TH
531.521
P871

Mr. Heidenreich
Bookshelf.

REPORT TO USAID/THAILAND
AND AID/W

TA 73-10

SEED PROGRAM/INDUSTRY DEVELOPMENT IN THAILAND

Services Rendered Under The Agreement Between AID/W and MSU

AID/csd 2976

A.I.D.
Reference Center
Room 1656 NS

SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
STATE COLLEGE, MISSISSIPPI

REPORT TO USAID/THAILAND AND AID/W

ON

SEED PROGRAM/INDUSTRY DEVELOPMENT

IN

THAILAND

SERVICES RENDERED
UNDER THE AGREEMENT
BETWEEN
AID/W and MSU
AID/csd 2976

Proj. 931-11-130-203

SEED TECHNOLOGY LABORATORY
Mississippi State University
Mississippi State, Mississippi

August, 1973

ACKNOWLEDGEMENTS

Our consultations in Thailand were informative, enjoyable and, hopefully, productive experiences. We are especially indebted to Dr. John Stone, Extension Advisor, Dr. Fletcher Riggs, Director, Office of Agricultural Development and Mr. David Lundburg, Program Officer, all of USOM, for their support and advice. At the technical level, Mr. Petcharat Wanapee, Project Leader, Soybean Project, and Mr. Tawee Pluemsab, Associate Changwat Officer (DOAE), provided us with exceptional insights into the technical, cultural and economic "facts of life" in Thailand as well as serving as interpreters, travel companions and congenial hosts. The unfailing support for and sincere interest in our activities on the part of Director-General Thumnong Sengabavanya and Associate Director Yookti Sarigaputi of the DOAE and Mr. Ponchai Pookamana, Associate Director, Rice Division, DAT, greatly facilitated our work.

The consultants are particularly appreciative of the assistance given by Dr. James C. Delouche in the organization and preparation of the final report.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS . . . . . .

REPORT SUMMARY . . . . . .

I. BACKGROUND 1

II. TERMS OF REFERENCE 6

III. CURRENT SITUATION AND RECOMMENDATIONS 8

A. General Requisites for Development of Thailand's Seed Program 9

1. Official Government Support 9
2. Trained Personnel 10
3. Finance and Credit 12
4. Available Land and Facilities 16
5. Utilization of International Assistance 18

B. Programs and Organizations 20

1. Foundation Seed Program 20
2. Seed Certification 21
3. DOAE Seed Multiplication Program 24
4. Commercial Seed Activities 27
5. Seed Regulatory Legislation and Program 29

C. Technical Operations (DOAE and DAT) 32

1. Varietal Improvement and Seed Research 32
2. Seed Production, Processing and Marketing 33
   Soybeans 34
   Maize 40
3. Availability of Specialized Inputs for Technical Operations. 42

D. Facilities (DOAE) 44

1. Phitsanulok Seed Service Center 44
2. Calabrian grain drying and storage facilities 51

Page

IV. APPENDICES 53

I. Daily Itinerary and Contacts 54
II. Time Framed Schedule for Training, Facilities and 61
Consultants.
III. DAT Research Stations 65
IV. Program - Seed Improvement Seminar 66
V. Survey of Seed Quality Planted During the Wet-Season 1972 . . 67
VI. Draft of Suggested "Seed Act" for Thailand and Comments . . . 68
VII. Seed Grower's Contract 80
VIII. Initial Staffing Requirements and Job Descriptions for the . . . 84
DOAE Seed Multiplication Program.
IX. Equipment Specifications and Preliminary Engineering 88
Drawings for Alterations and Additions to the Seed Service
Center.

REPORT SUMMARY

TITLE: Seed Program/Industry Development in Thailand

CONTRACT: Services under contract AID/csd 2976, Task Order No. 2, with Mississippi State University, Mississippi State, Mississippi 39762.

CONSULTANTS: Howard C. Potts and George M. Dougherty, Seed Technology Laboratory, M.S.U.

SUPPORTING STAFF: James C. Delouche, Seed Technology Laboratory, M.S.U.

PERIOD OF CONSULTATIONS: 24 April - 28 June, 1973.

Summary

One of the objectives of Thailand's Third National Economic and Social Development Plan (1972-1976) is the development of a seed program that will assure Thailand's farmers of a continuous supply of high quality seed of improved varieties at reasonable prices. For several years the Department of Agricultural Technology (DAT), Ministry of Agriculture and Cooperatives (MOAC), has produced and distributed limited quantities of "foundation" class seed to "key" farmers through a joint program with the Department of Agricultural Extension (DOAE). This program has not had sufficient impact on the kind and quality of seed planted in Thailand.

During 1972, the decision was made to establish a program which would increase the supply of high quality seed and encourage more active participation of the private sector in supplying seed of Thailand's basic crops: rice, maize, soybeans, castor beans, kenaf, mungbeans, cotton and peanuts. Responsibility for development and implementation of the program to achieve these goals was assigned to the DOAE. Soybeans were selected to be the initial focus crop of the new program with maize seed to be included during 1974.

Under the cooperative program between the DOAE and the United States Overseas Mission to Thailand (USOM), the services of two consultants under contract AID/csd 2976, Task Order No. 2, were requested by USOM/T to advise DOAE on seed program/industry development and to assist with several technical aspects of the program that were in urgent need of attention. Mississippi State University (MSU) nominated two specialists for the assignment: Howard C. Potts (seed program development), and George M. Dougherty (seed processing). Potts was on assignment in Thailand from 24 April through 7 June and Dougherty from 13 May through 28 June. The final report and the preliminary engineering drawings were prepared after the consultants returned to their home station.

Thailand has potential for development of a strong public-private seed industry within the country with some opportunity for movement of seed of its superior field crop varieties to adjacent countries. The research program supporting the development of superior varieties is productive, the private sector is effective in accumulation and distribution of agricultural products and services, climatic conditions are generally favorable, and official support for the development of a seed industry is good. On the other hand, there are weaknesses and deficiencies which must be overcome before an efficient, effective seed industry can develop. These weaknesses and deficiencies can be overcome provided the committment is made to do so, and the level of coordination and cooperation essential for balanced, sustained development can be achieved among the agencies involved - public and private.

The major deficiencies in Thailand's seed program development effort and recommended corrective actions are summarized below:

(1) The activities and/or goals of the various agencies engaged in seed production and supply in Thailand are not closely coordinated, and well organized. The result has been sporadic, duplicating, and often opposing efforts and programs. A National Seed Plan or Program is needed to establish firm, consistent policies regarding seed program/industry development, to define the responsibilities of the various agencies involved and organize their efforts, to set forth realistic goals, to ensure the necessary cooperation among agencies and programs and coordination of activities.

(2) The present base of trained manpower and technical facilities is inadequate for seed program/industry development. Officers with specific assignments in the developing seed program should be carefully selected for specialized training in the U.S. or other developed countries and reassigned to the same or similar position on their return. The few trained specialists presently in the program should be formed into teams for the purpose of giving in-service training to other officers and workers in the program.

A moderate base of technical facilities (seed drying-processing-storage) should be established in strategic locations to permit improvements in the quantity and quality of seed produced, to adapt and perfect the technology needed for seed production and supply under conditions in Thailand, to function as a training ground for seed specialists, and to serve as a pattern or model for potential private sector participants in the seed program/industry.

(3) Although the private sector is very active in export and distribution of vegetable seed, it is only slightly involved in production and supply of seed of basic agronomic crops. Participation of the private sector in seed program/industry development ought to be fostered and facilitated by every feasible means. The private grain industry is ample testimony of the vigor and resourcefulness of agri-business in Thailand.

(4) Seed certification and seed control, although not needed now, will be needed in the years ahead, perhaps, sooner than envisioned. Now is the opportune time, when the situation is not urgent, to begin serious work on formulation of a suitable role, organization, scope and objective for these programs within the context of adopted agricultural development strategy. The programs could then be phased into the seed program/industry development effort when they are needed without having to resort to the usual "crash program" approach that has too often characterized seed program/industry development in the LDC's.

The twenty-three specific recommendations made in the report are listed in the next section. In addition, many suggestions and guidelines are made within the context of specific discussions in the report.

LIST OF RECOMMENDATIONS

Each recommendation has been assigned a priority rating as follows:

Priority A - Immediate action is recommended with activity to be implemented or completed by September 1974.

Priority B - Less urgent but not less important. In some instances the action required by these recommendations cannot be undertaken until the Priority A recommendations have been implemented.

Priority C - Should be considered in formulation of the Fourth National Economic and Social Development Plan (1977-1981).

1. The Minister of Agriculture and Cooperatives in cooperation with other affected Ministries and the existing private sector should establish a high level committee for the purpose of developing a comprehensive, long-range National Seed Plan. (Priority A)

2. The MOAC and particularly the DOAE should give the highest of priorities to the selection of personnel for and implementation of the training programs outlined in Appendix II of this report, "Time Framed Schedule for Training, Facilities and Consultants - 1973-1976". (Priority A)

3. The MOAC and Ministry of Finance should develop a mutually satisfactory method for establishing a "revolving fund" for use in the purchasing and marketing phases of the DOAE seed multiplication program. (Priority A)

4. As a minimum, the current level of budgetary support should be maintained to finance adequately justified needs of the seed program. (Priority A)

5. An agricultural economist should be assigned to work with the seed program to identify and establish economic and fiscal parameters and base data for use in budgeting, program analysis, and industry development. (Priority B)

6. Persons involved in the planning of the Ministry's operations should establish, at least tentatively, a date at which time the Ministry will begin to phase out its "commercial" activities in seed production and supply. (Priority C)

7. The MOAC and DOAE should implement the recommendations given in subsection D for completion of the seed service center at Phitsanulok, and initiate planning for two additional similar seed service centers located at other strategic sites. (Priority A)

8. The MOAC and DAT should conduct a thorough review of present and projected breeder and foundation seed operations to identify needed improvements in facilities and production arrangements. (Priority A)

9. The MOAC should determine and make clear to external organizations concerned the specific areas in which technical and/or financial assistance is needed to develop Thailand's seed program. (Priority A)

10. Foundation seed production and supply for all crops should be integrated into a single program or section within DAT, including management, personnel and facilities. (Priority A)

11. The MOAC should organize a study group consisting of representatives from DAT, DOAE, BAAC, cooperatives, grain industry, farmer's associations, etc., for the purpose of formulating recommendations to MOAC on: (a) a general, national seed certification policy; (b) a national certification program realistic in organization, scope, standards, and objectives; and (c) a time phased schedule for implementation of a certification system by crop species and agricultural region. (Priority A)

12. DOAE should establish a Seed Multiplication Division or Seed Multiplication Project within the Division of Crop Promotion, whichever is determined to be most appropriate and advantageous, with responsibility for all of its seed multiplication activities - demand forecast, contract production, inspections, seed service center operations, allocation of seed, etc. (Priority A)

13. The DOAE should make every effort to speed the transfer or assignment of personnel trained in seed operations to the seed multiplication program. (Priority A)

14. The RTG through the MOAC should insist that prices of seed produced by governmental agencies be established at a level that will permit recovery of all costs including salaries plus a reasonable return (15% minimum) on capital investment in facilities. (Priority A)

15. The MOAC should determine ways and means by which private sector participation in seed production and supply can be fostered and facilitated. (Priority B)

16. The RTG and MOAC should charge the study group appointed under Recommendation 11 with the additional task of determining the type and scope of seed legislation which would be most beneficial to agricultural development. The study group should enlist and utilize knowledgeable, experienced advice and technical assistance in formulation of its recommendations on seed legislation. (Priority B)

17. The DAT personnel and facilities equipped for seed quality investigations should initiate a series of practical, applied studies to determine the specific causes of seed quality problems in soybeans and other seed kinds and their solution. (Priority A)

18. The DAT or DOAE should obtain the short term consultant services of a microbiologist qualified to identify likely causes and give recommendations concerning possible solutions to the problems involved in legume seed inoculation and nodulation.

19. An acceptable fiscal procedure should be developed which will assure that the DOAE seed program can purchase established minimum quantities of seed when they are produced. (See Recommendation 3). (Priority A)

20. Seed production agreements or contracts should be revised to include only those factors which the cultivator and the Department are capable of fulfilling. (Priority A)

21. The DOAE Seed Program should initiate a study to determine the effects of mechanized seed threshing and processing procedures on seed quality of soybeans and other crops. (Priority B)

22. The DOAE and DAT should initiate the arrangements for installation of seed drying facilities for ear corn at all locations where maize seed are processed. (Priority A)

23. Construction and installation of facilities at the Phitsanulok Seed Service Center should be completed as soon as possible in accordance with the plans and specifications provided in this report. (Priority A)

I. BACKGROUND

Until the early 1960's, Thailand's agricultural and national economy was based primarily upon rice. Since that time the agricultural economy has changed significantly in terms of both total productivity and kinds of crops produced. The main factors contributing to agricultural growth are: (a) availability of new land; (b) favorable natural climatic conditions; (c) favorable response of the private and government sectors to international market demands; and (d) effective utilization of foreign economic and technical assistance. [1/]

Current national goals affecting agriculture include: (a) improvements in crop yields per rai [2/] through adoption of modern techniques and inputs; (b) continued diversification of production with emphasis on crops with export potential; (c) expansion of irrigation; (d) strengthening of the institutional framework; (e) improvements in farm to market transport and storage facilities; and (f) an increase in the income of peoples in the poorer areas.

Nearly 75% of Thailand's estimated 40 million people are involved in farming operations. Farms in Thailand, though larger than adjacent countries in Southeast Asia, average only 18 rai (3 ha.). Average holdings per family are largest in the Central Plain, (26 rai), and smallest in the Northern valleys, (15 rai). Over 80% of the Thai farmers own all or part of the land they cultivate. Farm holdings are usually fragmented, often into widely scattered plots. It is not uncommon for a farm of 20 rai to be divided into 10 or more parcels each divided by a paddy dike. Except for plowing with the water buffalo, 95% of all farm operations are performed by hand. [3/]

Lack of irrigation water during the dry season and inadequate control of water during the wet season hinders crop production and diversification. Although, almost one-third of the 68 million rai (11 million ha.) of cultivated land has available irrigation water for part of the year, frequently from flooding rivers, only about 3 million rai are under controlled irrigation which permits cultivation on a year around basis. As a rule, all farmers produce at least one rice crop during the wet season; with other crops grown before or after rice or on land not needed or suited for rice production.

1/ "The Agricultural Economy of Thailand." O. Sabatini. 1972 USDA/ERS-Foreign No. 321, pp 99, USDA, Washington, D. C.

2/ 1 rai = 0.395 acre; 0.16 ha; 1600 sq. mt.

3/ "The Agricultural Economy of Thailand." Op. Cit.

Statistical data indicating changes in production of the principal crops during the period 1959-61 to 1969-71 are given in Table 1. Except for soybeans much of the increased production during this period was available for export. These data also reveal that most of the increased production resulted from increased acreage rather than improvements in yield per rai.

Thailand exported over 2 million tons of rice during 1972 and was the world's largest rice exporter. It is also a major exporter of maize (1.72 million tons), cassava (1.10 million tons), kenaf fiber (0.24 million tons), castor bean (0.03 million tons), sorghum (0.13 million tons) and raw rubber (0.33 million tons). 4/ The Third National Economic and Social Development Plan (1972-76) established goals to double exports of maize and increase soybean exports from the 6,000 tons in 1972 to 300,000 tons by 1976. This plan anticipates that production and export of rice, cassava, sugar, kenaf, mungbeans, and castor beans will remain stable during the same five year period.

One of the major impediments to increasing both acreage and productivity of soybeans and maize is an inadequate quantity of high quality seed of superior crop varieties. Like most tropical countries, the high relative humidities and year-around warm temperatures in Thailand make the production and maintenance of high quality seed very difficult when traditional methods of "farmer saved" seed are used. Seed high in oil such as soybeans, peanuts, cotton, castor beans and sesame, all crops of economic importance to Thailand, are particularly susceptible to the deteriorative effects of tropical environments.

Thailand presently has reasonable and continually improving requisites for the establishment of a modern comprehensive seed industry, i.e. high level support for public sector activities; business operations capable of providing the necessary inputs and marketing requirements; effective research and extension programs; technically trained personnel; financing for the seed program, and farm credit. 5/ Of the requisites listed above the last three appear to be the least developed in terms of seed industry development.

4/ "Thailand Economic Crop Data." Agricultural Economics Res. Bul. 23, 1973. Div. of Agri. Econ. Office of the Undersecretary of State. M.O.A.C. Bangkok. (unofficial English translation)

5/ "Seed Program Development." J.C. Delouche and H.C. Potts. 1971. Technical release ,TR3-71. Seed Technology Laboratory Miss. State Univ., Mississippi State, Miss. 120 pp.

Table 1. Crops: Planted area, production and yield, averages 1959-61 and 1969-71 and estimates for 1972

Commodity and group	Area planted			Yield per rai			Production			
	Average 1969-71	Percentage change: from 1959-61		Average 1969-71	Percentage change from 1959-61		Average 1969-71	Percentage Change from 1959-61		Prel. 1972
		Percent	Annual rate		Percent	Annual rate		Percent	Annual rate	
	1,000 rai	Pct.	Pct.	Kg. rai	Pct.	Pct.	1,000 ton	Pct.	Pct.	1,000 ton
Rice adjusted[1]	47,093	8.0	0.8	288	43	3.7	13,576	55	4.5	11,750
Upland Food	8,875	168	11.6	1,294	-36	-3.1	11,485	72	5.6	
maize	5,265	219		377	29		1,983	308		1,300
cassave	1,327	173		2,417	-13		3,208	139	9.1	3,700
sugar cane	1,109	24		5,547	4		6,152	29	2.6	7,573
Oilseeds	3,423	63	5.0	291	-49	-4.1	995	-17	-1.6	
castor bean	265	32		152	-16		40	10	1.0	
ground nut	670	7		190	-7		128	-0.3		
soybeans	342	141		149	-12		51	112	7.8	53
coconuts	1,963	95		385	-61		756	-24	-2.2	
Fiber Crops	3,296	130	8.7	160	-15	-1.4	529	52	4.3	
cotton	355	6		104	-13		37	-8	-0.8	
kapok (fiber)	315	0.3		321	-6		101	-6	-0.6	
kenaf	2,627	236		149	-26		391	149	9.5	430
Rubber	5,332	77	5.9	55	-5	-0.5	295	71	5.5	330
Tobacco	153	43	3.7	62	-22	-2.0	10	12	1.1	
All crops(adj) [1]	68,173	28	2.5				26,824	55	4.5	

[1] Riceproduction and area planted in 1959-61 adjusted upward by 15% (1.15) to concept consistent with estimates for recent years.

