review are the General Managers for Extension, the Agricultural Research Institute, and the Applied Research Division.

##### (a) Agricultural Research Institute (Yezin)

This Institute was established in 1971 and was organized into seven crop divisions and five disciplines in 1978. They are:

##### Crop Divisions:

1. Rice
2. Maize and other cereals
3. Oil seeds
4. Fiber crops
5. Food legumes
6. Sugar crops
7. Horticulture

##### Discipline Divisions:

1. Agronomy
2. Botany
3. Chemistry
4. Entomology
5. Plant Pathology

The Institute has a scientific staff authorization of 74 Research Officers and 202 Research Assistants. However, of the 74 Research Officers authorized, only 35 positions are filled, leaving over half as vacancies.

Only 3 Research Officers have PhD degrees and 10 have MS degrees. The others have BSc or BA degrees.

Research activities of the Institute include germ plasm collection and evaluation, selection and varietal improvement, crop culture techniques, seed production, crop responses to fertilizers, control of crop pests and diseases, and various other miscellaneous studies and activities. The task force was able during their short sojourn at Yezin to visit with a limited number of staff and review some of the research activities of the Institute. The staff members were enthusiastic about their work and displayed considerable interest in developing solutions to local agriculture problems.

(b) Applied Research Division

The Applied Research Division (ARD) is headquartered in Rangoon and conducts its primary research work on 19 central farms scattered throughout Burma. These farms represent the principal ecological and geographical locations for agriculture. Activities of the Applied Research Division are varietal adaptation, rice breeding, production of foundation seed, agronomic practices, mushroom breeding and production, and cell culture studies to produce virus-free potatoes, sugar cane, etc. Because of the many central farms operated by the Agricultural Research Division, they are in a somewhat more favorable position for solving farm problems than is the Agricultural Research Institute. The number of more highly trained professional staff (5 PhD's and 10 MSc's) is about the same as for the Agricultural Research Institute, but the total scientific staff of ARD is at least five times greater. The distinction between the functions of the two research agencies is implied to be more basic research for ARI and applied research for ARD. In practice, however, their research activities are very much the same.

The ARD has responsibility for seed production of major crops and operates 21 farms for this purpose. The crops include rice, sunflowers, cotton, sesame, wheat, barley, maize, groundnuts, sugarcane and pulses. Total land area suitable for crops was about 3000 in 1979-80, to which additions have since been made.

(c) Linkages with other Research Institutions, Education, and Extension Agencies

ARD and ARI have enjoyed very successful linkages with the International Rice Research Institute in the Philippines. A plant breeder from IRRI has been located with ARI at Yezin for a number of years. Through this association, several IRRI-bred rice varieties were introduced and tested but were found unacceptable because of poor quality and too short of stature for the flooded fields in Burma. Through a breeding program, the high yielding capabilities of some IRRI varieties have been crossed with native Burmese varieties to yield new varieties with high yielding, good quality characteristics and adapted to the various ecological conditions in Burma. Over two million acres have been sown to these varieties and their use continues to expand. IRRI also has provided valuable assistance in training.

The Agency for International Development is supporting a Maize and Oilseeds Production Project. Although directly linked with Extension, the project is cooperative with the ARI and ARD and has benefited from the assignment of ARI personnel to the project and from the use of ARI plant materials. The project is providing advanced degree training for key staff in the several Agriculture Corporation divisions, including ARI and ARD, which have responsibility for maize and oilseed crops.

The close location of the Institute of Agriculture and the ARI at Yezin has permitted some cooperation between them. ARI staff give lectures at

the college from time to time. Some graduate students use ARI facilities for thesis research. There are further possibilities for cooperation that could be mutually beneficial.

The research extension linkages appear to be very good. A system is used at the township level that links a new technology to governmental support, the community organization, and to demonstration and competition. Awards are given to those farmers who excel in the production of various crops. Concentrated training is given to village managers by the research workers. Research workers also assist managers in the training of farmers. In our view, any weak link in the system resides with limitations in developing new technology rather than in processes of disseminating it to users.

## 2. Research Staffing

Following is a summary description and discussion of research staffing—specifically for the Agricultural Research Institute and the Applied Research Division. It is based on preliminary impressions and limited data.

Advanced education in science and technology (although somewhat limited because of resource constraints) leading to positions in government service, and support for agricultural in-service training are established policies of the Burmese Government. Those admitted for advanced education beyond high school and especially the few considered for degree and non-degree training abroad are carefully screened; only the most capable receive this education and training. In-service training for agricultural research and extension staff, and for farmers working with extension in production programs, receive high priority for budget resources. The team recognizes that considerable progress has been made in training agricultural staff over the past 10-15 years, including some research officers and assistants; however,

professional training of the growing research staff needs to be accelerated to support sustained increase in agricultural production.

a. Agricultural Research Institute at Yezin (ARI)

ARI's seven Commodity and five Disciplinary Divisions have 152 and 123 research and assistant staff positions respectively for a total of 276 (Table 1). However, a substantial number of positions are not filled (estimated at over 90 as of December, 1983). Some staff are detached outside ARI or otherwise not available for sustained research work. With the exception of a few key research officers and assistants, most do not have the highly specialized skills and advanced training for conducting research. The most critical shortage is in specialized postgraduate training.

Of the 74 scientific research officer positions, ARI indicated that 35 positions, including 3 chiefs of Divisions, were vacant for a variety of reasons. Within this category only 3 PhDs and 10 MSc officers were in place as of December 1983. Suggested training needs to achieve authorized staffing is presented in Table 2. Several ARI research officers and assistants have received specialized short-term training outside Burma (IARCs, Asia and Western nations) but clearly considerably more of this type of training is necessary.