Source: "Changes in Thailand's Agriculture and Related Development Problems" Dr. R. F. Daley, USDA/PASA, Thailand 15 May, 1973.

The Department of Agricultural Technology (DAT) of the Ministry of Agriculture and Cooperatives (MOAC) is responsible for the development of superior crop varieties and the related research activities which affect seed production, quality control, storage and distribution. The DAT is developmentally more advanced than some other Departments of the MOAC primarily because of a long term emphasis on research activities, post graduate training of personnel and substantial input from both the Royal Thai Government (RTG), and several international technical assistance organizations.

Superior varieties of soybeans, maize, rice and some other species are already available with still better strains in the late testing stages. In addition to its basic research responsibilities, the DAT has been the principal producer-supplier of seed of these improved varieties to the farmer, primarily through the Department of Agricultural Extension (DOAE). In spite of the DAT's efforts, the available quantity of seed having known genetic characteristics and quality has never exceeded 1% of the national needs for the major field crops.

The DOAE in its present administrative form was established officially in mid-1968 with a major reorganization in late 1972. 6/ Presently its overall objectives and operational procedures are very similar to those in technically more advanced countries, including the U.S. Because of the comparatively recent emphasis on nationally coordinated extension activities the DOAE is badly understaffed (1 worker per 4000 farmers) and to date has only a very limited number of effectively trained and experienced personnel.

In spite of limited personnel, the DOAE was assigned the additional responsibility of establishing the programs and facilities necessary to increase the supply of high quality seed of improved varieties to the farmers at a "reasonable" price. Initially, this seed multiplication program is limited to soybeans but maize will be included by 1974.

With the exception of modern, commercial scale seed processing and handling equipment, the basic inputs for a seed production-supply industry, i.e., bags, tags, seed treatment materials, fertilizers, etc., are available in Thailand. The fact that Thai farmers have either saved or been supplied in some manner with seed of the crops produced is evidence that some sort of a seed supply, distribution, and marketing system has been in operation for many years. Indications are, however, that the kind and quality of seed available through the existing system are not in keeping with the requirements for accelerated agricultural production.

6/ "The Department of Agricultural Extension in Thailand" T. Sengalavanija. 1972. Unnumbered Bulletin. DOAE/MOAC Edited by J. T. Stone USOM/AG/PASA. 18 pp.

Village shop-keepers, money lenders, crop buyers, other business groups, and landlords provide almost one-half the farm credit with relatives and friends of the farmers making up the rest, according to a study published in 1972. [7/] The share of farm credit provided by regular financial institutions in 1972 was variously estimated at between 3 and 10%. The most important institution for farm credit was and is the Bank for Agriculture and Agricultural Cooperatives (BAAC) which was established in 1966. This institution loaned almost 700 million Baht (US $33.3 million) in 1969 of which 90% was still outstanding in January, 1970.

Funds expended by the DOAE, DAT and other agencies involved in seed production, processing and distribution are budgeted in such a manner that precise data on seed related activities are not available. However, the current public sector seed operation, described in detail in Section III, is basically a completely tax supported farmer subsidy. This policy has been justified on the basis of low farmer income, the national need for increased production of selected crops, and as a means for introducing more modern technology to the farm families of Thailand. One of the stated objectives of the DOAE is to encourage the private sector, including cooperatives, to assume responsibility for the production, processing and marketing of good seed of improved varieties.

[7/] "The Agricultural Economy of Thailand." Op. Cit.

II. TERMS OF REFERENCE

Following an exchange of information and views between USAID/T (USOM), AID/W and MSU, the Mission requested and the Contracting Officer authorized consultant services of two technicians under AID/csd 2976 Task Order No. 2, for a period of 1½ months each with the following general terms of reference.

1. Advise the Department of Agricultural Extension (DOAE) on a system for development of a long range seed improvement program, including training for both DOAE staff and farmer-seed grower groups.

2. Advise the DOAE regarding techniques to be used in seed handling, distribution and quality control, including certification, with major emphasis on seed of soybeans, maize, peanuts, cotton and vegetable seed.

3. Provide assistance to the DOAE in the initial operation of a seed processing facility and development of the necessary records systems.

4. Assist the DOAE in planning the development of a system for on-farm multiplication of limited quantities of seed of improved varieties.

Upon arrival in Thailand, officials of the DOAE indicated their most pressing needs for assistance were as follows:

1. Review of the overall seed program in Thailand and specifically the policies and operations of Department's seed multiplication program in soybeans.

2. Study of and recommendations related to:

   (a) Improvements in the seed production system - field supervision, harvesting, threshing and transportation.

   (b) Necessary alterations in the seed drying-processing unit, training in operation of available equipment and projection of future equipment needs.

(c) Improvements in quality control of seed.

(d) A records system which would provide management with information necessary for planning and control.

3. Preliminary advice and information on seed certification and seed regulatory programs.

4. Seminars and on-the-job training as time permitted.

The authors were nominated by MSU to provide the requested services. H. C. Potts, Seed Program Development consultant, arrived in Thailand April 26 and departed June 5. G. M. Dougherty, Seed Processing consultant, arrived May 16 and departed June 28. The consultants' itineraries, official contacts and the program of informal seminar are included as Appendix I to this report.

III. CURRENT SITUATION AND RECOMMENDATIONS

The current situation, recommendations and explanations presented in this section are divided into four categories: (A) General Requisites for Development of Thailand's Seed Program, which will require action and implementation on the administrative level, i.e. Minister, Under-Secretary, and Director - Generals of the Departments of Agricultural Extension (DOAE), and Agricultural Technology (DAT); (B) Programs and Organizations; (C) Technical Operations; and (D) Facilities. Implementation of the recommendations included in categories B, C, and D will be primarily the responsibilility of technical personnel but will require full administrative support and action.

Each recommendation has been assigned a priority rating as follows:

Priority A - Immediate action is recommended with activity to be implemented or completed by September 1974.

Priority B - Less urgent but not less important. In some instances the action required by these recommendations cannot be undertaken until the Priority A recommendations have been implemented.

Priority C - Should be considered in formulation of the Fourth National Economic and Social Development Plan (1977-1981).

The recommendations advanced are based upon the following general assumptions:

1. The MOAC and other Ministries of the RTG have agreed that a continuous supply of high quality seed of superior varieties is necessary for the continued growth of Thailand's agricultural economy.

2. The MOAC will continue to give a high priority to the continued development and implementation of a national seed multiplication program.

3. The MOAC initiated its seed program because a satisfactory seed industry has not yet developed in the private sector, including cooperatives; however, the policy goal is to transfer responsibility for the production, processing and marketing of commercial quantities of seed to the private sector at the earliest possible date.

4. The DOAE assumed responsibility for seed multiplication as a needed

service to all segments of Thailand's agriculture, but the Department's primary responsibility for "continued education of all persons in agriculture" will remain as its basic function.

A. Requisites for Development of Thailand's Seed Program

1. Official Government Support

The need for and potential advantages of an integrated seed industry capable of providing needed quantities of "good" seed at "reasonable" prices was clearly recognized by all persons contacted, from high officials of the MOAC to farmers in five separate villages. Although the need for a comprehensive seed program/industry is widely recognized to date no specific "National Seed Plan" has been established to set forth basic governmental policies, the specific responsibilities of both the "public" and "private" sectors and the basic objectives to be achieved by each organization, and/or sector.

The expressed desires of the present Director-Generals of the DOAE, "to proceed cautiously, one step at a time," and of the DAT, to maintain and when possible reduce "research's" seed multiplication activites are consistent with the general policy of retaining responsibilities for research, education and regulation in the public sector, while shifting responsibilities for production and marketing to the private sector.

RECOMMENDATION 1: (Priority A)

The Minister of Agriculture and Cooperatives in cooperation with other affected Ministries and the existing private sector should establish a high level committee for the purpose of developing a comphrensive, long-range National Seed Plan.

Such a plan must be acceptable and operable under existing conditions, laws and policies in Thailand and, therefore, except for some technical details must be developed cooperatively by knowledgeable persons representing both the public and private sectors.

Personnel qualified to develop such a plan are located throughout the RTG and the private business sector, therefore, no attempt is made to identify potential committee members or to specify their qualifications. The planning committee, when formed, should bear in mind the two factors which distinguish seed from the several other inputs required for agricultural development: viz, seed must be alive to be of value for reproductive purposes: and seed are the only production input

which farmers can produce or reproduce themselves.

In developing the scope of Thailand's seed program experiences derived from seed program development activities in other countries will be helpful. Several of the benchmarks established out of these experiences follow:

(a) Skilled, knowledgeable manpower was basic.

(b) Early developmental efforts were concentrated.

(c) The quality of inputs into the program was more important than their quantity.

(d) The time frame was realistic.

(e) Planning, evaluation and implementation were continuous.

Seed programs planned in such a manner that the public and private sector activities are operationally interdependent have been less costly and more successful than programs completely within one sector or the other.

A seed program development committee reportedly already exists but is not functional and does not include representation from successful marketing cooperatives or private seed companies. The Minister has the authority to cause the full committee to become functional.

2. Trained Personnel

The number of technically trained personnel in Thailand is proportionally greater than in most of the other developing countries. Their presence is felt in almost every sector of agriculture and they may be a major reason for the rapid development of Thailand's agricultural economy. In spite of this favorable situation, however, there are only a limited number of governmental personnel trained in seed technology, and essentially no farmers with modern seed production training and experience.

The majority of the personnel who have been trained in seed technology (about 10 specialists) are employed by the D. A. T. which at present is the most important organization for supplying good seed of superior varieties of field crops to the farmers. The DAT personnel involved in the production of foundation seed of rice, maize, sorghum, and soybeans have developed notably effective, but not necessarily operationally efficient programs. The Seed Technology

Laboratory, Field Crops Division, DAT has very well trained personnel with several years operational experience.

At present the DOAE has only one officer who is trained and working in its seed program. Another DOAE officer with advanced training in seed technology is working as a Changwat officer and two more are at present receiving advanced training in the United States. The present leader of DOAE seed activities in soybeans has never received technical training in any area of seed technology.

Observations suggest that the private sector is equally deficient in technically trained seed personnel except for those who are involved in the purchase, import, distribution and marketing of vegetable seed. Yet, the private sector has effectively demonstrated that it has the knowledge and capacity to handle large quantities of agricultural products at prices competitive on the world market. This demonstrated expertise in marketing, essential to a successful seed program, should be utilized. In this connection our experiences indicate that joint training of technicians from the public and private sectors is an effective means of promoting a mutual understanding between workers in both sectors.

A modern seed program will require personnel trained in fabrication and installation of specialized equipment and facilities needed for seed threshing, drying, processing and storage. Representatives of several "equipment supply" companies contacted readily stated they had no knowledge of just how seed should be handled "differently" than common grain. The representatives of these companies, however, were very interested in learning about changes which could be made in their grain handling equipment to extend their usefulness to seeds.

RECOMMENDATION 2: (Priority A)

The MOAC and particularly the DOAE should give the highest of priorities to the selection of personnel for and implementation of the training programs outlined in Appendix II of this report, "Time Framed Schedule for Training, Facilities and Consultants - 1973-1976".

Training is assigned an urgent priority because there is simply no other way to move seed program/industry development forward without an adequate cadre of trained, knowledgeable, resourceful professional specialists and managers, technicians and workers. Inadequate trained manpower has been and remains a major constraint in seed program development in far too many countries.

Four levels of training are essential for the orderly development of a seed program/industry in Thailand. (1) Indepth professional training is needed for

the specialists who will plan, implement and manage seed program activities, and resolve the technical problems that arise. This type of training can best be given in specialized training institutions of the United States and other developed countries. (2) Operational technical training is needed to develop an adequate degree of expertise in field and seed inspectors, seed analysts, processing plant operators, drying and storage technicians, production technicians, seed extension workers, etc. A combination of in-country, short term training courses and on-the-job training is the best vehicle for development of "operational" skills of these sorts. (3) On-the-job training is needed for the workers who will man the operational units of the seed program. This type of training should be done by the second echelon "operational" cadre identified in (2) above. (4) Extension or "appreciation" training is needed to instill an appreciation of the benefits of improved seed in DOAE and DAT personnel working in different but related areas, grain dealers, other private sector personnel, officials of cooperatives, extension workers, etc., until a "good seed mentality" permeates the entire agricultural sector.

Thailand has made a good start in indepth training of professional specialists. Much, however, remains to be done. Participants returning from long-term professional training abroad should be given specific responsibilities in the developing seed program as soon as possible. They will probably make some mistakes, but, hopefully their positive contributions will far outweigh the few mistakes they might make. Administrators of agricultural development programs must be ever mindful that professional training and education does not produce competent professionals. It only prepares persons in the best possible way to develop that competent and resourcefulness that is the hallmark of the professional. Resourcefulness and competence, in turn, can arise only out of work experiences.

The cadre of professional seed specialists developed should be capable in time of taking care of all lower levels of training. Given a little longer time, adequate support, and the necessary positions in institutions of higher learning, they should be capable of training other professionals in Thailand. Until these stages are reached, however, enlistment of periodic external professional assistance and advice is vital. When beginning young professionals are thrown into waters of unknown depth to swim or sink on their own resources, many of them just might sink. An experienced hand to throw in a line before the situation becomes hopeless is a good means of protecting the substantial investment in professional training.

3. Finanace and Credit

As indicated in Section I of this report, and all other reports studied, farmer

credit, both in terms of its availability and knowledge of its use, is a major constraint to agricultural development in Thailand. Because of the complexities inherent in establishing and administering an effective national farm credit system capable of serving individual farmers, it appears that improvement and acceleration of the present BAAC program is one of the best means of reducing the financial burden placed upon a farmer as he changes from "traditional" to an intermediate or advanced level of technology in farm operations.

Only when normal, interest regulated, commercial banks are able and willing to offer their services to a significant percentage of the farmers will the so-called "exhorbitant" interest rates and "tenant-farmer attachment" to the local money lenders be minimized. Viewed from a different perspective, many of the "lenders" who are in business to supply farmers with purchaseable inputs such as cooking oil, tools, insecticides, etc., must be considered as prime candidates for expanding their present supply activities to include seed of known physical and genetic quality.

Each year Thailand's farmers utilize or borrow an estimated B 1,179 million (U.S. $56,180,500)[8/] just for "seed" to plant their rice, maize, mungbean, groundnut, soybean and sorghum crops. Since this money comes principally from private sources good solid development of the private sector would provide the RTG with the opportunity to minimize its seed program expenditures while still meeting the desired goal of making high quality seed available at reasonable prices.

Present RTG fiscal policies which relate directly to the operation of the existing seed programs make seed purchasing and marketing operations most difficult. The DOAE must establish contracts with seed producing farmers to whom they guarantee a price, normally substantially above the price of grain. Funds needed by DOAE to purchase seed contracted, however, must be predicted and budgeted as much as 15 months in advance of its need and there is little recourse if the budget estimate is incorrect. This arrangement is satisfactory only when grain prices are stable and production per rai doesn't exceed expectations.

8/ Based on the total seed requirement for planting acreages reported (1969-71) at a standard farmer cost of 2 ฿ per kilo. This is believed to be a very conservative estimate since farmers reportedly exchange 2 or 3 kilos of grain for each kilo of seed purchased or suffer an estimated 40-50% loss of grain kept for seeding purposes.

The recent world wide price increase of soybeans raised farm level grain prices in Thailand from ฿ 2.50/kg to ฿ 5.00/kg. Soybean seed production contracts signed in January specified a price of ฿4.00/kg for seed which met contract specifications. The approximately 9,800 rai of soybeans placed under contract in January 1973 were anticipated to make 1000 m.t. of high quality seed available. However, latest estimates were that the DOAE seed program would be able to purchase only 65 tons for seed, the balance of the production having been sold for the higher grain market price. Thus, more than 90% of the time and money expended by the DAT personnel on production of foundation seed and DOAE personnel in working with seed producers was lost, not to mention 935 tons of soybean seed. The fact that all farmers didn't sell their seed for grain at higher prices is indicative of their cooperative spirit and ability to foresee the benefits of establishing themselves as seed producers for the normal times ahead when the grain market is stable.

The more experienced DAT personnel working with rice, maize, and sorghum have circumvented some of these fiscal restraints in their limited off-station contract production. These officers have found it best to supply seed producers with sufficient foundation seed to plant two or three times the acreage they anticipate they will need. They then promise to purchase a specific quantity of the production and to assist the seed grower in selling the excess production as seed. Seed not purchased by the DAT or sold as seed can always be readily sold as grain. This practice, although wasteful of valuable foundation seed, was more successful than the DOAE plan under the unusual circumstances this year. Such a practice, however, as resourceful as it is, must be discounted. Foundation seed requirements anticipated by DOAE are simply to great to permit waste.

In contrast to the fiscal problems experienced in contract seed production, budgetary support for facility construction and purchase of equipment needed for threshing, drying, processing, storage and testing of seed has been liberal. The DOAE received approximately ฿1.6 million (U.S. $80,000) to support the construction and equipping of seed drying, processing, storage and testing facilities at Phitsanulok; ฿200,000 for the purchase of 10 small, portable threshers, and ฿300,000 to finance operational expenses incurred as a result of seed activities, i.e., per diem for field workers, hiring of trucks to pick up and distribute seed, etc. Thus, it is evident that when expenses were accurately estimated and justified the seed program has received the necessary support to operate on an effective basis.

RECOMMENDATION 3: (Priority A)

The MOAC and Ministry of Finance should develop a mutually satisfactory

method for establishing a "revolving fund" for use in the purchasing and marketing phases of the DOAE seed multiplication program.

Such a fund might be established by the BAAC and be subject to its stringent accounting procedures. Since the decision has been made to have the DOAE extend its seed activities into the "commercial area", it is incumbent upon the supporters of this decision to implement this activity in a fiscally sound, if non-profit manner. The initial amount of this fund will need to be about ฿10 million.

An additional advantage of utilizing the services and resources of an organization such as the BAAC would be the accumulation of the detailed fiscal records, which, if favorable, could be used to convince persons and companies in the private sector that handling "good seed" can be a profitable business.

RECOMMENDATION 4: (Priority A)

As a minimum, the current level of budgetary support should be maintained to finance adequately justified needs of the seed program.

As an example, an estimated ฿200,000 will be required during calendar year 1974 to complete the modifications of the seed processing facility at Phitsanulok, as outlined later in subsection D. This sum does not include the U. S. $30,000 of equipment being supplied by USOM.

RECOMMENDATION 5: (Priority B)

An agricultural economist should be assigned to work with the seed program to identify and establish economic and fiscal parameters and base data for use in budgeting, program analysis, and industry development.