Because of Burma's dearth of highly trained agricultural scientific staff, ARI has recently been the source of senior staff transfers for priority projects and programs (especially those supported by external donors) and for senior positions within the Agriculture Corporation. This trend is likely to continue. Longer term assignment of postgraduate trained officers within their disciplines or speciality crop areas will enable them to make greater research contributions. Several officers were assigned to other disciplines or outside research after returning from training, some at a point when they were well into a research activity.

Table 1.

STAFFING - AGRICULTURE RESEARCH INSTITUTE AT YEZIN

	<u>Research Officers</u>	<u>Research Assistants</u>	<u>Support Staff</u>	<u>Totals</u>
A. <u>Commodity Divisions</u>	(42)	(110)	--	(152)
Rice	7	21	--	28
Maize & Other Cereal Grains	7	16	--	23
Oilseed Crops	7	18	--	25
Food Legumes	6	13	--	19
Horticulture	5	11	--	16
Fiber Crops	5	17	--	22
Sugar Crops	5	14	--	19
B. <u>Discipline Divisions</u>	(31)	(92)	--	(123)
Agronomy	6	24	--	30
Botany	5	10	--	15
Chemistry/soils	9	28	--	37
Entomology	6	15	--	21
Plant Pathology	5	15	--	20
C. <u>Administration</u>	(1)	--	(255)	(256)
<u>Total ARI staff</u>	(74)	(202)	(255)	(531)
<u>Total Research Staff</u>	<u>74</u> <sup>a/</sup>	<u>202</u> <sup>b/</sup>	--	<u>276</u>

a/ Graduate B.S. or higher; 3 PhDs and 10 M.S. degree staff as of 12/83; est 35 positions vacant

b/ Includes Sr. and Jr. research assistants, field and laboratory assistants; few are graduates

c/ Office and workshop staff (est 75) and permanent laborers (est 180); another 800-1000 field laborers are hired on a seasonal basis.

Table 2

RESEARCH OFFICERS AT YEZIN AT PRESENT, AUTHORIZED STAFFING NUMBERS, AND SUGGESTED TRAINING NEEDS TO ACHIEVE AUTHORIZED STAFFING

<u>Activity</u>	<u>Level of Training</u>	<u>Present Staff</u>	<u>No. Authorized and suggested training level</u>	<u>Needed to Achieve Authorized Level</u>
Administration	PhD	0	1	1
	MSc	1	1	0
	BSc/BAg	2	0	0
Commodity Divisions	PhD	1	8	7
	MSc	5	15	10
	BSc/BAg	13	20	7
	Dip	1	0	0
Disciplinary Divisions	PhD	2	7	5
	MSc	2	15	13
	BSc/BAg	8	7	0
Total		35	74	43

UNDP/FAO has been the primary donor to date assisting ARI upgrade its scientific capacity at the postgraduate level and they are urging acceleration of such fellowship training programs. The IRRI-Burma Cooperative Project which is the current program providing training resources for ARI has programmed 24 postgraduate fellowships (16 MSc, and 8 at the PhD level although half of these will likely be MSc). An additional 11 officers are in short-term specialized courses at IRRI (6) or are preparing to go to Canada (5) for training.

The AID supported Maize and Oilseeds Production Project is providing up to 36 advanced degrees (11 MS/PhD and 25 MS) for key staff of the Agriculture Corporation including ARI and ARD. On their return they will fill technical, management and research positions strengthening the maize and oilseed research-extension linkage. To the extent possible, thesis research will deal with problems of oilseeds and maize production in Burma. Part of the training period may also be in Burma.

Appendix I lists multilateral and bilateral assistance projects with research components. Most of these include training activities which contribute to enhancement of the capabilities of Burma's agricultural research personnel.

Training requirements have been identified in all disciplines, but training of key individuals to focus on adaptive and applied research leading to increased production is emphasized by the Agriculture Corporation. A shortage of staff trained in soils and water management were noted for research on oilseeds, maize and other cereals (except rice) and food legumes. Other needs are for specialists in plant breeding, crop protection, weed control, agricultural economics, and the planning and design of research.

Another identified need that can be addressed within Burma is upgrading of research officers to the MSc level (and research assistants to the BS level) at the Institute of Agriculture at Yezin. For example, an estimated 80 percent of the ARI Research Officer positions (see Table 2) are potential candidates. Several were reported starting in the program. Graduate and postgraduate work in-country and increased capacity in English will better prepare potential Agriculture Corporation candidates for scientific training outside Burma.

b. Applied Research Division (ARD)

ARD reported a total of 2,500 positions, including laborers, but on-board staffing of only about 1,200. They are tasked with several agricultural support services, primarily improved seed multiplication, in addition to adaptive and other types of applied research, e.g. variety trials and agronomic cropping systems work. The focus of this review is on the limited number of technicians and research staff with scientific/education levels from diploma to PhD. They are estimated at 314 (See Table 3). Time did not permit a break-out of research staff from other technical service staff or a break-out of disciplinary areas. Many have mixed functions. A rough estimate is that three-fifths of the on-board staff (or the full-time equivalent of 180 staff to account for those with mixed functions) devote primary attention to applied research or management of this research. Staff are spread over 19 central (experimental) farms and 21 seed farms located in the various administrative and agro-ecological regions of Burma, and the headquarters in Rangoon with administrative and technical backstopping functions.