It is evident from the economic data prepared for the "Accelerated Soybean Production and Marketing Activity for 1972-76"[9/] by the Division of Agricultural Economics, that competent economic specialists are available to examine in detail the agri-business dimension and potential of a seed program. Events have amply demonstrated that the necessary capital, credit, and entrepreneurship are available in Thailand to establish effective agri-businesses provided the opportunity is properly identified.

9/ "The Accelerated Soybean Production and Marketing Activity for 1972-1976" Agri. Econ. Res. Bul. 57. Div. of Agri. Econ. Office of the Under-Secretary of State, MOAC, Bangkok. 1972. 57 pp.

RECOMMENDATION 6: (Priority C)

Persons involved in the planning of the Ministry's operations should establish, at least tentatively, a date at which time the Ministry will begin to phase out its "commercial" activities in seed production and supply.

The earliest reasonable date to begin phasing out such activities appears to be in the early 1980's but this will be dependent on the interest generated in the private sector. The primary advantages of a competitive private enterprise seed program are: (a) less drain on tax revenues; (b) increased tax base for government; and (c) greater efficiency and higher quality in large scale seed production and supply. These advantages are, of course, not realized when subsidized, tax supported organizations operate in direct competition with commercial companies. On the other hand, private enterprise can usually show a profit when public agencies operate on a break-even basis, i.e., recover all investment, working capital, interest, salaries and other expenses through sales. At least initially, those companies which construct new facilities for the purpose of engaging in the business of handling high quality seed might be given the advantages accorded under the "Promotion of Industrial Investment Act of 2505."

4. Available Land and Facilities

Land for seed production is nearly all in the hands of the farmers. This is desirable because it permits seed to be produced by production specialists (farmers) without large capital outlays. The small amount of land required for building seed facilities can be purchased by indigenous or foreign companies duly registered under established laws.

The MOAC Departments, principally the DAT, control sufficient land at there 49 research stations and foundation seed multiplication centers to obviate the need for additional land purchases for seed production. The locations of these stations are given in Appendix III.

Except for the nominal facilities of the DAT and the DOAE's Seed Service Center at Phitsanulok, modern seed drying, processing, and storage facilities are essentially non-existant in Thailand. This fact combined with deficiencies in personnel trained to operate such facilities is and will be a major impediment to the development of an effective seed program, public or private. Experiences in other countries have shown that private investments in seed facilities cannot be expected until responsible governmental agencies have demonstrated the feasibility of moderate scale seed production and supply operations, determined the technical requirements for seed operations under prevailing conditions (climatic, economic, social) and established a suitable "operational" model or pattern for private sector participants to follow. All of these activities are proper and appropriate functions of government.

The MOAC needs to establish well planned, functional, centrally coordinated seed facilities in Thailand to: (a) handle the anticipated increase in foundation seed requirements, and limited quantities of multiplication and commercial seed; (b) serve as a training ground for workers, technicians, and professionals who will be needed not only to operate the facilities effectively and efficiently but also to solve problems as they arise and to train others for the seed industry as it develops; and (c) serve as a model or operational reference for the private sector. Although these facilities should be well planned and designed, they need not be elaborate, overly complex, or extensive, especially in view of the MOAC's expressed desire to enlist the private sector in large scale commercial seed production and supply.

Three moderate capacity (2000-2500 m.t./year) seed drying-processing-storage units including the developing Seed Service Center at Phitsanulok for multiplication of seed of upland crops such as soybeans, maize, mungbeans, sorghum, kenaf and sesame appear to be a reasonable goal for the near future. These centers could also handle rice seed multiplication, which would increase efficiency of the centers. The facilities should be located strategically (after careful study) in terms of regions and the transportation network.

RECOMMENDATION 7: (Priority A)

The MOAC and DOAE should implement the recommendations given in subsection D for completion of the seed service center at Phitsanulok, and initiate planning for two additional similar seed service centers located at other strategic sites.

Although planning for the two additional seed service centers should be initiated soonest, implementation should not begin until the Phitsanulok Seed Center is fully completed and operational so as to take maximum advantage of experiences earned in that endeavor.

Presently the DAT has the best seed facilities in Thailand and some of these are being improved. Limited discussions with DAT personnel, however, indicate that substantial improvements are needed in drying, cleaning and storage facilities for breeder and foundation seed to permit improvements in both the quality and quantity of these basic seed classes.

RECOMMENDATION 8: (Priority A)

The MOAC and DAT should conduct a thorough review of present and projected breeder and foundation seed operations to identify needed improvements in facilities and production arrangements.

Sufficient land is already available to the MOAC for its present and anticipated future activities in seed production. Should the land needs of the various departments change, responsibility for such land could be transferred on an interdepartmental basis. The purchase of additional land for seed production purposes would probably be interpreted by the private sector as an intention on the part of the MOAC to increase its commercial activities in seed.

5. Utilization of International Assistance

Another of the strong points in Thailand's agricultural program has been the effective utilization of bilateral and multilateral technical assistance. With specific reference to the requisites for a seed program, the contribution of the Rockefeller Foundation in rice, maize and sorghum improvement is evident throughout the country. The principal contribution of the USOM has been in providing scholarships for advanced training both in plant breeding and seed technology. The present leaders of the DAT's maize and sorghum project, rice seed multiplication program, and the Seed Technology Laboratories at Bangkhen and Khon Kaen received graduate degrees in Agronomy-Seed Technology through USAID scholarships. The University of Kentucky/USAID contract team is the principal source of technical assistance at the Northeast Regional Research Center, Khon Kaen.

Much of the credit for the apparent operational effectiveness of the two DAT seed testing laboratories, Seed Technology Laboratory, Division of Field Crops and Rice Seed Testing Laboratory, Rice Division, at Bangkhen is attributable to the technical assistance project in seed analysis and testing sponsored by FAO/UNDP which terminated in 1972. The Governments of Japan and Taiwan support plant breeding projects at Mae Jo for soybeans and vegetable crops, respectively. Assistance in cotton production and breeding is given by the British Government at the Tak Fa Cotton Development Station and the French at the Udorn Research Station. The Government of Australia sponsors a forage improvement project in cooperation with Khon Kaen University. Addition of forage seed production to the project is under active consideration.

In October-November, 1972, the World Bank, through FAO, sent a Seed Project Reconnaissance Mission to Thailand. The terms of reference for this mission were to discuss with the authorities concerned:

"(a) the scope and phasing of the project in terms of crops to be covered and the volume of seed to be produced;

(b) organization and management, including coordination between the Ministries and Departments involved and the role of private enterprize;

(c) procedures for appropriate seed quality controls and seed trade regulation and the legal basis thereof;

(d) research planning and organization for breeding and production of foundation seed;

(e) the need for a market survey and possible means of undertaking same.

3. Based on the foregoing you will prepare an outline of an application to the Bank for finance. You will then agree with the Government upon the detailed arrangements for project preparation...." 10/

A portion of the information gathered by this mission was used as background material in the preparation of this report.

A second FAO/IBRD Mission was in Thailand during March-April 1973 for the purpose of outlining a project which would extend the Government's role in seed multiplication and processing beyond the early generation (foundation seed) level. The preliminary report of second Mission was also made available to the USOM consultants.

RECOMMENDATION 9: (Priority A)

The MOAC should determine and make clear to external organizations concerned the specific areas in which technical and/or financial assistance is needed to develop Thailand's seed program.

The rendering of this decision at the earliest possible date will permit the external organizations to make the necessary planning and budgetary adjustments to maximize the utilization of the limited funds available for technical assistance. Of lesser importance, but still to the disadvantage of the seed multiplication program, is the good probability that contradictory recommendations will be made by the various missions.

It is of vital importance that the seed program presently being developed be Thailand's seed program and serve Thailand's needs. Several countries or organizations can,of course, supply the technical, and, if necessary, the financial assistance required for planning and implementing the program.

10/ "Report of the FAO/IBRD Seed Project Reconnaissance Mission to Thailand." J. M. Clark and J. Redrup. Report No. THA 53/73. 1973. FAO/IBRD Cooperative Program, UN-FAO, Rome.

B. Programs and Organizations

In this subsection the current situation with regard to the several "programs" or activities associated with a seed program/industry, i.e. foundation seed, seed certification, commercial seed, and seed regulatory programs are reviewed.

Except for DAT's foundation seed program none of the programs considered are effectively operational on a national basis although all have advanced at least to the early planning stages. Discussions concerning Seed Certification and Seed Regulatory programs were included at the request of the Director-General of the DOAE.

1. Foundation Seed Program

The DAT is responsible for foundation seed production and supply and has several effective foundation seed programs for the major field crops in which improved varieties have been developed. The Rice Division of the DAT appears to have the most highly trained personnel, best facilities, and most experience in the technical operations required for a foundation seed program. The foundation seed programs of the other projects in the Division of Field Crops are patterned after that of the Rice Division.

After a new field crop variety has been developed and thoroughly tested at the various locations where it might be adapted, it is recommended for release to a "Divisional" Release Committee. These committees, composed principally of DAT personnel, are well qualified to judge the general merits of the proposed new variety but do not always include persons from the commercial sector who may utilize the end result (grain, fiber, etc.) of the variety.

The breeders at the research station where a variety is developed are responsible for maintenance and supply of breeder's seed. Since most field crops are self-pollinated, the breeders use the mass selection or head to row methods of maintaining varietal purity. The ear to row method is used for maize. This seed is turned over to the foundation seed multiplication section of the Project, (or Division, in the case of rice) and subsequent multiplication is made at the various testing stations and multiplication centers under the Project's control. Because of this system, many of the 49 research stations are in reality varietal testing and foundation seed multiplication stations. Limited attempts to produce foundation class seed under contract with cooperating farmers has reportedly not been successful, primarily, because of difficulties in obtaining funds to pay growers for the seed when it is delivered.

Foundation seed production fields at the various outlying stations are inspected by Project personnel from the principal breeding station. Inspections emphasize isolation, freedom from crop and varietal mixtures and undesirable

weeds. Seed from these fields are routinely tested for purity, germination, and noxious weed seed. The personnel responsible for seed multiplication in each Project establish their own quality standards. Both the Rice and Field Crops Divisions have seed testing laboratories which use the I. S. T. A. Rules for Seed Testing as the basis for seed quality evaluations.

Most of the very limited amount of seed drying, processing and packaging equipment utilized in Thailand is under control of the various foundation seed multiplication sections of the DAT.

RECOMMENDATION 10: (Priority A)

Foundation seed production and supply for all crops should be integrated into a single program or section within DAT, including management, personnel and facilities.

After foundation seed are harvested, drying, processing, storage and distribution requirements are very similar for the different kinds of seed. Under the present conditions there are in reality several foundation seed programs, i.e. one each for rice, maize and sorghum, oil crops, etc. The advantages to be gained through integration and limited concentration of trained personnel and facilities, uniform procedures and standards, unified foundation seed demand forecasts, etc., would far outweigh the temporary inconveniences that may be created by re-assignment of personnel. A more subtle but most important advantage would be derived from the interchanges of ideas and information among the various projects of the DAT. Administratively, the major advantage appears to lie in the opportunity to avoid unnecessary duplication and reduce both the amount of funds and personnel required to fill the DAT's responsibilities for supplying foundation seed. Integration of personnel and facilities would also foster the development of an elite cadre of versatile seed technologists and a center of seed expertise which could provide the technical assistance needed in the developing seed industry.

Finally, unification of the several foundation seed sections into a single, centrally managed program is essential for the orderly development of a seed certification system and a seed industry. Certification officials and private seedsmen would quickly become frustrated trying to deal with a bunch of foundation seed sections each with their own regulations, standards and allocation procedures.

2. Seed Certification

Thailand does not have a seed certification system in the sense of operational certification programs in many developed countries. It does, however, already have most of the requisites for a seed certification system: improved varieties worthy of certification; breeder and foundation seed programs; and interest in and need for an orderly system for multiplication of seed of superior varieties.

Presently, informal discussions are underway relating to the establishment of a seed certification system in Thailand. The "ferment" for these discussions are personnel in the DAT who have some training in certification or, at least, have observed the important role of certification in seed production and supply in other countries. These discussions should be encouraged, continued and formalized into a study group consisting of representatives from all sections and sectors that would be affected by a certification program: DOAE, cooperatives, grain dealers, farmer-seed producers, etc.

RECOMMENDATION 11: (Priority A)

The MOAC should organize a study group consisting of representatives from DAT, DOAE, BAAC, cooperatives, grain industry, farmer's associations, etc., for the purpose of formulating recommendations to MOAC on: (a) a general, national seed certification policy; (b) a national certification program realistic in organization, scope, standards, and objectives; and (c) a time phased schedule for implementation of a certification system by crop species and agricultural region.

Seed certification should not be thought of as seed control legislation or seed marketing regulation, although it should be legally sanctioned to prevent misleading use of some terminology and nomenclature associated with certification, and to grant the necessary monopolistic rights to the program. An example of sanctioning legislation for a seed certification program is included in this report as Appendix IV. Note that specific rules and regulations for certifying specific crop are not part of the sanctioning legislation.

Establishment of a certification program would require appointment or designation of an official certifying agency as suggested in the sample legislation. This agency must be staffed with personnel having the technical training necessary to develop and implement reasonable rules and regulations for certification of the various kinds of seed. The agency must have offices, a staff and certain equipment. It must also be a legal entity, as provided for in the sanctioning legislation, with certain monopolistic privileges. One means of establishing an official seed certification agency in Thailand would be the formation of an incorporated, non-profit, service cooperative.

The present seed program of the DOAE, which involves private farmers in seed production, could be the principal training ground for producers of certified seed. Until a relatively large number of such producers understand the techniques of producing quality seed, however, there will be no effective "grower base" for a certification program.

Technical assistance for both the organization and implementation of a seed certification program is available from several countries and multilateral organizations and should be utilized to the fullest extent.

When considering the development of a certification program, the study group recommended should keep in mind that the purpose of seed certification is to provide the farmer or user of the seed an assurance regarding the genetic purity and other important aspects of seed quality that cannot readily be determined by visual examination of the seed itself. They should also be mindful that few programs have been more highly promoted or caused more confusion and disappointments in developing countries than seed certification. For this reason, the following list of things that certification is not is included:

(a) It is not a seed program. It is only one supporting element.

(b) It is not seed multiplication and production. It is a system for accomplishing these tasks.

(c) It is not governmental production of seed. It is concerned with how seed is produced and not who produces it.

(d) It is not seed labeling although certified seed should carry a distinctive label or marking.

(e) It is not seed marketing and distribution.

(f) It does not assure that all seed certified are the highest quality available. It should assure that all certified seed are of high quality.

Finally, the present use of the terms normally associated with certification should be discouraged until certified seed are in fact available to the farmers so as to avoid confusion. For the present, the following terminology used by some MOAC personnel is recommended:

(a) Breeders Seed - seed directly controlled by the originating or sponsoring plant breeder or research station.

(b) Foundation Seed - seed which are the progeny of breeders or foundation seed so handled as to most nearly maintain specific genetic purity and identity.

(c) Stock Seed - seed which are the progeny of foundation seed.

(d) Multiplication Seed - seed which are the progeny of stock seed.

(e) Commercial Seed - all seed or grain planted for reproductive purposes which do not meet one of the above classifications.

Upon implementation of the seed certification program the "stock seed" and "multiplication seed" classes would become "registered seed" and "certified

seed", respectively. These changes will faciliate a distinction on the past of the farmers between the initial efforts being undertaken now toward the development of a comprehensive seed program and the actual establishment of an operationally effective seed certification program in the future.

3. DOAE Seed Multiplication Program

The DOAE initiated its seed multiplication program in 1972 and to date has only been actively involved in the production and processing of soybean seed. Officially, only two persons are directly assigned to the seed program and they have the additional responsibilities of developing and supervision of the DOAE's national program for soybean promotion. Neither of these persons has received specialized training in technical aspects of production, processing, distribution or management of seed operations. In view of the good progress made despite severe handicaps as discussed under Technical Operations, the program leader has done a most outstanding job.

As implied above, there is no formal organization to the DOAE's seed program. Rather, the efforts so far have been on the very informal basis of a cooperative lending personnel to accomplish the necessary tasks. The overall management and planning of the program is the responsibility of the Leader of the Soybean Project. The supervision of seed producers is the responsibility of the Amphoe and Changwat Extension Officers. The operation of the Seed Service Center at Phitsanulok is the responsibility of the Associate Changwat Officer of Changwat Phitsanulok. A decision has not yet been made concerning assignment of responsibilities when maize, which is administratively under another project, is taken into the DOAE seed multiplication program. Quite obviously, the budding seed multiplication program is confronted with serious organizational problems! Several paths appear to be avenues out of this organizational wilderness: (a) a separate seed project, equal organizationally to other projects of the Division of Crop Promotion could be created, budgeted and staffed; (b) a seed production cooperative along the lines suggested by the World Bank study team could be created; (c) each crop oriented project of the DOAE could establish its own seed multiplication program along the lines presently followed by DAT; (d) a Seed Division could be established in the DOAE with responsibility not only for seed production-distribution but also certification, other regulatory activities, promotion, etc. or (e) a temporary Seed Multiplication Coordinating Section within the DOAE could be established with power to supervise all the seed multiplication activities and programs until such time that the DOAE can be relieved of at least the commercial aspects of the seed program. Under present circumstances and until a comprehensive National Seed Plan is formulated alternatives (a), or (d), or combination of (a) and (b) appear to be most appropriate.

RECOMMENDATION 12: (Priority A)

DOAE should establish a Seed Multiplication Division or Seed Multiplica-

tion Project within the Division of Crop Promotion, whichever is determined to be most appropriate and advantageous, with responsibility for all of its seed multiplication activities - demand forecast, contract production, inspections, seed service center operations, allocation of seed, etc.

Unification of seed multiplication responsibilities will permit concentration of the limited number of trained personnel into a single working group, maximize utilization of the limited facilities, facilitate intra-and inter-departmental communications and coordination, minimize personnel transfers and changes, and, thereby, increase the probability of success.

The most serious impediment to successful implementation of DOAE's seed multiplication program is insufficient personnel technically trained in the various aspects of seed technology. At present, the DOAE has but two employees who have received detailed, intensive training in seed technology with two additional men in advanced training programs. None of these men have significant operational experience and only one is actually working in the present DOAE seed multiplication program. The assignment of personnel trained in seed technology duties in unrelated projects is wasteful of the funds spent on training, retards development of the seed program, and is frustrating to the individuals.

RECOMMENDATION 13: (Priority A)

The DOAE should make every effort to speed the transfer or assignment of personnel trained in seed operations to the seed multiplication program.

Mechanical threshing, artificial drying and conditioned storage of large quantities (500-1000 tons) of seed are unknown in Thailand. Attempts to undertake such a program with personnel who do not understand the reasons for or consequences of misuse of mechanical facilities will inevitably lead to unsatisfactory results. The suggested staffing plan given in Appendix V indicates that nine officers, grades 1 to 4, will be needed by 1975. At least seven of these positions are new occupational specialities which require specialized training before they can become operationally effective.

All the time of our visit, only the leader of the DOAE's Soybean Project could be classified as having any real experience in the task being undertaken by the DOAE. His experience, however, is very limited and he has not yet received any technical training in seed. Fortunately, it was possible to make arrangements for him to receive six months intensive technical training and practical experience in the U.S., starting immediately, through the cooperative R.T.G./U.S.O.M. participant training program.

The increased quantity of seed needed in Thailand must not be achieved through sacrifice in quality. For this reason the Seed Multiplication Program should take all reasonable precautions to assure that all seed produced and distributed under the DOAE seed program are much better than those supplied by grain merchant or saved by farmers. Seed production goals call for 6,500 tons of high quality seeds by 1976. In view of the lack of trained personnel, experience, and facilities, a more realistic goal for 1976 would appear to be about 2,000 tons. Only when trained experienced personnel are available should larger goals be established. The fact that in spite of a four-fold increase in contracted acreage in 1973 over that of 1972, the quantity of seed of the improved soybean varieties available for distribution decreased from 160 tons in 1972 to an estimated 103 tons in 1973 is indicative of the instabilities seemingly inherent in developing seed programs. Some officials feel that the only reason the 1972 goal of 800 tons of soybean seed was not achieved was the sudden and dramatic increase in soybean grains prices. In our view, however, the reason was "built-in" inflexibility in fiscal policies which did not permit adjustment to the changing market, as well as inexperience, and inadequate facilities.

Experiences in other countries - developed and less developed alike - have demonstrated that government seed production and supply operators on any "commercial scale" are invaribly inefficient, and usually ineffective as well. Seed production and supply simply require a level of fiscal and managerial flexibility and decisiveness that is beyond the capability of most governmental organizations. For these reasons, and considering that DOAE, first and foremost, is and should be an educational-promotion organization - a change agency - the RTG should initiate an active program to encourage the development of "commercial scale" seed production and supply in the private sector. The vigorous grain trade in Thailand is ample testimony of the availability of capital and managerial talent for agri-business endeavors in the private sector. Indeed, a substantial "seed trade" already exists for certain kinds of seed, e.g., vegetable and kenaf seed.

Private sector seed production and supply operations, however, can only become established when the economic and political climate is favorable. A private seed company must be able to recover all production and operational costs plus a reasonable return on its total investment. Otherwise, it cannot continue in business. Seed prices, therefore, must either be allowed to attain the level determined by the interaction of supply and demand, or when controlled, must be set a level allowing a reasonable margin of profit.

In our view the present DOAE policy of selling seed at essentially "grain" price is counter-productive in terms of seed industry development. There is no scope for private sector activity in a basically subsidized supply operation of this sort. As a general rule, non-hybrid field crop seed of the kinds needed in Thailand, i.e., rice, soybean, sorghum, maize, etc., should command a 50 to

100% premium over "grain" price, with the self-pollinated species toward the low end, and the cross pollinated kinds (maize) toward the upper end. Such seed, of course, would have to be of premium quality to go along with premium prices.

The old assumption that farmers cannot "afford" the premium prices which good seed ought to command has been invalidated by experiences all over the world. Farmers, even in the poorest countries, will pay and have paid not just premium but exorbitant prices for high quality seed of truly superior varieties. They will not pay premium prices, however, for seed that have no substantial advantages, or may even be inferior to the seed they save, regardless of who produced it or how attractively packaged and "officially" labeled it might be.

RECOMMENDATION 14: (Priority A)

The RTG through the MOAC should insist that prices of seed produced by governmental agencies be established at a level that will permit recovery of all costs including salaries plus a reasonable return (15% minimum) on capital investment in facilities.

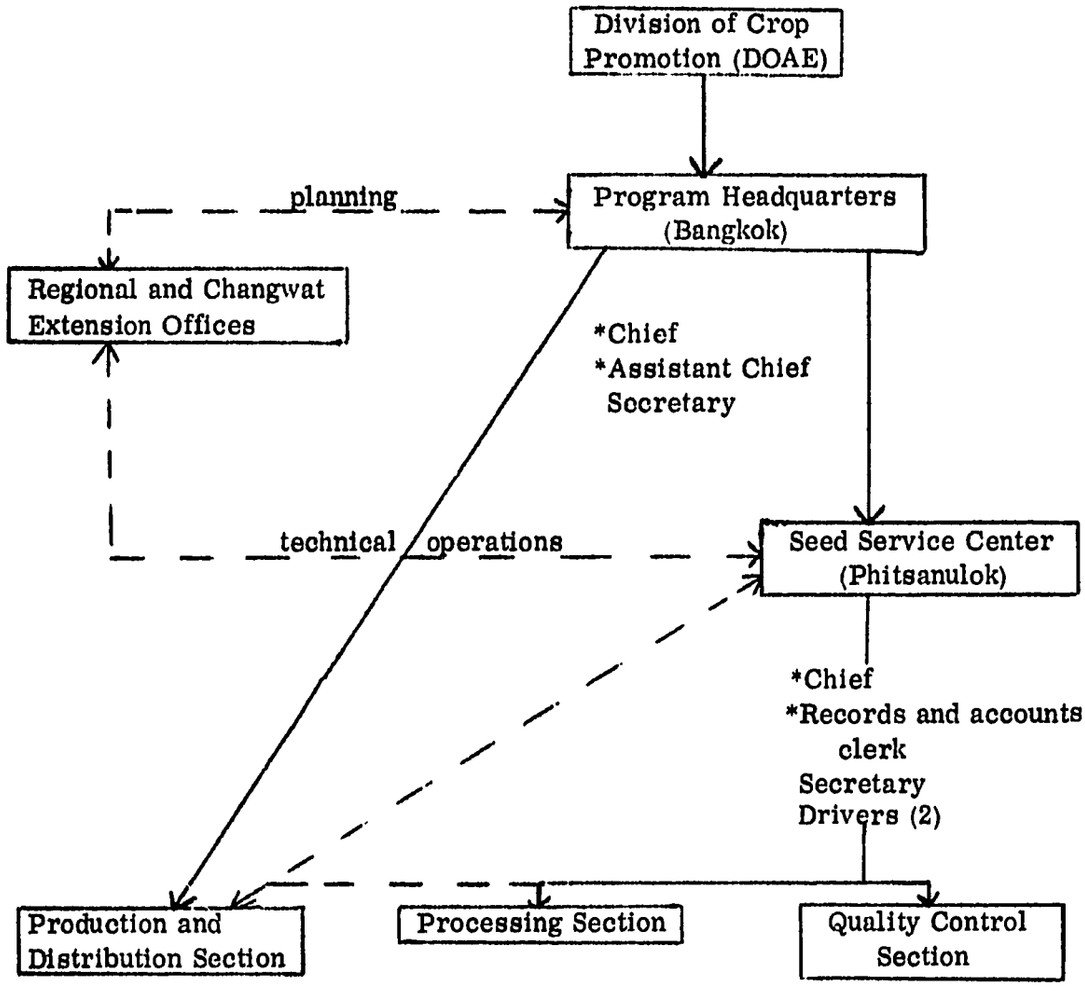
Implementation of this recommendation will require an analysis of capital investments and costs of production. Recommendation 5 relating to assignment of an agricultural economist to the seed program was directed at just this objective. Monies recovered through seed sales for costs of budgeted items, i.e., salaries of officers, could be used to establish the "revolving fund" of Recommendation 3 until a satisfactory level is attained, then returned to the RTG's general fund. The minimum 15% return on capital investment could be used to establish a fund for maintenance, replacement and expansion of capital facilities. Overall the seed multiplication program should become essentially self-supporting by 1976-78. This achievement would go far in establishing a favorable climate for private sector entry into commercial seed production and supply.

A suggested organizational plan for DOAE's Seed Multiplication Program listing the principal officers and their location is given on the following page. The job-descriptions and responsibilities of these personnel are outlined in Appendix VIII. For administrative purposes, all officers stationed at the Seed Service Center should be assigned to the Northern Regional Extension Training and Supervision Center with Branch Headquarters at Phitsanulok. Assignment to this location would permit necessary travel without approval at the Changwat level throughout the major seed production area.

4. Commercial Seed Activities

Time did not permit detailed inquires into present private sector seed activities and operations. Officials of the MOAC indicated that most vegetable seed

Suggested Organizational and Initial Staffing Pattern for the DOAE Seed Multiplication Program



*Chief of Production and Distribution

*Chief of Processing
*Processing Superintendent
*Equipment Mechanic
General Workers (4)
Temporary Labor

*Quality Control officer
*Senior Seed Analyst
*Junior Seed Analyst
*Analyst's Assistants (2)

*Job Descriptions are given in Appendix VIII

sold in Thailand were distributed through importers located in Bangkok. Casual visits and observations made during "free" time revealed that many businesses catering to farmers displayed vegetable seed which had been imported. The results of a survey of the quality of seed offered in the market place (Appendix V) suggest that seed quality could and should be improved.

The one business man visited who offered both vegetable and field crop (kenaf and maize) seed stated that seed were a profitable side line to his major business of manufacture and sale of oxen plows. This man regularly purchased several bags of maize and kenaf seed from farmers, stored them in the back of his store until the next planting season, and then offered them for sale. He did not have his seed tested for purity or germination but indicated that his customers never complained about seed quality except for vegetables.

The vegetable seed handled by this business man were packaged both in paper envelopes and small hermatically sealed cans. He stated that he had to purchase the seed in sealed cans but that those in envelopes were sold on a consignment basis, the packages being exchanged once each year. He believed that this was the "sales" policy of all vegetable seed importers.

Our general impression is that there is little interaction between public officials and the business community which serves the farmers at the national, Changwat and local level. Frequently, public officials knew the location of businesses which sell "seed" to farmers but not their names, the kinds of seed sold or the price of the seed. MOAC, especially through DOAE, ought to take a more active interest in budding agri-businesses and assist them with improvements in their supply lines and operation in every possible way.

RECOMMENDATION 15: (Priority B)

The MOAC should determine ways and means by which private sector participation in seed production and supply can be fostered and facilitated.

The Government can do much to create a climate favorable for private sector entry into the seed program/industry through formulation of and adherence to wise policies, tax concessions, investment credit, production and operational credit (short term), technical assistance, etc.

5. Seed Regulatory Legislation and Program

At present, the "Plant Quarantine Act BE 2507" (1964) and the subsequent Ministerial Regulations are the only legal controls applied to seed. This Act covers both the import and export of plant materials for phytosanitary purposes only.

Interest in legislation to regulate the quality of seed offered for sale within Thailand has existed for several years, principally, among personnel of the DAT. This interest received new impetus as a result of the study and recommendations of the initial FAO/IBRD "seed" mission. An "unofficial" English translation of the most recent draft of proposed seed legislation was supplied to us along with request for our comments and suggestions.

We must state here and now our view, which is: the essentially, or even the importance of seed regulatory legislation in a beginning seed program has not been demonstrated. In our technical assistance activities in more than 35 countries, we have not seen one instance in which seed program/industry development was fostered or facilitated by seed regulatory legislation. We have, on the other hand, seen several instances where seed legislation was used as a club to beat off all attempts by the private sector to enter into seed production and supply operations. The point is that seed regulatory legislation is a two-edged instrument. It can, at least theoretically, advance seed program/industry development by assisting seed producers and suppliers with improvements in seed quality and by protecting legitimate seed businesses as well as farmers against unscrupulous practices. The other side of seed regulatory legislation is all restrictive and punitive. Emphasis is totally on preventing malpratices, which all too often are ill-defined and include any private sector activity, without any attempt to foster good practices and assist seed producers and suppliers in compliance with provisions of the legislation.

It seems to us that there are several "keys" to successful implementation of seed regulatory legislation:

(a) Selectivity - The legislation, especially the regulations promulgated thereunder, ought to be concerned with marketing of only those kinds of seed for which seed control would substantially benefit agricultural development. The legislation must, therefore, be selective. It should be directed at specific kinds of seed, control of which could be extremely beneficial and justify the effort and expense of implementation and enforcement. Those kinds of seed not initially controlled can be taken under control when the need arises and an implementation and enforcement capability has been developed.

(b) Realism - Seed legislation ought to be realistic. Beginning seed businesses in the less developed countries cannot be expected to meet the same regulations and standards as those in developed countries. They lack the experience, technical and managerial capability to do so. Similarity, seed control agencies in the less developed countries lack the experience, supervisory and technical capability to implement and enforce advanced seed legislation. Therefore, in framing seed legislation and regulations in the less developed countries where

seed production and supply are just beginning, it is most important that they be realistic in terms of actual and present seeds, capability of seed businesses to comply with regulations and standards, and capability of the seed control agency to implement and enforce promulgated regulations and standards.

(c) Education - Implementation of seed regulatory legislation is and should be about 90% education, and public relations and 10% or less punitive actions. Seed companies have to be educated so that they will understand what regulation and standards they are expected to comply with, and how they can so order their operations as to facilitate and achieve compliance. Farmers have to be educated on the meaning of seed labels and importance of good seed. And, seed control officials and inspectors have to be educated continously in the service and public relation aspects of seed control. The "policeman attitude", which arises naturally, must be de-emphasized.

(d) Impartiality - Seed legislation must be impartially implemented and enforced. There is no place in seed control for favoritism, bribery, and corruption.

The promulgation, implementation and enforcement of seed regulatory legislation is a big step in a developing seed program/industry. It must not be taken lightly or in the wrong direction. The authors of seed legislation in Thailand must be ever mindful that the capacity of seed laws and regulations to restrict, inhibit, impede and even destroy is virtually unlimited, and that there is as much danger to seed program/industry development from over control as there is from lack of control.

Carefully conceived, thoughtfully implemented, and equitably enforced seed regulatory legislation could be a focus for marshalling the best resources of both the public and private sectors for the benefit of Thailand's farmers. And it must be so.

An example of the type of seed legislation which could be beneficial in Thailand is given in Appendix VI. We emphasize that this is an example only. The RTG and MOAC should take advantage of the best assistance and advice available in framing and implementing seed legislation attuned to its present and projected needs.

RECOMMENDATION 16: (Priority B)

The RTG and MOAC should charge the study group appointed under Recommendation 12 with the additional task of determining the type and scope of seed legislation which would be most beneficial to

agricultural development. The study group should enlist and utilize knowledgeable, experienced advice and technical assistance in formulation of its recommendations on seed legislation.

C. Technical Operations

Technical operations refer to those activities directly involved in varietal development and subsequent production, harvesting, drying, processing, storage, distribution and quality control of the seed. The following discussions and recommendations relate principally to the Seed Multiplication Program of the DOAE. Because of the intimate association between varietal development and initial seed increase (breeders and foundation seed) programs and subsequent multiplications, however, certain aspects of DAT's seed activities, are also considered. Except for the following section, the technical operations are discussed by crops. The complete sequence of technical operations is given in detail for soybeans and in lesser detail for maize.

1. Varietal Improvement and Seed Research

The DAT is responsible for and has done an excellent job of developing and testing improved varieties of most of the major field crops grown in Thailand. The DAT presently recommends specific varieties of the following crops: rice, 38; soybeans, 2; maize, 3; sorghum, 2; groundnuts, 3; cotton, 3; mungbeans, 3; kenaf, 1; and vegetable crops, 3: (chinese radish, kale and sugar pea). Superior lines of rice, maize, sorghum, mungbeans and kenaf will probably be released during the next year or two. It is evident that the varietal improvement program has reached the point where a continuous stream of improved and more improved varieties is assured.

Research in the various areas of seed technology, except in seed analysis and quality evaluation, is virtually non-existant. It is widely recognized that soybeans are the source of more seed quality problems than any other crop and this is reflected in the high priority they are receiving in the seed program. Nevertheless, the specific factors or combination of factors which cause the rapid deterioration of soybean seed as they are produced, harvested, threshed and stored in Thailand have not been identified. It is not sufficient to know that "high temperatures and high relative humidities" are "bad" for soybean seed (they're also "bad" for all kinds of seed). The exact times during present seed operations when these factors combine to wreck seed quality must be pinpointed. The usual farmer practice of trying freshly harvested soybean plants with seed moisture contents ranging from 18 to 30% into bundles as large as 30 cm in diameter to facilitate carrying the plants to their homes for storage, might just be,for example, a major contributor to seed quality problems.

Although, the body of research on seed production, harvesting, threshing,

drying, processing, packaging and storage is rather vast on a worldwide basis, most of this research has been conducted under and is directly applicable to temperate climatic zones. It will be necessary for DAT seed technologists to adapt and adjust the established principles to the specific practices and conditions in Thailand. The facilities and trained personnel are available to initiate seed research of an applied nature, which is badly needed.

The apparent ineffectiveness of soybean inoculants is another problem affecting the productivity of soybeans, and presumably other legumes. Soybean plants pulled from the ground showed little or no evidence of nodulation , although, the seed reportedly had been inoculated. It was not possible, however, to determine the cause: poor inoculant, use of insufficient quantities, improper strains of Rhizobium, soil conditions, etc.

The DAT has trained soil microbiologists working on this problem; however, to date the results of this important work are not available in a practical way to the farmers. Considering the high cost of nitrogen fertilizer and the fact that over 2 million rai of legume crops are planted each year, the widespread utilization of effective inoculants would be an inexpensive means of supplying several thousand tons of nitrogen for crops such as rice and maize:

RECOMMENDATION 17: (Priority A)

The DAT personnel and facilities equipped for seed quality investigations should initiate a series of practical, applied studies to determine the specific causes of seed quality problems in soybeans and other seed kinds and their solution.

If necessary and requested, short term technical assistance for the purpose of problem identification and outlining specific seed research projects should be available either through USOM, Rockefeller Foundation or FAO.

RECOMMENDATION 18: (Priority B)

The DAT or DOAE should obtain the short term consultant services of a microbiologist qualified to identify likely causes and give recommendations concerning possible solutions to the problems involved in legume seed inoculation and nodulation.

2. Seed Production, Processing, and Marketing

All technical operations for breeders and foundation seed are the responsibility of the individual projects of the DAT. Most of these seed are produced and processed on the various research stations located throughout Thailand (see Appendix III). Because the need for high quality seed often exceeds the DAT's capacity to produce, some "multiplication" seed have been produced in recent years through a cooperative program with farmers located adjacent to the research stations.