Over half (56%) of ARD's 314 technicians and research staff are stationed at the 19 central farms, one quarter at the 21 seed farm and

Table 3

CURRENT ARD STAFFING PATTERN

	<u>PhD</u>	<u>MSc</u>	<u>BSc/BAG</u> <sup>1/</sup>	<u>Diploma</u>	<u>Total</u>
Hdq. Technical/Admin	5	4	45 (15+30)	2	56
Central Research Centers	1	5	104 (14+90)	68	178
Seed Farms	-	1	54 (3+51)	25	80
TOTAL	6	10	203 (32+171)	95	314

<sup>1/</sup> BAg are graduates of the Institute of Agriculture at Yezin; most BSc degree holders are from the former College of Agriculture at Mandalay.

one-fifth at the headquarters. While there are only 6 PhDs and 10 MSc degree holders in ARD, there are just over 200 BSc/BAG graduates, which account for two-thirds of the total staff. The bulk of these graduates (171 of 203) are from the Institute of Agriculture at Yezin. It is noteworthy that 1 PhD and 4 MSc degree holders are assigned to central farms to staff the UNDP/FAO supported Cotton Improvement Project in cooperation with ARI. Without external support such field assignment would likely not to be the case because of other demands for scientific staff. Finally, there are 95 Diploma holders. ARD reported receiving about 15-20 BAG level graduates each year, most after a period of service with the Extension Division in a village.

ARD has had or currently has responsibility for several foreign assisted projects or elements of projects (primarily UNDP/FAO e.g. Cotton Improvement, Crop Improvement, Plant Protection, Seed Improvement) so staff assigned to ARD has received some advanced degree and short-term specialized training. Beyond the special projects which include incremental (project duration) staff, specialized training has been very limited. Clearly, ARD's shortage of trained technical and research personnel is a major constraint to adequately performing its service and research functions.

Given the applied research mandate (although some basic types of research were evident where qualified staff are assigned) and the large number of centers and seed farms spread over various agro-ecological zones, a wide range of highly qualified scientific and management staff is needed. An in-depth analysis is suggested to specify the disciplines required. The need for improved capacity in farm management, economic analyses, research design and planning were noted in addition to the need for more capacity in biological and natural resource sciences.

c. Sources of New Scientists

Burma produces 300 BSc and BAg and 200 Diploma graduates each year. The majority of these graduates go into the Extension Service. ARI and ARD receive very few BSc and BAg graduates per year for research positions (an estimated 5 to ARI and 15-20 for ARD, most after serving with Extension). New graduates are generally better prepared than many current staff, which will gradually strengthen research institutional capacity. They will also increase the qualified pool from which to select future post-graduate candidates for training inside and outside Burma.

The Institute of Agriculture now offers university MSc level training in agriculture. This will be a primary source of new scientists and research managers. The constraint to an accelerated MSc program is primarily a shortage of teaching and graduate staff. Postgraduate courses are now offered in six subjects. Lack of equipment is a secondary but real constraint. Current College staff are being assisted by selected post-graduate students. Although there are currently some joint activities between the Institute of Agriculture and ARI, both located at the same campus, the potential for ARI to assist with graduate teaching and guidance on thesis research is significant. Current ARI participation with Agriculture Corporation staff members enrolled in postgraduate degree work at Yezin is a positive move and should be expanded. Overall, the Institute of Agriculture at Yezin needs additional staff, equipment and new facilities to produce qualified agricultural staff to meet the long-term research, extension and agricultural service needs of Burma. A range of donor assistance to the college from limited library support to staff training and equipment would be beneficial.

To accelerate needed agriculture research over the next 4-5 years, the number of incoming staff with postgraduate degrees from the Institute of Agriculture should be complemented by specialized degree training outside Burma. The rough review of projected needs within the next 5-10 years suggests a substantial number (200 plus).

d. In-service Training for Staff Development

Because of the high cost of sending research staff abroad for training, loss of services during extended periods for degree training and the strict selection criteria used, including English capability, in-service training within Burma will continue to be the primary mode of increasing scientific and technical skills. The UNDP supported Crop Development Project, the IRRI-Burma Rice Improvement Project and the AID supported Maize and Oilseeds Production Project, for example, have provided for some of this type of training. Adaptive and other applied research to increase production under varied environmental conditions by widely dispersed research stations (Yezin, central farms, seed farms and research trials on farmers' fields in cooperation with extension) argues for an expansion of this type of training. Donor assistance is most appropriate.

While the principal training sites will likely be ARI/AI Yezin and ARD/Gyogon, the Japanese supported Central Agricultural Development Training Center will significantly expand the capacity for training. The latter Center, while focusing on training of extension staff, presents a valuable opportunity to link training of research staff and extension staff.

A second appropriate mode of training assistance by external donors is short-term scientific skills-type training and more general study tours in the Asia Region and countries like the U.S. Expanded specialized research skills training at several IARCs, similar to the on-going arrangement with IRRI is especially appropriate. It should especially cover the research

concerns of oilseed crops, maize and other cereal crops, food legume and horticultural crops. Training at IARCs establishes a valuable professional and institutional linkage. Study tours abroad offer an overview of agricultural research systems and a more tailored focus on new technologies/methodologies and research management.

e. Overall Staff Training Needs

Agriculture Corporation officials and representatives of other donor organizations contacted clearly identified the limited number of mid to senior level scientific research staff as a constraint to more effective research leading to sustained increases in agricultural production. Based on the assessment team's preliminary analysis of Burma's research needs, and drawing on the structure and organizational experience of a range of other countries, it is clear that the requirements for highly qualified and committed research staff will accelerate as the agricultural sector continues to grow in absolute terms and contributes to the national economy, and as agriculture production becomes more intensive. Both conditions are occurring in Burma.