In 1972, the DOAE was assigned specific responsibility for the technical operations required for multiplication of seed beyond the foundation seed class. Since soybean seed were consistently so low in quality this crop was chosen for the initial multiplication effort by the DOAE. The current 5 year plan also specifies that the DOAE will be responsible for the multiplication of maize seed starting with the 1974-75 crop year.

Soybeans -- At present only two varieties of soybeans, SJ-1 and SJ-2, are recommended by the DAT. Both varieties are similar in general plant characteristics having been selected from related genetic materials introduced from Japan. The selections were made at the Mae Jo research station where breeders seed are maintained. Seeds of the two varieties are distinguishable on the basis of hilum color, SJ-1 has a dark brown hilum, and SJ-2 has a reddish brown hilum. Both varieties have similar oil (20%) and protein (45%) contents which make them satisfactory on the local and world markets for both crushing and edible purposes. traditional varieties grown for human consumption are low in oil (14-16%) and, thus, not too desirable on the world market. It was estimated that the recommended varieties were planted on 320,000 rai or 80% of the soybean acreage in 1972.

All soybean seed planted for seed production by the DOAE are produced and supplied without charge by the Oil Seed Project, Field Crops Division, DAT. The quantity supplied is based on the request made by the leader of the DOAE soybean project. The DAT has always been able to supply sufficient quantities of foundation seed although germination of the seed supplied for planting the 1973 dry-season crop was "lower than usual".

The DOAE soybean project leader and his co-workers determine the general location (by Changwat) of the areas for seed production. The project leader then contacts the Changwat Extension Officers and requests that they locate sufficient farmers to produce the desired number of rai. Seed producers are selected by the Amphoe and Changwat technical officers.

The selection of producers is based on village location (it is necessary to obtain several seed producers to secure sufficient production at a single village), previous seed production experience, and general willingness to follow recommended production practices. Individual farmers produce only 10-15 rai ($1\frac{1}{2}$-$2\frac{1}{2}$ ha.) of soybeans; however, some villages may produce a combined total of more than 100 rai. After all potential seed producers in a village are contacted, those interested sign a growers contract (see Appendix VII).

Recommended plant populations are 40 plants/m^2 planted in 50 cm rows, 5 cm between plants. Partly because of the low germination, plant populations in several seed production fields were as low as 10/m^2. (Plant populations in some grain production fields observed were as low as 3 plants/m^2).

The land is prepared by plowing and leveling, primarily with water buffalo. Seeding is done by hand. Only a small percentage of the producers inoculate, use chemical fertilizer, or apply herbicides to control the weedy grasses, including volunteer rice. Opinions on the availability and profitability of using labor for hand weeding were conflicting. Hand weeding of research plots increases yields 10-20% but yield increases as high as 40% have been reported. No weed free seed production or grain fields were observed, although, weed infestation varied considerably. The available herbicides must be soil incorporated after planting and farmers do not consider this practical when it must be done by hand.

Harvest begins when the pods turn tan or brown and the leaves turn yellow (near physiological maturity of the seed). The plants are pulled or cut at ground level by hand, stacked loosely in piles often with the plants inverted. Usually the daily harvest is bundled and carried to the farmer's home each day to prevent theft. If it rains or drying conditions are very poor some growers will leave the cut plants in the field until the leaves wilt and begin to dry.

As time and weather permit, the bundles are placed in the sun to dry, but care is taken to make sure the plant material can be moved under cover in case of rain. More experienced farmers tended to tie the plants in smaller bundles (10-15 cm. diameter) and allow more space between bundles when drying. At one village the plant bundles were approximately 35 cm in diameter with the plants in the center of each bundle completely molded.

When the pods are dry, threshing is effected using the traditional flail and/or tramping methods. The average threshing capacity per worker was determined to be 30 kilos per 8 hr. day. Farmers at three separate villages indicated that farm labor was in short supply and increasingly expensive (฿12 and the noon meal or ฿20 per day) during the harvesting-threshing period. After threshing, the seed are winnowed, sieved and then hand picked to remove foreign materials and rotten or green seed. The seed cleaned each day are placed in large woven baskets or in jute bags and stored in or under the house.

What was believed to be the first on-farm demonstration of a motor powered soybean thresher in Thailand was observed in Ban Nong-ha Changwat Lampang on May 10. The thresher, made in Thailand, was powered by a 10 h.p. gasoline engine. It was modeled after the rasp-bar cylinder, plot thresher similar to those used by research workers in the U.S. The thresher is road portable behind any car or truck equipped with a hitch, and hand movable, a necessity to reach some villages. Ten of these threshers were purchased by the DOAE soybean project for ฿20,000 (US $1,000) each. The thresher had an output of about 30 kilos/hour during trial runs.

Reactions to subsequent demonstrations in other villages ranged from "glee" on the part of the women and children who do most of the threshing and hand cleaning, to "not satisfactory" by the farmers who could find an occasional un-

threshed pod containing good seed. All grains good, bad, rotten and immature are removed from the pods by the flail method.

The quality of seed after mechanical threshing and winnowing appeared to be equal to that of the completely hand cleaned seed. The thresher apparently offers some distinct advantages for seed purposes, i.e., reduces threshing time, eliminates the necessity to remove soil particles and stones "mixed in" when the soybeans are flailed on the ground, and reduces labor requirement during the "rush" period. Regardless of the final usefulness of these threshers, this type of inovative thinking to resolve a known problem should be encouraged. In view of its high initial cost, unknown effectiveness for threshing other crops, principally rice, lack of knowledge of maintenance and operation costs, and unknown life expectancy, all of which need to be determined, the thresher is not yet recommended for farmer purchase. Nevertheless, a custom service charge of ฿0.25/kg threshed seed would result in savings of ฿0.15/kilo to the seed growers and should cover the maintenance, operation and moving costs according to the preliminary estimates made by DOAE technicians.

The purchase of seed, as with all products by a governmental agency, requires that the seed be inspected and accepted by two separate committees. The inspection committee is typically composed of the Chief, Crop Promotion Division, Chief, Regional Extension Training and Supervision Center, and Leader of the Crop Promotion Project, involved. The composition of the acceptance committee is typically the Changwat Extension Officer, a disinterested Amphoe Extension officer and the Amphoe Officer responsible for supervision of the seed producer.

When all seed producers in a village have their seed ready for sale the two committees are notified. Each farmer's seed are examined visually to determine if the seed generally meet the quality standards set forth in the contract.[11/] The committees may also question the supervising Amphoe officer and the seed producer to determine contract compliance.

Seed acceptable for purchase (75% meet the requirements) are weighed, placed in jute bags and transported to a central location on trucks hired by the DOAE from the government transportation office (ETO). The farmer is issued a bank draft for the total amount of seed accepted in accord with the contract price.

The contract price for dry-season production in 1972 was ฿4.00/kg for SJ-1 and ฿3.50 for SJ-2,
tering of SJ-1 when grown under dry-season climatic conditions. The same year

---

[11/] The contract states that soybeans may have a maximum moisture content of 20%, which is above the equilibrium moisture at 95% R.H., and a minimum germination of 85%, which is not determined!

the price was ฿2.50/kg for grain containing up to 10% inert matter and damaged kernels. The written 1973 contract price was the same as in 1972; however, by early May, 1973, the price of grain soybeans at the farm level had risen to ฿4.85/kg. To remain in a competitive position, the DOAE requested and received authorization and money to increase the payment price for soybean seed to ฿4.50/kg and ฿3.75/kg for SJ-1 and SJ-2, respectively, but this required time - too much time. By May 26, the grain price in Changwat Cheing Mai had increased to ฿5.10/kg and most of the seed producers were selling their seed as grain. Thus, the DOAE was able to buy only about 6% of the 1,000 tons of soybean seed it had anticipated buying.

Until now, the DOAE has no facilities for drying, cleaning, or determing the moisture content of the seed. The seed are brought to a central location, placed in new jute bags even-weighed, 100 kgs. per bag, identified as to variety and stored in rented, borrowed, or other available storerooms to await distribution.

Since the period between dry-season harvest (April-May) and the first wet-season planting (May-June) is short, the seed are not routinely tested to determine mechanical purity or viability. Reportedly, spot checks of germination percent during 1972, made on samples drawn when the seed were at the collection points, revealed germination percentages in the range 80 to 85%.

Multiplication seed produced during the dry-season are planted in an area approximately 300 km. to the south. Two to three months prior to soybean planting time the DOAE Amphoe Officers start taking orders by variety, maximum of 100 kgs. per farmer, from farmers in the planting zone. Multiplication seed of soybeans are sold for ฿4.00/kg f.o.b., the using Amphoe distribution point. "Orders" are consolidated at the DOAE Changwat office and forwarded to the leader of the soybean project. After the orders are received, the seed ready for distribution are shipped to the ordering Changwat or Amphoe hqs. The farmers then pay for and receive the quantity of seed booked. During the first two seasons of operation the supply of seed never met the demand. The acreage of soybeans contracted and tons of clean seed sold by the DOAE since it started seed multiplication are given in Table 2.

Table 2. Volume of soybean multiplication seed sold by the DOAE.

Harvest Season	SJ-1 Variety		SJ-2 Variety	
	Rai	MT	Rai	MT
	Contracted	Purchased	Contracted	Purchased
Dry 1972	1,500	111.3	1,000	59.5
Wet 1972	0	0	2500	10
Dry 1973	6,000	63(est)	3,800	40(est)

RECOMMENDATION 19: (Priority A)

An acceptable fiscal procedure should be developed which will assure that the DOAE seed program can purchase established minimum quantities of seed when they are produced. (See Recommendation 3).

This recommendation is directed at the most important problem to be resolved! Until the DOAE seed program can consistently provide even small quantities (a few tons) of good seed of superior varieties, season after season, there is little hope for the development of an effective, efficient seed program either in the public or private sector. Just as the farmer must have seed and the grain merchant must have grain, the DOAE seed program must have seed to distribute or go "out of-business". It was not the unpredicted, rapid increase in soybean price that essentially prevented the DOAE from purchasing a reasonable supply of good seed this year, rather it was the inflexibility of government fiscal regulations.

The grain price of all non-hybrid crop species will fluctuate every year, one year soybeans, the next year rice, etc., etc. Grain prices cannot be easily controlled and a "healthy" internal and external economy maintained. Unlike the DAT, the DOAE is dependent upon farmers for production of the desired quantities of seed, therefore, it must develop some means of competing with the seed producer's alternative grain market if it is to be assured a supply of seed.

RECOMMENDATION 20: (Priority A)

Seed production agreements or contracts should be revised to include only those factors which the cultivator and the Department are capable of fulfilling.

The inclusion of statements or standards which are not enforceable tends to create mistrust and a sense of meaninglessness to the agreement. Specific items in the current agreement which were not or could not be enforced relate to plant spacing and weeds and seed quality standards. (see Appendix IV).

With reference to plant spacing and weeds, either the advice being given is not in keeping with practical cultural recommendations, or the cultivators are not following the advice given. Reasonable implementation of this provision will be to the farmers' advantage.

The Department presently does not verify by test some of the seed standards included in the producer contract, e.g., moisture %, germination %. The standards, however, should be verified and they could be satisfactorily verified with a minimum investment in simple portable equipment such as a gram scale and an electric moisture tester. Germination could be simply tested by planting seed in sand boxes.

Suggested seed quality standards for the producer's contract are:

(a)	Minimum pure soybean seed	97%
(b)	Maximum adulterating materials, i.e., gravel, soil, stems, etc.	3%
(c)	Varietal purity; maximum number of seed of other soybean varieties per kilogram.	7/kg (or 0.1%)
(d)	Maximum green unripe soybean seed	5%
(e)	Maximum spoiled seed, i.e., broken, thin, insect damaged, rotten.	10%
(f)	Maximum moisture %	18%
(g)	Minimum germination	85%

There are many obvious places or times in the present sequence of harvesting, drying and threshing seed where seed quality could be substantially damaged. A good place to start looking for damaging procedures is at harvest. Are the plants harvested too early? Could harvest be delayed until leaves drop, or would shatter loss be excessive? Are the harvested plants gathered in too large bundles?

DAT specialists should initiate studies immediately on seed quality losses in soybeans and other kinds of seed to identify problem areas and devise alternative procedures which will minimize losses in seed quality (see Recommendation 12).

Excessively large bundles of plants tend to dry so slowly that some of the plants, pods and seed will become "moldy" and quality of seed will be severely damaged. Practically, seed producers could be instructed not to tie the plants in bundles no larger than they can reach around when their thumbs and fingertips touch. Bundle size could easily be verified by the Amphoe officer. The bundle would be self supporting for field drying purposes, and several bundles could be loosely tied together for transport from the field to the producers' home, after which they could be untied before stacking at the house.

Specific bundle size is not recommended for inclusion as a contract provision because the recommendation is based on limited observation and it is possible that even smaller bundles would be required for wet-season production. It is only one factor that should be studied by DAT researchers.

RECOMMENDATION 21: (Priority B)

The DOAE Seed Program should initiate a study to determine the effects of mechanized seed threshing and processing procedures on seed quality of soybeans and other crops.

If possible, this study should be initiated with seed produced during the dry-season 1974 or wet-season 1974. It is suggested that the 10 available threshers be concentrated, in two villages, and that all seed produced be mechanically threshed. Villages selected should be those in which threshing is prolonged by a shortage of hand labor.

The threshed seed should be purchased and delivered to the Phitsanulok Seed Service Center as rapidly as a truck load (5 tons) can be accumulated. Equal quantities of traditionally threshed and cleaned, and mechanically threshed, uncleaned seed should be identified and a minimum of two truck loads (10 tons) of each seed class should be sent to the Center for drying, processing and packaging in the 30 kg. plastic lined paper bags. Careful records should be maintained of the time from harvest to delivery of threshed seed to the processing unit, seed moisture on delivery to the plant, drying time and cost, cleaning loss, mechanical purity of the clean seed, initial germination, and germination at monthly intervals up to 10 months or until it falls to 50%, and the seed producer's reaction to the "new method".

Such a commercial scale "demonstration" will be needed to develop new guidelines and standards for producer contracts, to determine the effectiveness of the mechanical threshes for seed threshing as compared with traditional threshing methods, to determine effect of mechanical processing on quality of farmer threshed and mechanical threshed seed, and the influence of threshing and processing method on storability of the seed.

The Chief of the Center is qualified to develop further details and supervise this demonstration-research. Assistance in the evaluation of seed quality (purity analysis, seed moisture and germination) is available through the DAT Seed Technology Laboratory at Bangken or Khon Kaen upon request. The MSU/AID-W contract personnel will assist in any way possible as requested.

Maize -- The DOAE is programmed to initiate seed production of the improved varieties of maize during the 1974-75 growing season. To date only the DAT's Maize and Sorghum Project has experience in the production of multiplication seed of maize in cooperation with farmer seed producers, therefore, the following current situation is based primarily on conversations with some of the key personnel of this Project.

The major impediments in maize grain production appear to be: (a) widespread use of poorly adapted varieties; (b) limited use of chemical fertilizers, (c) downy mildew and locust (grasshoppers); (d) inadequate weed control; and (e) variable climatic conditions with no supplemental irrigation[12/]. In addition to these general problems, isolation and lack of seed drying facilities were reported to be the major problems in producing maize seed.

The major portion of the 6.2 million rai of maize is planted with farmer saved seed of an open-pollinated flint type of maize introduced from Guatemala in the early 1950's. During 1971, nearly 1,000 tons of a composite variety, Prabuddahabat No. 5, developed in Thailand was distributed to farmers. The initial farmer plantings of a new composite variety, moderately resistant to downy mildew, will be made this year. The DAT is responsible for varietal maintenance and seed multiplication of breeder, foundation and, to date, "multiplication" seed of these three varieties. Breeders and foundation seed are produced at the several DAT stations located in the maize production regions of the Central Plains and Northeast.

The DAT supervised the production of some multiplication seed in 1970 in order to increase the quantity of seed for planting. Project personnel circumvented some of the production problems through careful selection of farmer-seed producers and production of seed in several different Changwats. The isolation was solved by supplying foundation seed of the variety being produced to all maize producers in the immediate area of the seed production fields.

Rainfall distribution in the major maize production area is such that most maize matures during rainy weather. Neither farmer-seed producers nor the public agencies have facilities for artifically drying maize seed, therefore, the mature maize frequently remains in the field 30 to 45 days after the seeds reach physiological maturity and are subject to rapid deterioration from high temperatures and moisture contents, insects, and diseases. On the average, only 50% of the acreage planted for production of maize seed has been suitable for seed.

All maize seed is harvested by hand. Drying is achieved by use of drying floors. Most of the shelling is done mechanically with high speed "grain" shellers, however, mechanical injury was not viewed as a major problem due to the hardness of the flint-type maize grown in Thailand. Germination of maize seed is usually above 90%.

12/ "The Accelerated Corn Production and Marketing Activity for 1972-76". Agr. Econ. Res. Bul. 55. 1972. Div. of Agri. Econ. Office of the Under-Secretary of State, Min. of Agri. and Coop.

Reportedly, much of the maize seed is infested with the rice weevil when it is received from the seed producers. Processing includes only nubbing, hand picking damaged kernels and aspiration. The DAT routinely treats maize seed with a fungicide and insecticide just prior to packaging the seed in a 30 kilo, 4-ply paper bag having a thin plastic liner.

Most of the foundation seed is distributed by the DOAE on the advanced order basis. Until 1970 maize seed were sold for ฿1.00/kg. (average price for grain) and the demand never met the available supply, therefore, each year several tons of quality seed of improved varieties were sold as grain. In 1971, the price of seed corn was raised to ฿3.00 kg. and, in spite of yearly increases in production, the supply has since never met the demand. It was the conclusion of the personnel in the Maize Project that when the farmers could purchase seed for the same price they received for their grain, they (the farmers) felt that the seed could be no better than grain. Apparently, raising the seed price to more nearly reflect its actual value convinced the farmers that the DAT's seed were of a higher quality than grain and "worth while". The result has been increased utilization of good quality seed of a superior variety.

RECOMMENDATION 22: (Priority A)

The DOAE and DAT should initiate the arrangements for installation of seed drying facilities for ear corn at all locations where maize seed are processed.

A maize drying facility is already needed by the Maize-Sorghum Project of the DAT and one will be needed by the DOAE in 1974. One possible solution would be to make arrangements for each Department to assume control of the dryer and drying bins to be taken over by the MOAC from the defunct Calabrian operations. Conversion of these excellent grain drying facilities to seed drying facilities would be relatively inexpensive and simple operation. Explanation of the steps necessary for the conversion of this equipment are given later under Facilities.