The specific needs projected over the near-term (4-year national plans) and the longer-term (15-20 years against Burma's prospective plan) under different sets of assumptions (e.g. world markets, serious disease losses, new technologies) are not clear. This suggests an Agricultural Research Manpower Needs Study be conducted by the Agriculture Corporation starting with projected planning targets, likely production constraints and technological opportunities.

### 3. Physical Facilities and Support Services

#### a. Libraries

The libraries at ARI and the Central Farms are severely limited because of the cost and difficulties of importing current periodicals and books. Research productivity will be much improved if corrective measures are made. Obviously, it is not possible to provide libraries at all locations. We suggest that one central library under control of a trained librarian be established at Yezin for joint use by ARI and the College. One of the responsibilities of the librarian should be to review all incoming periodicals, identify articles of use at various centers, and provide them with summaries. Articles of special interest can be copied for the research worker.

Library management is a rather specialized and complicated activity. We recommend that a short-term librarian consultant be employed to review the problem and design a system to meet the needs.

#### b. Laboratories and Laboratory Equipment

The laboratories of the ARI are providing the basic needs of the present staff at Yezin. New scientific equipment will be needed continuously to serve the need of modern science. Laboratory space per scientist at Yezin is probably greater than space allotted per person in American Universities. Therefore we do not see the need immediately for more space. Current space may require remodeling to meet new demands.

Time did not permit more than cursory inspection of office, testing and field equipment at the central farms. Since research activities at these farms are mostly field oriented, space needs are largely for storage of plant materials and field equipment. Rooms for meetings are pleasant and spacious.

c. Field Equipment

Equipment for field research is extremely limited. The problem is further aggravated by the lack of diesel fuel to operate motorized equipment. In view of this difficulty and the likelihood that the problem will not disappear, we suggest major attention be given to improved animal powered field equipment. The International Center for Research in the Semi-arid Tropics (ICRISAT) has an active program to improve animal powered field equipment. Although the designs are perhaps more expensive than can be purchased by the Burmese farmers, they could serve a useful purpose on the central farms and the seed farms. We suggest that ICRISAT be contacted with the request that the engineer responsible for this work visit Burma and recommend the steps to be taken to improve field equipment for these farms.

#### IV. RECOMMENDATIONS

##### 1. Agricultural Research Policy, Organization and Planning

The long-range future of agricultural development in Burma depends on the educational preparation of young men and women entering the various research, teaching, extension, and production activities. It is evident that advanced degree training is not adequate to meet future needs. At present, Burma is benefiting from research knowledge and materials produced abroad. Examples are the rice varieties imported from the International Rice Research Institute, corn varieties from the Center for the Improvement of Maize and Wheat in Mexico, and equipment developed at various other centers for research. While these sources will remain important, in time Burma will need far more people trained beyond the BSc degree than are now entering the research and educational system if it is to exploit advances in science and technology to meet the country's needs.

The organizational structure for research and extension education was reviewed, as well as the procedures for producing seeds, rhizobium cultures, and rodent control bait. We were informed as to planning procedures for meeting agricultural production goals. An evening meeting with the Rector of the Institute of Agriculture at Yezin provided us with a general understanding of the formal degree training of the College.

We have concluded from these discussions and on-site visits to central farms and production camps that there are opportunities for more efficient arrangements within the three primary functions of research, extension education, and seed and other production services.

##### a. The Agricultural Research System

The two agricultural research agencies in Burma are making good progress in solving important needs but their activities are not separated as to goals and in some cases are duplicative. An implied

distinction between the Agricultural Research Institute as working on more basic problems and the Applied Research Division as working on applied problems, in reality does not exist. Both work on cropping systems, both engage in rice breeding, and both have more basic studies on cell culture.

It is recommended that the research activities of the Agricultural Research Institute and that part of the Applied Research Division which deals with research, be combined as a Burma Agricultural Research Service (BARS). The staff at Yezin should give special attention to the kind of problems that require the laboratory facilities present there. They should continue, as at present, to use the facilities of the central farms where these are needed.

We also recommend adding two new units to the present five disciplines identified in the present Institute at Yezin. These are On-farm Water Management and Farm Mechanization. The Water Management unit should devise systems for more efficient use of water for crop production, including means for lifting water from wells and streams. They should also find improved methods for field distribution to minimize losses and waterlogging. Conservation of surface and ground water is an important problem with crops grown without irrigation following the monsoon season.

The new Farm Mechanization Unit would design more efficient and inexpensive equipment for seed bed preparation, weed control, mechanical planting, crop harvesting, and threshing. Because of the shortage and high cost of diesel fuel, emphasis should be on animal powered equipment, including lifting water from shallow wells and streams. Attention should also be given to drainage.

b. Seed Production and Other Services

Seed production is now being done by the Agricultural Research Institute, the Applied Research Division and by Extension. The Institute at Yezin also produces and distributes rhizobium cultures and rat poison for farmers use. The seed production function is confused because three agencies are responsible for it.

It is recommended that a new division of Seed Production Services (SPS) be created within the Agriculture Corporation with the sole responsibility of producing seeds, supervising quality control, and distributing it. The central farms and seed farms should limit their seed activities to the production of foundation seed (the first generation after breeders seed). Breeders seed should continue to be the responsibility of the plant breeders in the Burma Agricultural Research Service.

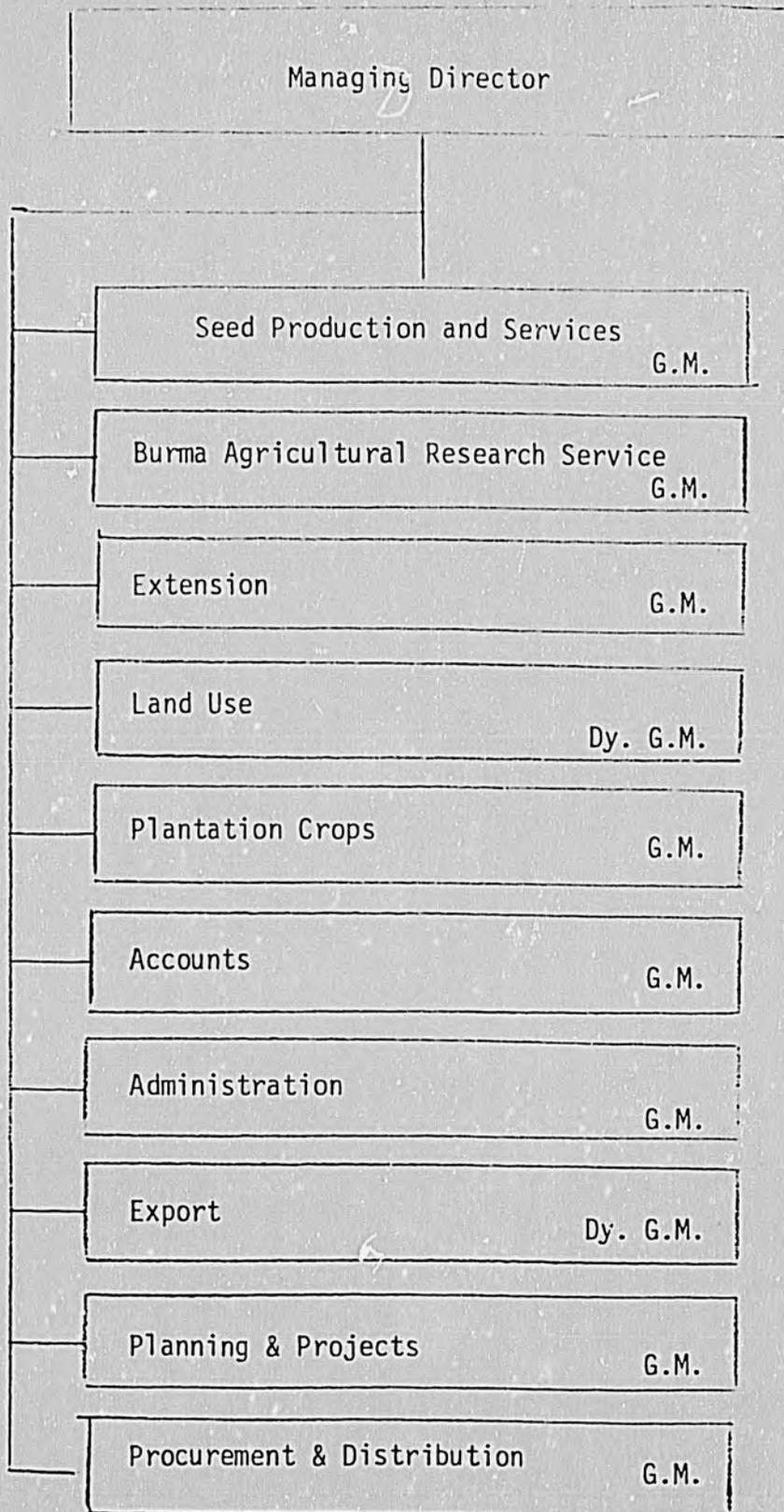
To expand the production of high quality seed beyond what is possible on the seed and central farms, we recommend that highly successful farmers produce pure seed of the generations following foundation seed, to be identified as certified seed. This seed should be inspected, tagged and sealed by officials of the Seed Production Service organization to assure its quality.

The Seed Production Service could also be assigned responsibility for the production of rhizobium cultures and rat poison, as these activities detract from needed research (See figure 3 for changes proposed in the Organization of the Agriculture Corporation).

c. The Agricultural Extension Service

The Agricultural Extension Service is doing a good job in training farmers on how to use better crop varieties, control pests, use fertilizers, and other means to improve yields. We recommend that the

FIGURE 3  
PROPOSED ORGANIZATION  
OF  
THE AGRICULTURE CORPORATION



Extension Service turn over its seed production activities to the new Seed Production Service. We also recommend that Extension take on the responsibility for training farmers at the central farms, but with the assistance of staff from the central farms.

d. Institute of Agriculture - Yezin

We recommend that those members of the research staff in the Agricultural Research Institute at Yezin who have MSc and PhD degrees be granted courtesy titles without salary in the Institute of Agriculture. This arrangement should be mutually beneficial to both organizations. It would permit the participation of ARI staff in in guiding thesis research of graduate students in the Institute. This arrangement also would further the research work of ARI. Staff members with courtesy titles would be expected to give lectures from time to time to students in the Institute.

These kinds of cooperative arrangements have been used very successfully at universities in the United States. Titles used include Adjunct Professor, this signifying a relationship but without privileges of regular faculty members in guiding the policies and procedures of the Institute.

e. Planning Strategy

A Rice Working Group has been appointed for planning and coordinating the work on rice in Burma. The Group is appointed by the Managing Director of the Agriculture Corporation and has members from research, extension, and seed production. Rice breeding is conducted at eight locations. Without this working group programs could become duplicative and confusing to farmers.

We recommend that the Managing Director appoint similar working groups for the other important crops, with representation from research, extension, and seed production. Working Groups for oilseed and for maize are particularly advisable.