When facilities for drying maize on the ear become available, the seed growers will be able to harvest their maize crop as it matures, in the rain if necessary, thus reducing the present very high field and storage losses in both quality and quantity.

3. Availability of Specialized Inputs Needed for Technical Operations.

The development of a modern comprehensive seed program requires the utilization of certain specialized equipment and supplies for the production, processing and distribution of seed in addition to those required for grain. The information in this part of the report is based on personal observations and discussions with MOAC personnel, equipment manufacturers, and licensed importers operating in Thailand.

Equipment -- Assuming that the present utilization of farmer seed producers will continue, widespread mechanization of seed production does not appear likely or desirable in Thailand in the near future because of the relatively abundant labor, lack of off-farm opportunities for employment, and small farm size. On the other hand, several farmer-seed producers mentioned that labor for harvesting and threshing is limited and hampers these operations; therefore, there appears to be both a need and an opportunity for increased utilization of mechanical threshers of the type already described or similar low cost, low capacity equipment. A multipurpose thresher capable of threshing a wide range of crops (rice, soybeans, kenaf, sorghum and mungbeans) should be developed, copied, or imported. Individually, the farmers in most villages cannot afford to buy a thresher, which costs ฿20,000, just for soybeans. If a small thresher were available, and capable of threshing both rice and soybeans, each group of farmers producing 50-75 rai of threshable crops per year might be able to afford a thresher. If such a thresher is developed, Thai manufacturers are capable of manufacturing them in mass.

The long period of time required for "sun drying" high moisture seed is viewed as one of the major impediments in the production of consistently high quality seed. At present, the construction and operation of even simple dryers using natural air is not practical at the village level because electricity is not generally available. The one operational dryer observed (Phitsonulok) was patterned after one of Swedish design for grain drying but was satisfactory for drying seed after appropriate modification. This dryer was fabricated in Thailand. The Thai fabricator was most interested and cooperative in making the necessary changes to adapt the dryer for drying of seed.

An air-screen seed cleaner for small volume operations (less than one ton/hr.) has been manufactured in Thailand for several years. This and related equipment has been patterned after that used by the grain industry and, though satisfactory for rice, the equipment should be modified to minimize mechanical injury and facilitate clean-out for seed operations. The technology for conversion of such equipment is available, but it must be passed on to the equipment manufacturers.

Because of the year-around high temperatures and 8-10 months of high relative humidity, most reserve seed stocks will need to be stored in conditioned storage facilities, either sealed or controlled temperature-humidity, to assure maintenance of germination at satisfactory levels. Plastic (polyethelene) packaging materials are widely used in Thailand including the 2 mil (est) bag liner used for seed by the DAT. This liner is moisture resistant but not moisture vapor proof. We were unable to determine the availability of plastic bags of at least 7 mil thickness, which is most satisfactory for storage of seed.

Refrigeration and dehumidification equipment are available throughout Thailand, but all of this equipment is imported. Apparently, styrofoam insulation is the most readily available and least expensive insulating material.

The high cost of electricity is a factor which must be considered by anyone designing or recommending the use of electrically powered equipment in Thailand. As an example, the reported cost of operation for an 18,000 BTU, 220 V, 50 hertz, room air conditioner was ฿1200/month. Although industrial users pay less per kilowatt the added costs of insulating and vapor proofing seed storage facilities could be recovered in a few years through savings from reduced costs of electricity.

All of the small equipment items associated with seed operations such as balances, sewing machines, hand trucks, sample dividers, vacuum cleaners, moisture testers, germinators, etc., are imported.

Supplies & Services - The major expendable supply items for a seed program are bags or packages and chemical treatment materials. Traditionally, grain and seed are packaged in jute bags, 100 kgs. per bag, which are available and used throughout Thailand. For the past several years, the DAT has utilized a locally manufactured polyeythelene, heat sealable bag for packaging 5 kgs. of seed or a 4-ply kraft paper bag which holds 30 kgs. of maize, sorghum and similar seed. Regardless of the material used in packaging the cost per kilo of seed packaged was reportedly the same, ฿14-15/100 kgs.

Insecticides used for seed treatment are available in powder, wettable powder and liquid formulations at farm supply centers throughout Thailand. Fungicides for seed treatment are not as readily available but can be obtained in quantity from suppliers located in Bangkok.

Services for maintenance and repair of most mechanical equipment are available at the principal city of each Changwat. However, because of limited experience with such equipment as threshers, elevators, dryers, air-screen machines, etc., it is often necessary to contact the fabricator or importer to obtain replacement parts for precision machines.

D. Facilities

The DOAE has responded to its responsibility for multiplication, processing and distribution of high quality seed by planning and initiating construction of a Seed Service Center in Changwat Phitsanulok. The Center will contain all the operational components necessary to handle seed of several crop kinds. The different units of the Center were in various stages of development on our arrival.

1. Phitsanulok Seed Service Center

Construction had been completed or was nearing completion on buildings to

house the drying-processing plant, the workshop, and the unconditioned storage warehouse. None of these units, however, had been fully equipped. The offices, seed testing laboratory, drying floor, ear-maize drying-shelling unit, and the conditioned storage warehouse were still in the late planning or design stages of development. Specific site selections had not been made for units not under construction.

Our assignment relative to the Center was to provide the DOAE with assistance in the installation and initial operation of the seed drying-processing unit. This involved making on-site alterations, installation and testing of the available equipment, and training personnel in equipment operation. In order to provide the assistance needed to develop the Center into a integrated, operational seed handling unit with the capability of handling seed of soybeans, rice, and maize it was necessary to prepare preliminary engineering drawings and equipment specifications not originally envisaged in the Task Order. Verbal approval, "to do whatever was necessary", to make the Center operational, however, was granted by the USOM contact officer.

In summary, some of the important accomplishments achieved, in collaboration with DOAE, DAT, and Agriculture Engineering Partnership Company personnel were as follows:

(1) The heater-fan unit was modified to provide additional air volume and decrease fuel consumption.

(2) The drying bins were modified to permit more satisfactory operation and performance. After modification, the bins were tested for performance and seed drying guidelines were established.

(3) A dryer bin seed sampling device was designed, fabricated and tested; its performance was judged to be satisfactory.

(4) Air-screen cleaner and elevator assemblies were tested for performance. Several modifications were required, most of which were completed prior to our departure. A need for additional screens for the air-screen cleaners was established.

(5) Guidelines for soybean seed cleaning were established.

(6) A six-month soybean seed storage study was initiated. Seed dried to a moisture content of 8-9 percent were packaged and placed in the existing storage warehouse. Samples are to be tested monthly for germination and seed moisture content.

(7) Discussions and on-the-job training sessions in equipment operation were conducted for DOAE personnel.

(8) Specifications were prepared and submitted to USAID/Thailand for additional equipment needed at the Center.

(9) Seed Testing Laboratory construction plans were reviewed. Some minor changes were suggested and accepted.

(10) A tentative layout plan for the entire Center was prepared and submitted to the DOAE for review.

(11) Preliminary drawings and an equipment specification list for a conditioned seed storage warehouse were prepared and submitted to the DOAE.

(12) Preliminary drawings and an equipment specification list for an ear-maize drying and shelling unit were prepared and submitted to the DOAE.

RECOMMENDATION 23: (Priority A)

Construction and installation of facilities at the Phitsanulok Seed Service Center should be completed as soon as possible in accordance with the plans and specifications presented below.

Seed Service Center Layout (Drawing Sheet 1, Appendix IX) -- Movement of seed in an orderly manner between operational units was important consideration in design of the overall layout plan. The layout takes into consideration existing buildings and property limitations. It also shows locations of access roadways and all operational units under consideration for construction.

Conditioned Seed Storage Unit (Drawing Sheet 2, Appendix IX) -- Unfavorable climatic conditions for seed storage exist much of the time in the Phitsanulok area. Consequently, it is advisable that the Seed Center be provided with a moderately environmentally conditioned storehouse. The warehouse should hold a minimum of 100 tons of seed under conditions of 21°C (70°F) and 50% relative humidity.

The storage building is 16 meters x 8.6 meters. It contains two seed storage rooms and a general work area. The building should be constructed on a concrete slab poured on grade. The slab should be of wire re-enforced concrete and of a thickness commonly used for buildings of similar size in the area. Footings beneath the slab may be desirable. Construction features include:

(1) Floor - The floor should be a concrete slab; it should be poured over well packed fill with a 10 mil plastic vapor barrier between fill and concrete.

(2) Walls - Exterior and interior walls of the storage rooms should be 8" (20.2 cm) concrete blocks. Exterior walls of the general work area can be constructed of 4" (10.1 cm) concrete blocks. Exposed surface walls of the storage rooms should be painted with a good grade of moisture resistant paint.

(3) Roof - A pitched roof is shown in the drawing but a flat roof would be as satisfactory provided it is adequately treated to prevent leaks.

(4) Ceiling - A ceiling is not shown in the general work area as the extra headroom may be needed. Ceilings of the conditioned storerooms are as given in the drawings.

(5) General Work Room - As noted previously, this room need not have a ceiling nor be air-conditioned.

(6) Conditioned Storage Rooms - Construction details for the two seed storage rooms are given on the drawing. Each room is 7.7m (length) x 4.0m (width) x 3.6m (height), substantially insulated, moisture vapor proofed, and provided with a refrigerator type door. Suggested specifications for the door are as follows:

Refrigerator Door - "Butcher Boy" type; standard cooler and freezer door; single seal; 3 ft. x $6\frac{1}{2}$ ft. for door opening of 3'4" x 6'$8\frac{1}{2}$"; 4" semirigid board foam insulation; 3 hinges included; with frame and other required galvanized hardware. Suggested Vendor: The Harry Alter Co., Inc. 2399 S. Archer Avenue, Chicago, Illinois 60616.

For conditioning of the two storerooms, two 14,000 to 16,000 BTU self contained window type air conditioners should be installed in each room (local purchase). For dehumidification it is recommended that the Dryomatic Model R150 (desiccant type) dehumidifer currently on order be used. This should provide sufficient dehumidifcation for both rooms.

Processing Plant (Drawing Sheets 3,4,5,6, and 7; Appendix IX) -- Seed processing equipment presently installed at the Seed Center consists of two locally constructed air-screen cleaners. These cleaners are to be replaced with a single higher capacity machine. To complement the new cleaner additional

equipment has been ordered. All equipment items ordered by USAID/Thailand in June, 1973 for both the processing plant and the seed testing laboratory are shown on the Equipment Specification List - Appendix IX.

An equipment layout plan for the machinery to be installed in the processing plant is shown on drawing sheets 3 and 4. Drawing sheets 5, 6, and 7 give construction details of bins, support frames, etc. that are to be fabricated locally. Identification numbers of equipment items shown in the drawing sheets correspond to those used below in describing the function of the various kinds of equipment.

ITEM NO.	DESCRIPTION
1	Conveyor - portable, horizontal, belt-type. This conveyor is presently on site. Conveyor delivers seed from the receiving area to the main receiving elevator. NOTE: present conveyor needs to be modified to permit lowering to a horizontal position.
2	Conveyor - portable, horizontal, belt-type. This conveyor is presently on site. Conveyor delivers seed from the drying bins to the main receiving elevator. NOTE: present conveyor needs to be shortened to 2.7m length and modified to permit lowering to a horizontal position.
3	Cleaner surge bin - approximately 4.5 m.t. capacity, center discharge, hoppered bottom bin, receives seed from the main receiving elevator. Bin requires mounting in floor supported frame. Bin and frame construction details are shown on dwg. sheets 5 and 7. Bin and framing should be fabricated locally.
4	Air-screen cleaner - 3 to 3.5 m.t. per hour capacity for cleaning seed. Used to separate particles differning significantly from the crop seed in width or thickness. Particles significantly lighter in specific weight than crop seed are removed by the air system. Used for all crop seed. Clean seed discharged into elevator (item 5); waste products bagged-off. Cleaner requires mounting on floor supported frame, frame construction details are shown on dwg. sheet 7. Framing should be fabricated locally. The cleaner requires 2 dust collectors and 14m of air ducting. These items should be fabricated locally. Construction details for the dust collectors are shown on dwg. sheet 7.
5*	Elevator assembly - maximum 5 m.t. per hour capacity,

ITEM NO. (Cont'd)	DESCRIPTION
	discharge height 6.0 m., equipped with 2-way valve. Receives clean seed from cleaner and delivers them to bin over gravity (item 6) or bagging bin (item 10).
6	Gravity Table Surge bin - approximately 1.8 m.t. capacity corner-of-side discharge, hoppered bottom bin, receives seed from elevator (item 5). Bin requires mounting in floor supported frame. Bin and framing construction details are shown on dwg. sheets 5 and 6. Bin and framing should be fabricated locally.
7*	Gravity Table - Approximately 3.5 m.t. per hour capacity for medium and large size seed. Receives seed from bin (item 6). Separates clean seed from lighter weight insect or disease damaged seed. Clean seed delivered to conveyor (item 8); waste products bagged-off. Gravity table requires mounting on concrete foundation. Foundation details are shown on dwg. sheet 7.
8*	Conveyor - vibrator type, delivers clean seed from gravity table to elevator (item 9). Conveyor requires mounting on simple floor supported frame; frame should be designed and constructed at time of installation.
9*	Elevator assembly - maximum 5 m.t. per hour capacity, discharge height 6.0 m. Receives seed from conveyor (item 8) and delivers them to surge bins (items 10 and 11).
10 and 11	Surge bins - approximately 2.5 m.t. capacity, center discharge, hoppered bottom bins, receives seed from elevator (item 9). Both bins are mounted within a single frame. Bin and frame construction details are shown on dwg. sheets 5 and 6. Bins and frame should be fabricated locally.
12*	Seed treater - approximately 9 m.t. per hour capacity, for application of either slurry or liquid seed treatment materials. Treated seed to be bagged-off. Treater will require mounting on a portable frame; frame should be fabricated at time of installation.
13	Bagger - similar to Howe-Richardson "Unipak". The bagger is presently being considered for purchase by the DOAE.

* These items appear on the equipment order placed in June, 1973 by USAID/Thailand (Appendix IX)

Ear-Maize Drying-Shelling Unit (Drawing Sheet 8; Appendix IX) -- The seed dryers presently installed in the processing plant building are not designed to handle ear-maize. Consequently, an additional drying unit is required. A drying unit consisting of two flat-floor type drying bins of the type presently located at the Calabrian silo installation in Changwat Sukothai, Suwan Kalok is recommended. The 27 ft. diameter, perforated floor bins will have the capacity to dry approximately 5 tons of ear-maize or 10 tons of seed maize per foot of depth. Maximum drying capacity for each bin should be 40 tons of ear-maize (maximum 8 ft. depth) or 30 tons of seed maize (maximum 3 ft. depth).

The DOAE should obtain equipment from this Calabrian installation, if available at reasonable cost, including the hoppered-bottom weigh bin, generator, electrical control panel, metal sided storage warehouse, perforated floor, 27 ft. diameter drying bins (2) complete with sweep and unloading augers, fuel storage tank and the Model 500R Campbell heater-fan unit.

The heater-fan unit may require some modifications. Contact has been made with the Campbell Company regarding modifications that may be necessary for the unit (Serial No. 14550). To date the only information received is that this heater fan unit is not a standard model unit. As additional information is received it will be forwarded to Mr. Tawee Pluemsab at the Seed Service Center.

The dryer bins will not require any specific modifications. When reassembling, however, each bin should be mounted on a concrete foundation ring and sidewall height should be reduced to 4.7 meters.

The equipment items available at the Suwan Kalok installation will have to be supplemented with two portable link chain conveyors and possibly a maize sheller. Specifications, sources and estimated costs of this equipment are given in Appendix IX.

Seed Testing Laboratory (Drawing Sheet 9; Appendix IX) -- Construction blueprints, prepared by the Department of Fine Arts, Division of Education, MOAC, for the seed testing laboratory were reviewed and discussed. During discussions some changes were suggested and DOAE technicians requested that we develop a floor plan for the laboratory showing equipment arrangement.

The floor plan developed is based on the assumption that building construction will proceed in accordance with the blueprints already prepared including the changes suggested. Space for laboratory testing equipment under consideration for installation was also taken into account.

Space allocated for seed testing operations is approximately $80m^2$ in size. This area is sub-divided into a sample storage room, an analysis work room, and a germination work room.

(1) Sample storage room - This room is to be used for storage of samples which may need to be maintained after initial tests.

(2) Analysis Work room - Primary area in which seed samples will be tested for purity and moisture content. Furnishings, such as tables, chairs and desks are to be constructed or procured locally.

(3) Germination work area - Primary area in which germination tests will be conducted. Water and drains required. Furnishings, including sand benches, are to be constructed locally.

Establishment of realistic goals in terms of seed production, seed supply and seed quality will be vital to the ultimate success of the seed multiplication program. Realistic goals in terms of seed quality are especially important to the success of operations at the Seed Service Center. Numbers and quality of the equipment available will not substitute for manpower quality in the output of an acceptable quality seed product. In this respect, equipment and mechanization can be likened to the use of visual aids in extension teaching, their effectiveness is maximized when used by a well trained individual.

Calabrian Grain Drying and Storage Installations.

Few drying, processing and storage facilities for handling seed exist in Thailand. Some of these facilities are operated by the DAT. Based on information obtained and observations at two of these facilities, the DAT operations are small in size and have very limited, or no, capability for drying and storage of seed.

On several occasions during the assignment USOM, DAT, and DOAE officials and technicians expressed interest in the utilization of unused equipment at the "Calabrian" maize silo installations for seed drying and storage.

There are seven similar installations at scattered locations. Constructed in the late 1960's for drying and storage of grain corn (maize), their use was discontinued following one or two years operation.

The Sukothai installation, believed to be representative of installations at other locations except for its smaller capacity consists of:

(1) Drying Bins - two (2), 27 ft. (8.2m) diameter metal bins with 20 ft. (5m) sidewalls. Bins are equipped with sweep and unloading augers and an elevated, perforated metal drying floor.

(2) Storage Bins - two (2) 27 ft. (8.2m) diameter metal bins with 24 ft. (7.3m) sidewalls. Bins are equipped with aeration ducts and fans. These bins are not equipped with flooring.

(3) Heater-fan - oil-fired, portable, special order Model 500R Campbell dryer (complete with 40 h.p. fan motor and air ducting).

(4) Storage Building - metal structure approximately 50 ft (15m) width x 100 ft. (30m) length x 20 ft. (6m) sidewalls. Storage capacity estimated at 800 to 900 tons bagged grain (or seed).

(5) Miscellaneous - bin loading auger (1); maize shellers (7); weigh bin (1); platform scales (5); diesel generator with electrical control panel (1).