2. Suggested High Priority Areas for USAID Support

a. Crop production: Maize, Oilseeds and Selected Food Crops

The AID-supported Maize and Oilseeds Production Project (482-0005) is making good progress in improving yields and production of maize, groundnuts, sesame and sunflower crops by concentrating a package of improved varieties and production technologies with well organized support services in selected townships having high production potential. While further improvements in production of these crops are possible with existing technology it is not likely that substantial increases can be sustained for long without encountering many problems for which additional external support is needed. The purpose of this project would be to augment the support provided under 482-0005 by providing resources to develop capability in Burmese institutions to solve these problems.

Among the problems which will take on increasing importance over the next several years are the following:

1) The large gap between rice yields in the mid-seventies and the potential provided by research at IRRI and other research institutions made it possible for Burma to achieve remarkable increases in yields in a short time through its breeding and adaptive research program. To sustain a high rate of increase in yields it will be necessary to maintain a continuing infusion of improved varieties and technologies. As the International Agricultural Research Centers generate new scientific knowledge, Burma must carry out a vigorous research program to adapt the technology to its various agro-ecological environments. This will require strengthening of the research staff at Yezin as well as at the central farms. Advanced degree training is required for some of the staff at Yezin. Short-term training, mainly at the IARC's, is needed for personnel throughout the

research system. Coordination of research under working groups, as is now being done in rice, would be an important arrangement for all crops. The center at Yezin as well as at each of the central farms in the research network need better machinery and equipment for proper seed bed preparation and field plot harvesting.

2) The traditional farm equipment and cultivation practices limit possibilities for successful double and triple cropping. Research and development are needed to design and evaluate improved equipment for improving seed bed preparation, controlling weeds and speeding up key operations such as harvesting and threshing.

3) Disease and pest problems can be expected to increase as the intensity of cropping increases. Specialists in Entomology, Plant pathology and Plant Protection are needed in sufficient numbers at appropriate locations to identify pests and diseases and to develop effective controls.

4) Harvesting and post-harvest handling problems will need improvement to reduce losses and maintain quality. Storage problems at the farm level require applied research to design low cost, efficient storage structures and treatment. Storage technology suitable for local and terminal market centers is available for the variety of conditions in Burma. What is needed is investment in appropriate storage and handling facilities and training of personnel in efficient storage methods.

5) Marketing problems will become increasingly important. It is likely that domestic demand for edible oils could be met within several years if some of the crops such as sunflower continue to increase in yield and production at current rates. Studies are needed to determine appropriate adjustments in production of various oilseed crops, or appropriate shifts to other food or industrial crops. Export demand for oilseed cake may, for

example, indicate greater emphasis on soybeans which, if properly processed, should enjoy a relatively favorable export potential. Also, a study of the livestock industry's requirements should indicate the market potential for oilseed cake. Market analysis may suggest greater emphasis on maize relative to oilseed crops. Again, this will involve assessment of the domestic requirements of the livestock industry and the export potential. The present agricultural research system is not staffed to do market research or any other kind of economic analysis of agricultural problems. It is recommended that an Agricultural Economics unit be established with responsibility for evaluation of agronomic practices, market analysis and analysis of agricultural policy issues.

6) There is inadequate information available on the suitability of various crops not now grown in Burma. Several new crops may have good potential, for example safflower and rapeseed, as alternative oilseed crops. These should be introduced at several locations and their technical feasibility and economic viability evaluated.

b. Water Management and Irrigation for Winter Crop Production in the Delta

The delta lands of Burma are primarily used for rice production during the monsoon season. During the winter season when temperatures are favorable and skies are cloudless much of the land is idle. The goal of a water management project is to bring these lands under cultivation during the dry season through improvement in water management and by increased irrigation.

Opportunities

The delta lands developed as alluvium from rivers and streams are among the worlds most productive soils. They also enjoy a near source of irrigation water either from the rivers or ground water storage during the monsoon

season. The delta in Burma has very favorable weather. All primary requirements for crop production - good soils, water, bright sunlight and favorable temperatures - are combined in the delta.

Two cultural systems should be considered: crops grown from residual moisture, and crops that benefit from additional irrigation. Crops that should be studied in addition to those of known adaptation such as corn and sunflowers are the Brassica species, safflower, wheat, barley, tomatoes and other vegetables.

Ground water remaining after the monsoon season can be used more fully than at present for the culture of crops that respond favorably to the cooler temperatures and are able to mature before residual soil moisture is fully extracted.

Other crops and varieties can produce good yields if the residual soil moisture is supplemented by only one or two irrigations. The primary source for limited irrigation may be shallow dug wells, tube wells, or water pumped from rivers, streams, and drains.

Some winter season crops are being produced with water from dams, tube wells and diversions from rivers. The heavy investment requirements for these water sources has deferred their development.

#### Problems

Problems currently limiting greater use of delta lands for winter crop production are:

- 1) Need for more Burmese specialists trained in soil and water management. They are needed to discover better cultural practices to conserve and use residual ground water, and to devise better systems for lifting and delivering ground water to crops,

- 2) Inadequate knowledge of the location, depth and amount of ground water,

3) Inadequate knowledge of costs in relation to returns from making full use of delta lands for winter crop production,

4) Need for more information on the kinds of crops and crop varieties adapted to delta lands in winter months,

5) Lack of energy (diesel fuel and electricity), and equipment for preparing seed beds on land previously in rice without loss of some of the surface moisture. Loss of surface moisture and cloddy soils greatly increases the difficulties for obtaining good stands. Row crops such as sunflowers that are to be irrigated are more productive when grown on raised bed. Equipment for preparing raised beds on heavy soils previously in rice is not available,

6) Insufficient nitrogen and other fertilizers to meet even existing needs. Crops following rice are usually very deficient of nitrogen and the water-logged condition in rice reduces the availability of phosphorus for subsequent crops. This deficiency is particularly noticeable with safflower, a crop anticipated to be suitable for winter production on delta lands,

7) Need for additional storage, processing, and transport facilities to handle projected crop increases, and

8) Undeveloped markets and marketing facilities for delta winter crops.