With some exceptions the equipment at these installations could be used for seed drying and storage purposes at either the present or different location. The storage building, drying bins and storage bins can be disassembled, moved and re-assembled; the other equipment is portable. The only equipment present which was considered unsatisfactory for use in seed handling operations was the inclined bin-loading augers. Suitability of the maize shellers is also questionable. They should be tested and determinations made concerning incidence of seed damage sustained during shelling.

Some equipment modifications will be required. The storage bins should be equipped with perforated drying floors, even though only used for seed storage purposes. At present, seed placed in these bins comes into contact with the slab on which the bins are mounted, a most undesirable situation. It is also probable that the heater-fan units will require some modifications. Exact specifications regarding air-flow and heat output were unavailable at the time this was written. It has, however, been established through contact with the manufacturer that these units are not standard models. Specific modifications required for the heaters prior to use for drying seed will have to be ascertained once a decision with respect to acquisition of the equipment has been reached.

APPENDICES

APPENDIX I

DAILY ITINERARY AND CONTACTS

April 26	Arrival Bangkok Seed Program Development Consultant (Potts)
April 27	Bangkok - Complete Mission arrival procedures and meet Thai Extension leaders for preliminary discussions. Dr. John Stone - USOM - Extension Advisor and Consultants' Contact Officer. Dr. Fletcher Riggs - USOM - Director, Office of Agricultural Development. Dr. Rex Daley - USOM - USDA/PASA Agricultural Economist Mr. David Lundburg - USOM - Program Officer, O.Ag. Dr. Robert Fowler - USOM - Deputy Director, O.Ag. Dr. Russell Brannon - USOM/U. of Ky. Chief of Party (Khon Kaen) Mr. Thumnong Singabavanija - Director General, DOAE/MOAC Mr. Chalor Judjang - Acting Chief of Planning, DOAE/MOAC Mr. Tawee Pluemsab - Associate Changwat Officer, Phitsanulok
April 28 & 29	Free Time
April 30	Bangkok - Discussions with USOM contact officer and Thai officials to establish specific terms of reference and develop background material. Mr. Yookti Sarigaputi, Associate Director, DOAE Mr. Petcharat Wanapee, Project Leader, Soybean Project, Div. of Crop Promotion, DOAE and Consultants' RTG counterpart.
May 1	Bangkok - Discussions with Thai Extension officials and collection of background materials. Development of specific terms of reference for seed processing consultant to arrive May 15. Mr. Tiencha Leevisitputna - Technical Officer, Northern Regional Center, Phitsanulok.

May 2	Bangkok - Development of specific travel itinerary and preparation of specifications for seed processing equipment to be supplied to the DOAE by USOM. Miss Rattana Sawatasai - Soybean Project, Crop Promotion Div. DOAE.
May 3	Bangkhen - Visit Seed Technology Laboratory to observe methods and techniques of operation. Discussions with Changwat technical officer concerning his responsibilities in promoting the use of good seed of new varieties. Mr. Sanit Kittikorn Chief, Seed Techn. Lab. Div. of Field Crops, DAT. Mr. Porncark Paksantipong - Ext. Technical Officer, Rajaburi
May 4	Travel to Khon Kaen with stop at Sara Buri. Discussion of Changwat extension workers methods for determing the seed needs of their farmers. Mr. Tawich Sangthum, Ext. Technical Officer, Sara Buri
May 5	Khon Kaen - Visit Northeast Regional Research Center. Discussions with U. of Ky. and DAT technicians concerning their program operations as related to seed. Visit Mahasalakrm seed multiplication farm to discuss DAT "foundation" seed production procedures for soybeans and kenaf seed. Visit Kalasin Seed Multiplication Center. Observed equipment used for threshing, drying, processing and storage of "foundation seed of soybeans, peanuts, and kenaf. Dr. Prasoat Sittisroung - Leader, Seed Investigations, Div. of Field Crops/DAT NE Regional Research Center. Dr. Russell Brannon and Staff of U. of Ky. Contract Mr. Chumreon Satagarak Chief, Seed Multiplication Station, DAT, Mahasalakarm. Mr. Kasem Sukapant, Chief, Seed Multiplication Station DAT Kalasin.
May 6	Return to Bangkok. Discussions with owner of farm supply store which sells vegetable seed and purchases and resales "seed" of maize and kenaf. Visit and tour Suwan farm, DAT's principal maize and sorghum research station and training center.

Narongsak Senanarong, Agronomist Bangkhen Agricultural Experiment Station Ban Phai (Suwan farm)

May 7 — Bangkok - Observed Plowing Day Ceremonies. Initiated preparation of draft of background information.

May 8 — Bangkok - Continued summerization of background information.

May 9 — Travel to Lampang visit to Chainat Agricultural Experiment Station, DAT.

Mr. Sawing Nattribhop, Chief, Chainat A.E.S., Chainat

May 10 — Lampang - Discuss role of Changwat Extension officers in the soybean seed program and visit with village leader and other farmers producing soybean seed under contract.

Mr. Suporn Karunpar, Ext. Changwat Officer, Lampang
Mr. Lan, farmer, Ban Nong-ha, Lampang

May 11 — Cheing Mai - Meet with Extension officers of the Northern Regional Center involved in seed program. Visit Mae Jo Agricultural Experiment Station and a farm village to observe seed harvesting and threshing operations.

Mr. Sunan La-Ongsri, Chief, Mae Jo Experiment Station
Mr. Jaroon, Technician, Foundation Soybean Seed Production, Mae Joe Experiment Station.
Mr. Vorasak Pakdee, Chief, Northern Agricultural Extension Training and Supervision Center.
Mr. Sakorn Prapipong, Technician, Northern Regional Ext. Center.

May 12 — Cheing Mai - Visit farm villages in two districts to talk with farmer seed producers about production practices, seed and grain prices, etc.

May 13 — Cheing Mai - Discussed operational problems of the "plot-type" thresher with technicians from manufacturing company and Div. of Agricultural Engineering DAT concerning possible improvements in design and operation.

Travel to Tak.

May 14	Tak to Phitsanulok.
	Visit Extension training center, site of Seed Service Center Calabrian corn storage facility at Suwan Kalok.
	Mr. Boonkrong Nakornsri, Technician, Ag. Ext. Office, Sukhothai.
May 15	Phitsanulok - Visit Phitsanulok Rice Expt. Station - return to Bangkok.
	Mr. Kampanart Mookdee, Chief, Phitsanulok Rice Expt. Station.
May 16	Bangkok - (Holiday) Arrival of Mr. Dougherty, Seed Processing Consultant.
May 17	Bangkok - Meetings with USOM and RTG officials to introduce Mr. Dougherty.
	Discussion of needs and terms of reference.
May 18	Bangkok - Discussions with DOAE counterparts to plan itinerary; arrange for needed background materials, prepare specifications for seed processing equipment for USOM purchase.
May 19-20	Weekend
May 21	Bangkok - Conference with Kansas State U. contract personnel concerning grain marketing in Thailand. Conferences with DAT personnel at Bangken.
	Mr. Richard Phillips, Kansas State U. Grain Mkt. Contract Dr. Do Seep Chang, Kansas State U., Grain Mkt. Contract Dr. Arwoot Na Lampang, Leader, Oil Crop Seed Investigations, DAT. Dr. Ampol Senanaroung, Station Director and Leader, Maize and Sorghum Investigations, DAT.
May 22	Bangken - Conferences with officials of the Rice Division, DAT.
	Ponchai Pookamana, Assoc. Director, Rice Div. and Chief of Rice Seed Multiplication program.

Sermsak Awakul, Rice Breeder, Rice Division, DAT.

May 23 — Phitsanulok - Conferences with Building contractor and DOAE officials concerning alterations necessary for processing plant operation.

Building contractor, Agriculture Engineering Partnership, Bangkok.

May 24 — (Potts) Phitsanulok - Conferences with Thai officials and building contractor concerning alterations in processing plant.

Potts to Bangkok.

May 25 — (Potts) Bangkok - Preparation of draft report.
(Dougherty) Phitsanolke - Preparation of required alterations in available equipment.

May 26 — (Potts) Bangkok - Preparation of draft report and consultations with DOAE officials.
(Dougherty) Travel to Cheing Mai.

May 27 — (Potts) Bangkok - Preparation of draft report.
(Dougherty) Cheing Mai - Observed soybean threshing operations

May 28 — (Potts) Bangkok - Preparation of draft report
(Dougherty) Cheing Mai - Visit Mae Jo Expt. Station observed seed processing storage facilities.

Panoo Satayanabul - Extension Changwat Officer, Trat.

May 29 — (Potts) Bangkok - Preparation of draft report and discussions with DOAE officers.

(Dougherty) Phrae - observed Calabrian installation at Suwan Kalok.

Mr. Chaisab Sabsarm, Acting Chief, Div. of Crop Promotion, DOAE.

May 30 — (Potts) Bangkok - Preparation of draft report.

(Dougherty) Phitsanulok - Preparation of list of recommended alterations for processing-drying unit. Return to Bangkok.

May 31	Bangkok - Preparation of draft report and preparation for Seminar
June 1	Banghken - Presentation of Seed Seminar. Discussions with Rockefellow Foundation Technician. Dr. Ben Jackson, Plant Breeder, Rockefeller Foundation.
June 2	Bangkok - Discussions with Engineer and DOAE technicians concerning necessary alterations in the seed drying-processing facilities at Phitsanulok. Mr. Anusorn Boon-it, Division of Agriculture Engineering, DAT.
June 3	Free
June 4	Bangkok - Presentation of preliminary recommendations to Director General and all Division Chiefs of DOAE. Debriefing by USOM Director and USOM/Ag. Personnel Mr. Rey Hill Director, USOM/Thailand
June 5	Departure of Seed Program Development Consultant. Bangkok - Preparation of preliminary designs for conditioned seed storage warehouse.
June 6	Phitsanulok - Discussions with officials concerning conditioned storage room designs. Supervision of alterations processing plant. Mr. P. Jijjongrak, Dept. Public Works Mr. C. Smitanarn, Architect, Dept. Fine Arts.
June 7-13	Phitsanulok - Supervision of alterations; testing equipment; preparation of major seed storage study; discussions and on-the-job equipment operation training sessions for DOAE technicians: Mr. Tawee Pluemsab Mr. Panoo Satayavibul Mr. Jaraspong Arunsit

June 14	Suwan Kalok - Visit to Calabrian Silo Installation with DOAE technicians to determine which components might be useful at Seed Center; also to observe equipment in connection with training exercises.
June 15-18	Phitsanulok - Supervision of alterations; continuation of on-the-job training sessions; preparation of preliminary facility layout drawings.
June 19	Bangkok - Preparation of draft report and discussions with DOAE officials concerning progress of alterations in seed processing plant.
June 20	Bangkok - Preparation of draft report
June 21	Bangkok - Preparation of preliminary designs for ear-maize drying-shelling unit.
June 22	Bangkok - Discussions with DOAE officials concerning alterations and review of draft report.
June 23-24	Weekend
June 25	Bangkok - Presentation of report to DOAE and USOM officials.
June 26	Bangkok - Preparation of preliminary designs on seed testing laboratory equipment installation; inspecting new equipment prior to transport to Phitasanulok Seed Center.
June 27	Bangkok - Final debriefing and completion of departure procedures.
June 28	Departure of Seed Processing Consultant.

APPENDIX II

SUGGESTED TIME FRAME FOR TRAINING, FACILITY CONSTRUCTION, AND CONSULTANTS

May 1973 - September 1976

Tentative Date	Principal Action Agencies	Activity and/or Requirement
1973		
May - June (completed)	DOAE, USOM	(a) T.A. - Consultant[1] - seed program planning 6 weeks - program review and recommendations.[2] (b) T.A. - Consultant - Seed Processing - 6 weeks - processing operations, equipment installations and training.
July - August	DOAE, SP[2]	Training - Processing Superintendent and Mechanic to work at equipment manufacturer's to learn maintenance and repair procedures
Sept. - Oct.	SP	Training - On-the-job training of Processing Superintendent and Mechanic by Supervisors
September	DOAE, USOM	Training - Program Leader to Miss. State U. 6 months - specialized training in seed production, analysis, drying and processing, and physiology (Sept. - Dec.) On the job training with commercial seed company in management, processing, distribution and sales (Jan. - Feb.).

[1] TA = Technical Assistance, consultant should be utilized

[2] SP = DOAE Seed Program

Tentative Date	Principal Action Agencies	Activity and/or Requirement
1973		
Oct. - Nov.	SP, DAT	Training - Two seed analysis to receive on-the-job training at Seed Technology Lab. Bangkhen. 4 to 6 weeks each
1974		
January	SP	Facility - Completion of Seed Testing Lab
March-May	DOAE, USOM, DAT, MSU	TA + Training - Special Seed Technology Training Course - 3 weeks duration - Phitsanulok 2 consultants (a) Seed Production and Processing (b) Seed Quality Control - one month each, concurrently. Trained personnel from S.P. and DAT assist in instruction, participants - 20 maximum. Intensive training and practical exercises covering all aspects of modern seed technology. Lecture, laboratory notes and training aids used will be left for utilization during future in - country Seed Appreciation short courses. (Ref. TAB/MSU contract)
March	DOAE, SP	Facility - Construction of holding bins and supporting structures at Processing Center in accordance with plans submitted by MSU.
June-July (every year)	DOAE, USOM	Training-U.S.A.-Seed Improvement Training course for International Students only. Most participants are those who are in the U.S. for degree training in other fields. (Mr. Vorasak Pakdee, DOAE Northern Region,

Tentative Date	Principal Action Agencies	Activity and/or Requirement
1974		attended in 1970 as have 21 officers of the DAT since 1958).
July-August	DOAE, USOM, SP, MSU	TA-Facility & Training - Installation of seed processing equipment ordered May 1973 by USOM. One consultant - Seed Processing Engineer - 6 weeks to supervise installation and give on-the-job training. Consultant should also obtain specifications for preparation of preliminary engineering drainings and equipment specification for second seed processing facility. (Ref. TAB/ MSU contract).
1974		
August	DOAE, USOM	Training - M.S. in Agronomy, Seed Technology. Two participants 18 months with 6 months extension priviledges. (a) One male, with some mechanical interest, training emphasis should be on seed drying and processing. (b) One to have training emphasis in Seed Quality Control and Marketing.
September	DOAE, SP, DAT	Training - Seed Appreciation training course 4 or 5 days. One each in Northern and Northeast regions. 25-30 participants each. Participants to be Changwat and Regional Crop specialists; grain dealers known to sell seed; DAT seed production personnel.

Tentative Date	Principal Action Agencies	Activity and/or Requirement
1974		
October December	DOAE, DAT, USOM, MSU	T.A. - Seed Certification and Seed Control Consultant. (Ref. TAB/MSU Contract)
1975		
March - June	DOAE, SP, DAT	Training - 2 Seed Appreciation courses Central and South regions.
June - July	DOAE, DAT, USOM, MSU	T.A. - Consultant on seed program development; review of national seed plan (Ref. MSU/TAB Contract).
August	DOAE, SP, DAT	Training-MS participant-emphasis on seed processing and drying
September	" " "	Training - 2 Seed Appreciation courses-Northern and Northeast regions.
November	" " "	Facility - final planning for second seed processing facility (TA consultant may be needed)
1976		
March	DOAE, SP, DAT	Training - 2 Seed Appreciation courses Central and Southern regions
(a) April or (b) June	DOAE, DAT, USOM, MSU	T.A. (a) Seed Certification or (b) Seed Regulatory Consultant (Ref. TAB/MSU Contract)
September	DOAE, SP, DAT	Training - 2 Seed Appreciation courses North and Northeast regions

APPENDIX III

DEPARTMENT OF AGRICULTURAL TECHNOLOGY RESEARCH STATIONS (Excluding Rubber)

Northern Region

Chiengrai (R) 1/
San Patong (R)
Phrae (R)
Nan (C) 1/
Chiengmai (C)
Maejo (C)

Northeast Region

Chumpae (R)
Khon Kaen (R, C)
Primai (R)
Surin (R)
Sakornakorn (R)
Ubon (R)
Kalasin (C)
Sakalnakorn (C)
Nongkai (C)
Loei (C)
Udorn (C)
Nakornpanom (C)
Roi-et (C)
Burirum (C)
Chaiyaphoom (C)
Nakornrajsima (C)
Surin (C)
Ubol (C)
Mahasarakam (C)

Central Plain Region

Phitsanulok (R)
Chainat (R, C)
Koksomrong (R)
Suphanburi (R)
Huntra (R)
Rajburi (R)
Bangkhen (R, C)
Klong Luang (R)
Rangsit (R)
Tak Fa (C)
Nakornsawan (C)
Tak (C)
Sukothai (C)
Supanburi (C)
Saraburi (C)
Thonburi (C)
Rayong (C)
Chantaburi (C)
Purabuddhabatt (C)
Uthons (C)

Southern Region

Nakornsrithamars (R)
Kuan Gut (R)
Pattani (R)
Chumphorn (C)

1/ R-Principal emphasis on rice
C-Principal emphasis on crops other than rice

Source: Department of Agricultural Technology - M.O.A.C.

APPENDIX IV

PROGRAM

Seed Improvement Seminar
June 1, 1973
Auditorium, Rice Protection Building
Bangkhen

Topics	Time	Speaker
Introduction	9:00 - 9:10 a.m.	Mr. Yookti
Comprehensive Seed Program	9:10 - 10:15 a.m.	Dr. Potts
	Break	
Seed Production	10:30 - 10:45	Dr. Potts
Seed Drying	10:45 - 12:00	Mr. Dougherty
	Lunch	
Seed Processing	1:30 - 2:20 p.m.	Mr. Dougherty
Seed Storage	2:10 - 3:00 p.m.	Dr. Potts
	Break	
Quality Control	3:15 - 4:15 p.m.	Mr. Dougherty
Summary and Comments	4:15 - 4:30 p.m.	Mr. Petcharat

Attendance: Morning session - 42
Afternoon session - 29

APPENDIX V

SURVEY OF SEED QUALITY PLANTED DURING THE WET-SEASON 1972 1/

Kind	Number of Samples	Average Purity %	Germination	
			Average %	Range %
Field Crops				
Rice-Non-Glut.	16	98.1	81	57-98
Rice-Glutinous	154	98.5	80	3-100
Maize	102	95.8	83	4-100
Sorghum	14	97.2	83	44-96
Soybean	27	97.0	58	0-94
Mungbean	36	95.9	67	0-99
Groundnut	41	98.4	81	22-97
Cowpea	17	99.8	85	21-98
Cotton	9	99.4	54	0-87
Kenaf	16	96.6	92	82-97
Sesame	31	97.5	64	16-99
"Native" maize	45	97.5	80	1-100
Vegetable Crops				
Black Mungbean	14	98.7	89	78-96
Chinese Cabbage	26	98.8	82	34-99
Cucumber	26	98.5	75	0-100
Pea (english)	10	98.3	95	91-100
Sweetcorn	9	98.3	71	2-96
Coriander	24	94.8	63	0-100
Pumpkin	16	97.4	84	72-99
Yard long Bean	13	95.5	66	0-99

Source: Seed Technology Laboratory, Div. of Field Crops, D.A.T.