#### Solutions:

Solutions to problems in the use of delta lands for winter crop production are diverse. They include:

1) Train specialists in water management, crop production, crop processing, and marketing of delta grown winter crops,

2) Employ consultants in ground water analysis to provide estimates of the amount, location and costs of developing ground water in the delta,

3) Engage in agronomic studies to determine the crops and crop varieties adapted to the delta during winter months, and the cultural practices includ-

ing tillage, fertilizers, and water requirements for these crops,

4) Devise better systems and equipment to quickly prepare rice fields for winter crop production. Because of the limitations at present on procurement and use of engine powered equipment, special attention should be given to cultural practices using animal power,

5) Discover and exploit the use of winter adapted leguminous nitrogen fixing crops that are not too expensive to grow, as a means for providing nitrogen needs of the next crop to be grown in the rotation. Crops suggested for trying are berseem, purple vetch and other cool season legumes that are adapted to the more acid soils,

6) Plan for the construction of storage and processing of crops that may be adapted to delta winter production but delay construction until more is known of the crops to be grown. Market development should occur simultaneously with expansion in crop production.

c. Training

A general shortage of staff and, particularly, a shortage of adequately trained scientific staff will be one of the major constraints limiting sustained growth in agricultural productivity. Ultimately Burmese institutions should be able to meet advanced degree training requirements. Until that time substantial numbers of research staff members will need to be sent abroad for MSc and PhD training. Even after Burma can meet advanced degree training needs there will be a continuing need for agricultural scientists to participate in a variety of short-term training programs at IARCs and in other countries. USAID and other donors need to assist in identifying these needs and in supporting the training.

1) It is recommended that the Agriculture Corporation carry out an Agricultural Research Manpower Needs Study covering the current 4-year plan and the 20-year prospective plan periods. Starting

with (a) projected agricultural production targets, (b) likely production constraints (including those not yet identified or quantified) and (c) new science and technological breakthroughs. The study should project research staff requirements for the near and long-term. This should strengthen the position of the Burmese Government in dealing with external donors when planning projects which include long-term degree and short-term technical training. This study could also appropriately review the sources of new scientists, especially from the Institute of Agriculture at Yezin and the potential for accelerating the Institute postgraduate program, including possible donor assistance.

2) The team recommends an increase in the scientific staff of ARI Yezin to the authorized position strength and to increase staff educational levels through (a) the Institute of Agriculture at Yezin (with ARI participation in teaching and thesis research) and (b) degree training abroad through external donor assistance. We specifically recommend an accelerated interim postgraduate degree program over the next 5 years. This recommendation should be further tested by the proposed manpower study.

3) We recommend an accelerated training program to increase the capability of Agriculture Corporation research staff stationed at central farms who are charged with conducting the adaptive and other applied research linked to production. We specifically observed training needs for staff working on oilseed crops, maize and other cereal grains, and food legumes. The focus should be on in-service training within Burma, with selected staff sent overseas for specialized skills/agricultural commodity training with priority at international research centers and, secondarily, at university, government and commercial research programs. More attention must be given to the large number of ARD staff who carry a significant research and research management load at central farms but do not become

with (a) projected agricultural production targets, (b) likely production constraints (including those not yet identified or quantified) and (c) new science and technological breakthroughs. The study should project research staff requirements for the near and long-term. This should strengthen the position of the Burmese Government in dealing with external donors when planning projects which include long-term degree and short-term technical training. This study could also appropriately review the sources of new scientists, especially from the Institute of Agriculture at Yezin and the potential for accelerating the Institute postgraduate program, including possible donor assistance.

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involved in special projects, which often provide many of the training resources.

The proposed integration of ARI and ARD research functions and separation of selected agriculture support services (e.g. seed multiplication) discussed in an earlier section can help streamline the process of planning and conducting priority agricultural research and help rationalize the assignment and coordinated use of Burma's limited number of scientific staff.

4) Consideration should be given to (a) undertaking an accelerated English program for both selected and potential Agriculture Corporation candidates for overseas training and (b) a regular English program at ARI/Yezin. Alternative actions are skills/management training of Burmese staff to expand the Corporation's present efforts and drawing on U.S. Government/AID project resources or a U.S. voluntary organization (e.g. International Voluntary Services) to provide technical assistance and teaching instruction. A 6-12 month trial period may be appropriate if U.S. assistance is desired.

Multilateral and Bilateral Assistance Projects with  
Research Components

<u>Agency</u>	<u>Project</u>
1. UNDP	Assistance to the Institute of Agriculture, Veterinary Science and Forestry
2. UNDP	Strengthening of the Agricultural Research Institute at Yezin
3. UNDP	Genetic Improvement of Crop Plants using Institute at Yezin
4. UNDP	Livestock Industries Development
5. UNDP	Seed Development
6. UNDP	Crop Development in Burma
7. UNDP	Cotton Development
8. UNDP	Rubber Rehabilitation
9. World Bank	Lower Burma Paddyland Development I Lower Burma Paddyland Development II Pump Irrigation and Area Development Kinda Multipurpose Dam Project
10. World Bank/UNDP	Seed Development Phase I Certified & Quality Seed Production Phase II
11. World Bank/FAO	Rubber Rehabilitation Plantation Crop Development
12. ADB	Sedawgyi Multipurpose Dam Project
13. ADB/OPEC	Fertilizer Pipeline Projects (Phase I Crop Intensification Programme)
14. ADB/Switzerland/EEC(EDF)	Palm Oil Development
15. F.A.O.	Prevention of Post Harvest Loss
16. USAID	Maize and Oilseed Production
17. Japan Technical Assistance	Rice Production Development
18. JICA	Central Agriculture Development Training Centre - CADTC

- |     |                          |   |
|-----|--------------------------|---|
| 19. | CIDA/IRRI/Burma          | Canada-IRRI-Burma Cooperative<br>Research Program Phase I |
| 20. | IRRI (CIDA funded)/Burma | IRRI-Burma Cooperative Research Program -<br>Phase II     |
| 21. | DANIDA                   | Strengthening of Soil Survey and Land Use<br>Evaluation   |
| 22. | GTZ                      | Fertilizer Marketing & Distribution                       |
| 23. | GTZ/FAO                  | Plant Protection and Quarantine Phase II                  |
| 24. | U.N.                     | UN/Burma Drug Abuse Control Programme                     |

## Research Review Team Members

Dr. Russell O. Olson has been involved in international agricultural development work for the past 25 years. He obtained his BS and MS degrees from the University of Minnesota and his PhD in Agricultural Economics from Iowa State University. He spent four years with FAO in Rome as Chief of the Land Use and Farm Management Branch. Service with AID included assignments in India, Nigeria and Washington, D.C., where he was Chief of the Agriculture Division of the Near East Bureau. Since his retirement from AID in 1980 he has had short-term consultant assignments in Indonesia, the Philippines, Pakistan and India.

Dr. Maurice L. Peterson is Professor Emeritus at the University of California at Davis. He obtained his BSc degree from the University of Nebraska, MSc degree from Kansas State University and his PhD from Iowa State University. At the University of California, he engaged in rice research, and also served as chairman of the Department of Agronomy, Director of the California Agricultural Experiment Station, and University Dean of Agriculture. In 1981 he was awarded an honorary degree of Doctor of Science from the University of Nebraska, a distinguished service award from the Rice Technical Working Group, and the University of California Citation for his service to the University and to international programs.

Don F. Wadley is currently Deputy of the Food and Agricultural Directorate, Science and Technology Bureau, AID Washington. He has BS and MS degrees in Horticulture from Utah State University and a MPA in Development Administration from Syracuse University. Mr Wadley has 21 years field experience with AID in Asia working in Agriculture and Rural Development in Thailand, Laos, Vietnam and the Philippines.

### Scope of work

The Agricultural Research Review Team was charged with the following scope of work:

1. To determine, in collaboration with Burmese officials and the USAID, the appropriateness and priority areas for any U.S. assistance in the subsector of agricultural research.
2. To provide a descriptive assessment of the overall research program in agriculture, including:
  - strength and weaknesses of the system,
  - institutional arrangements and activities,
  - institutional linkages, including with the IARCs,
  - institutional management,
  - training programs,
  - sources of new personnel,
  - assistance being provided by other donors,
  - staff capacity and capabilities, and
  - physical plants and equipment.
3. To assist USAID with appropriate material for a Project Identification Document.

## Methodology

The Agricultural Research Review Team arrived in Rangoon on December 1, 1983. The Team remained in Rangoon through December 6th to review background documents and hold discussions with USAID and with Burmese Government Officials concerned with agricultural development. The Team also visited the Hmawbi Agricultural Research Central Farm and Production Camp near Rangoon during that period.

On December 7th the Team began a week long trip north to Mandalay and back with stops at several places for observations of on-going programs and discussions with officials in charge concerning their activities. (The institutions visited are listed in Appendix V). U Aung Khin, General Manager of the Agricultural Research Institute, Yezin accompanied the Team for the first four days of the tour and hosted the members at the ARI facilities in Yezin for two days. During this two day stop the ARI program and facilities were reviewed in some detail. The Team also observed the facilities at the Institute of Forestry at Yezin and held discussions with the Rector of the Institute of Agriculture, Yezin. Visits were also made to nearby villages participating in "high technology" campagins.

Upon return to Rangoon the Team began drafting the report which was discussed at the meeting with senior officials of the Agriculture Corporation on December 16th. A draft report was completed and submitted to USAID on December 19th.

INSTITUTIONS AND INDIVIDUALS CONTACTED

U Thein Myint      Director General, F.E.R.D.  
U Khin Win        Managing Director, Agriculture Corporation  
U Tin Hlaing      General Manager, Extension Division  
U Hla Myint Oo    General Manager, Planning Division  
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Dr. Myint Thein    General Manager, Applied Research Division  
U Mya Maung      Project Director, Maize and Oilseeds Production Project  
U Siang Uk        Dy. Director, Maize and Oilseeds Production Project  
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Dennis Weller     Agricultural Officer, USAID

Daik-U Production Camp  
Kyaung Su, MOPP Seed Farm  
Agricultural Research Institute, Yezin  
Applied Research Division, Rangoon  
Hmawbi Agricultural Research Central Farm  
Forestry Institute, Yezin  
Nyaung Bin Central Farm  
Sebin Seed Farm (MOPP)  
Chaung Magyi Seed Farm  
Kyaukse Central Farm, Mandalay  
Popa Horticulture Nursery

Nattalin (Thitcho Certified Seed Farm)

Central Research Farm Magwe