1/ Based on samples submitted by Extension and Research workers throughout Thailand. No attempt was made to determine the age, source, quantity or similar history of the seed samples examined.

Appendix VI

DRAFT OF SUGGESTED "SEED ACT" FOR THAILAND AND COMMENTS

Seed Act

B E 25--

It is deemed proper to have an Act concerning seed considering:

(a) the important role seed of improved varieties can play in increasing agricultural productivity;

(b) that to achieve the objective of increased agricultural production, a consistent supply of high quality seed of improved crop varieties must be attained and guaranteed;

(c) that guidance is needed for the orderly development of a seed industry; farmers need to be protected against the consequence of low quality seed of unimproved varieties; seed producers and seed handlers need guidance and assistance in their efforts to produce, process, distribute and market high quality seed of improved varieties, and certain activities of seed merchants must be regulated to achieve these goals;

His Majesty King Bhumibol Adulyadej has been graciously pleased to proclaim the following act, by and with the advice and consent of the cabinet.

Chapter 1

GENERAL TERMS AND DEFINITIONS

Article 1. This Act shall be called "The Seed Act B.E. 25--".

Article 2. This Act shall become effective 90 days after it is published in the government gazette.

Section 3. In this Act the meaning of the terms used shall be as follows:

(a) "Seed" means the seed used for sowing of food, fodder, oilseed, estate, vegetable and fruit crops and includes also vegetative parts and/or organs used for propagating same.

(b) "Agriculture" includes all activities involved in the cultivation, production and marketing of food, fodder, estate, horticultural, fruit and industrial crops.

(c) "Minister" means the Minister of Agriculture and Cooperatives.

(d) "Seed Marketing" refers to the transport, distribution and sale of seed and includes storage of seed in transit and at the market place.

(e) "National Seed Board" means the advisory board for seed industry development established pursuant to this Act.

(f) "Certification of Seed" means the certification by an officially sanctioned agency,as defined in g.,in such form as may be prescribed that the origin, multiplication, production, and distribution of a seed lot were in accordance with the procedures, regulations and standards of an Official Seed Certifying Agency.

(g) "Official Seed Certification Agency" means the agency authorized and designated in this Act and/or an agency so designated and sanctioned by the laws of a foreign country.

(h) "Import or Importation" means bringing into Thailand seed from a place outside Thailand.

(i) "Kind" means one or more related species or subspecies which singlely or collectively is known by one common name; for example: paddy, corn, soybeans, peanuts, etc.

(j) "Variety" means a subdivision of a kind which is characterized by plant, growth, flower, fruit, seed, or other characteristics by which it can be differentiated from other sorts of the same kind; for example: SJ-1 soybeans.

(k) "Registration" means the official and mandatory listing of persons, firms, and/or agencies engaged in marketing of regulated seed.

(l) "Label" means the display of written printed or graphic information on seed quality and source affixed to or accompanying any seed lot whether in bulk or in containers, while labeling means the activities of preparing and affixing labels.

(m) "Seed lot" or "lot of seed" means a definite quantity of seed identified by a lot number or other identification mark, every portion or container of which is uniform for the quality factors represented on the label within permitted tolerances.

(n) "Container" means a box, sack, can, wrapper or other receptacle in which seed are placed.

(o) "Seed Control" means the regulation of seed marketing through compulsory labeling and establishment of minimum quality standards for seed marketing.

(p) "Seed merchant" means any person, firm, agency or corporation engaged in the marketing of seed.

(q) "Regulated seed" means the kind and/or varieties of crops, whose seed are declared as subject to marketing regulation and control pursuant to the provisions of this Act.

(r) "Origin" means the Province or country in which the seed were produced.

(s) "Pure Seed", "other crop seed", "inert material", "weed seed", "germination percentage", "hard seed percentage", "tolerances" and other seed testing and labeling terms not defined herein are defined as in the International Rules for Seed Testing as adopted by the International Seed Testing Association and any subsequent amendments thereof, or additions thereto.

(t) "Treated" means that the seed have been given an application of a substance or subjected to a process designed to destroy or repel certain disease organisms, insects, or other pests attacking or infesting seed or seedlings grown therefrom to improve their planting value or to serve any other purpose.

(u) "Records" means the file of information which relates to the origin, germination, varietal identity and purity of each lot of regulated seed sold, offered for sale or exposed for sale, and includes seed testing reports, declarations or records pertaining to the seed, labels, sales, cleaning, blending, treating and storage, and a representative sample of the seed.

(v) "Minimum standards" for seed marketing means the minimum standards of seed quality adopted for regulated seed pursuant to the provisions of this Act.

(w) "Breeder Seed", "Foundation Seed", "Stock Seed", and "Multiplication Seed" are as defined in regulations promulgated pursuant to the provisions of this Act.

(x) "Processing" of seed means drying, cleaning, treating and packaging and other operations wherein seed are prepared for marketing.

(y) "Stop sale order" means any written or printed notification or order given or issued by the Minister or his authorized agents to the owner or custodian of any lot of regulated seed directing him not to sell, offer for sale, or expose for sale such seed until the requirements of this Act and Regulations promulgated pursuant to the provisions of this Act shall have been complied with and a written release has been issued in the manner as prescribed by the Minister.

(z) "Seed producer" means any person, firm, agency or corporation engaged in the production of seed for marketing and sowing purposes.

Section 4. The meaning of other terms as are necessary for the implementation of this Act will be as defined by the Minister.

Chapter II

ESTABLISHMENT OF A NATIONAL SEED BOARD

Section 5. The establishment of a National Seed Board is hereby decreed to assist and advice the Government with planning and formulation of policies necessary for the effective and orderly development of a national seed industry.

Section 6. The Minister (MOAC), as soon as practical after the promulgation of this Act, shall organize said National Seed Board, and specify its management, functions and procedures, and promulgate the same in a decree under his authority. Provided, however, that any duties, procedures and organization prescribed shall conform to and include those specified hereinafter.

Section 7. The National Seed Board shall be constituted of high level representation from among the various Ministries, Directorates, Institutes, and other agencies, including those within the private sector, that are concerned with agricultural development in this country, but shall not consist of more than 10 members exclusive of the chairman and secretariat staff.

Section 8. Duties and functions of the National Seed Board shall include, but not be limited to, advice and assistance to the Minister of Agriculture on:

(a) Formulation of Ministerial and/or Directorial decisions related to the development of a seed program as herein provided for.

(b) General regulations and procedures adopted for the control of seed marketing and for certification of seed and implementation thereof.

(c) Regulations pertaining to importations and exportations of seed and their implementation,

(d) Procedures for the orderly and effective release of new and/or improved crop varieties, and discontinuation of obselete varieties in the national agricultural programs.

(e) Participation of private enterprises in the national seed program.

Chapter III

REGULATION OF SEED MARKETING

Section 9. The Minister is hereby impowered to regulate the marketing of specific kinds and/or varieties of seed, in Thailand or subdivisions thereof, as he deems to be in the national interest, by promulgation of reasonable rules, regulations, and procedures pertaining thereto.1/*

Section 10. Before adopting and promulgating rules, regulations and procedures for the marketing of seed as authorized under Section 4, the Minister will obtain the advise of the National Seed Board.

Section 11. Rules, regulations and procedures for control of the marketing of seed will be promulgated by decree of the Minister and will become effective upon publication in the government gazette.

Section 12. The kinds and/or varieties of seed (crops) that are to be regulated, and the provinces or subdivisions of the country thereof, where regulation and control will be in force, will be specified by the Minister.2/

---

* Refers to explanatory notes at the end of this appendix.

Section 13. Regulation of the marketing of seed will be confined to the following:

(a) Registration of merchants and distributors engaged in marketing of seed kinds and/or varieties, declared as regulated, and in provinces or subdivisions thereof as stipulated by Ministerial Regulation. 3/

(b) Requirements for the compulsory labeling of seed declared as regulated that are for sale as to composition, quality and source of the seed. 4/

(c) Establishment of minimum quality standards for regulated seed offered for sale, and maximum sizes of seed lots. 5/

(d) Procedures that will be followed by all persons and/or agencies engaged in marketing of regulated seed to obtain the information required for labeling of seed lots. 6/

(e) Such administrative and technical procedures and actions as are necessary for the effective implementation and enforcement of seed marketing regulations, to include sanctions and penalties for violations of provisions of the regulations.

Section 14. For the purposes of carrying out the provisions of Chapter III, Sections 9, 10, 11, 12 and 13 of this Act, the Minister will establish and support a SEED CONTROL AND CERTIFICATION project in the Ministry of Agriculture and Cooperatives.

(a) The Seed Control and Certification Section will be administered by a Director appointed by the Minister and will include such other technical and administrative staff as required for its effective functioning, and it may establish laboratories and/or inspection units under its control in various provinces or subdivisions thereof.

(b) The Seed Control and Certification Service will not actively engage in the production and marketing of seed, nor will any of its staff be so engaged.

Chapter IV

SEED CERTIFICATION AGENCY

Section 15. The Minister is hereby empowered to establish, organize and support an official SEED CERTIFICATION AGENCY within the Seed Control

and Certification Section as specified in Chapter III, Section 14, and to adopt and prescribe administrative and technical regulations, standards and procedures for the certification of seed of those kinds and/or varieties of crops in such provinces of the country or subdivisions thereof, as he deems to be within the interests of agriculture in the country.

Section 16. The purpose of seed certification shall be to maintain and make available to farmers, seed of superior crop varieties so produced and distributed as to maintain a high degree of varietal purity and quality.

(a) Certification of seed shall be a service to seed producers which they may or may not use at their option. 7/

(b) Certification of seed shall be confined to superior varieties of crops approved by the CROP VARIETY REVIEW AND RELEASE COMMITTEE of the National Seed Board. 8/

Section 17. The Minister will consult with the National Seed Board before:

(a) Establishing and organizing the Official Seed Certification Agency.

(b) Adopting and prescribing the general regulations and procedures for the certification of seed.

(c) Determing the seed of crop kinds and/or varieties that are to be eligible for certification, and provinces in the country or subdivisions thereof, in which the certification service is to be offered. 9/

(d) Establishing fees as may be necessary for services provided to seed producers. 10/

Section 18. The Minister may delegate authority for the formulation and adoption of the specific and technical regulations and standards for certification of the various crop kinds and/or varieties to the Director-General of Agricultural Technology which will, however, conform to the Regulations promulgated by the Minister.

Section 19. The Seed Certification Agency will be administered by a Director, who will be the principal inspector of the Seed Control and Certification Section (Chapter III, Section 14 of this decree).

Section 20. The Seed Certification Agency may establish inspection units under its central control in the various provinces and/or subdivisions thereof as necessary to carry out its work.

Section 21: In the interests of economy, the Seed Control and Certification Section will be organized so as to make maximum use of its seed analysts, seed inspectors and other personnel for both the control of seed marketing (Chapter III) and Seed Certification (Chapter IV), and to minimize duplication of effort.

Section 22. The general procedures of the Seed Certification Agency and the general certification standards adopted will be in conformity with the general pattern and meaning of seed certification as accepted internationally.

Section 23. The Seed Certification Agency authorized in this degree shall be the only Seed Certification Agency in Thailand.

Chapter V

STANDARDS FOR SEED IMPORTS AND EXPORTS

Section 24. The Minister is hereby empowered to establish reasonable quality standards for seed imported and exported, taking into account such standards as are already in effect under the Plant Quarantine Act of BE 2507.

Section 25. In establishing minimum quality standards for imported or seed the Minister will consult with the Ministry of Foreign Affairs and the National Seed Board.[11/]

Section 26. Minimum standards prescribed for imported or exported seed will be confined to standards for germination percentage, varietal identity, purity, and restrictions on contaminating weed seeds which if introduced or exported may be detrimental to Thailand's agriculture.

Section 27. Enforcement of standards for imported seed will be the responsibility of the D vision of Plant Quarantine, which will utilize the technical services available in the Seed Control and Certification Agency in determining whether imported seed meets minimum standards.[12/]

Section 28: Enforcement of standards for seed exported will be the responsibility of the Seed Control and Certification Agency.

Chapter VI

GENERAL PROVISIONS

Section 29. Exemptions: The provisions of this Act are not to be enforced on:

(a) government agencies and operational units thereof when seed are to be used for research and educational purposes or does not involve the sale of seed.

(b) when seed are sold and delivered by the farmer-grower on his own premises.

(c) dealers of seeds declared as regulated by this Act which are packaged in their original container by a person licensed according to this act and when such sales are made without opening the original container.

(d) any person for having sold, offered or exposed for sale seed, or mixtures of seed, which were incorrectly labeled or misrepresented as to kind, variety or origin, which seed cannot be identified by examination thereof, unless he has failed to obtain an invoice, a written grower's declaration or other labeling information and has not taken such other precautions as are reasonable to insure the identity to be as stated.

Section 30. Seizures:

The Minister may cause to be seized and held any lot of seed, or mixtures of seed, found to be in violation of any of the provisions of this Act or subsequent regulations until such provisions or regulations have been complied with and said violation otherwise legally disposed of. The competent officers of the Seed Control and Certification Agency of the Ministry of Agriculture and Cooperatives shall power to enforce this section.

Section 31. Penalties

The principal penalties for violation of the provisions of this decree and rules and regulations promulgated thereunder shall be "stop sale" or "seizure" orders which will prohibit sale of the lot of seed until it has been brought into compliance or result in confiscation of the seed without compensation. In the case of repeated violations, by

the same person or firm, his or its registration as required under Section 13 (a) may be cancelled, and the Minister may cause the institution of proceedings in a court of competent jurisdiction to prevent said person or firm from engaging in any activity related to seed production and marketing under penalty of fine or imprisonment or both.

Section 32: Assessment and Collection of Fees:

The Minister is herby empowered to establish and collect reasonable fees as may be desirable or necessary in implementation of this act, and for services made available to seed producers, merchants, importers, exporters, in furtherance of the objectives of this act. In establishing the fees authorized under this section, the Minister will seek the advice and counsel of the National Seed Board. Fees may be collected from seed merchants for registration as required under Section 13 (a), seed import and export permits, certification applications, inspections and labels, seed testting services, and for any other services as may be deemed reasonable and necessary.

Section 33: Disposition of Fees:

All fees collected by the Minister under this act shall be paid by him to the Ministry of Finance who shall deposit said money to the account of the Thailand Seed Act Fund. Said fund shall be expended as legally authorized for the enforcement of the Seed Act and operation of the supporting technical facilities.

Section 34: Separability of Provisions:

If any provisions of this Act, or the application thereafter to any persons or circumstance, is held invalid, the remainder of the Act, and the application of such provisions to other persons or circumstances, shall not be effected thereby.

Section 35: Interim Provision:

All matters not sufficiently covered in this Act shall be as interpreted and determined afterwards by the Minister of Agriculture and Cooperatives.

Countersigned by _____

EXPLANATORY NOTES

1/ The purpose of the wording of this section is to make explicit the intent that marketing of only the most important seed kinds and/or varieties are to be regulated. For example, marketing of the seed of the high yielding varieties of rice might be regulated throughout Thailand, while, marketing of seed of improved varieties might be regulated only in the Northeastern region.

Seed marketing legislation enacted by many developing countries encompasses all kinds of seed and is impossible to implement. Such broad, all encompassing legislation is totally unnecessary in the context of agricultural development and its potential benefits are almost inconsequential. Since broad seed legislation is impossible to implement, such laws simply take up space in the statue books, this fosters disrespect for and cynicism about laws in general. It is our belief that it is much better to have no law at all than one that cannot or will not be implemented and enforced.

Limiation of seed regulatory activities to the most important kinds of seed (crop and varieties) in the more advanced provinces will best serve agricultural development by permitting implementation and enforcement of its provisions.

2/ Careful consideration should be given to determination of the seed kinds and/or varieties that need to be regulated at the marketplace, and the provinces wherein such regulation is needed and is feasible.

3/ Compulsory registration of seed merchants engaged in marketing regulated seed will (a) identify, and establish and maintain contact with active agents in the seed trade and (b) provide a very effective penalty for non-compliance with other provisions of the seed marketing decree (cancellation of registration which will effectively prohibit a person, firm, or agency from marketing regulated seed).

4/ This provision follows the truth-in-labeling philosophy of enlightened product regulatory law making.

5/ Establishment of minimum standards is not inconsistent with the truth-in-labeling philosphy. The standards should be reasonable and based on in-depth surveys of seed quality presently available in Thailand.

6/ This provision when amplified will require that controlled seed offered for sale be tested by the laboratory(ies) of the Seed Control and Certification Agency.

7/ Certification will be voluntary as it should be. Compulsory certification is nothing more than thinly disguised, rather heavy handed government control of seed production, processing, storage, distribution and marketing.

8/ Certification has the purpose of making available seed of superior varieties to farmers. There is no good reason to waste time and resources certifying an unimproved traditional varieties or kinds.

9/ Certification services should be offered to seed producers only in areas that are accessible to inspectors.

10/ Certification, when it becomes on-going, should be an essentially self-supporting service. Thus, seed producers will have to pay for the services rendered in the form of fees or charges for seed labels (tags).

11/ Vegetable seed is the major kind of seed imported. A survey should be conducted of the germination quality and field performance (including varietal purity) of imported vegetable seed to provide a basis for establishment of import standards and regulations.

12/ The Division of Plant Quarantine will take samples of imported seed, transmit same to the Seed Control and Certification Testing Laboratory for tests, and then take action in accord with reports received from seed testing laboratory.

APPENDIX VII

SEED GROWERS CONTRACT
(Unofficial Translation)

Soybean Multiplication Seed Production Agreement, 1973
Department of Agricultural Extension
Ministry of Agriculture & Cooperatives

****

This agreement is signed at _____on_____19___ between (Mr. Mrs. Miss)_____whose address is _____(house No.)_____(Village No.)_____ _____ (Tambon)_____(Amphoe)_____(Changwat) who in the agreement, shall be called the "cultivator" as one party, and (Mr. Mrs. Miss)_____(official position, title and grade) Amphoe agricultural officer, the representative of the Agricultural Extension Department, as the other party.

The provisions of the agreement are as follows:

1. The cultivator gives his statement of agreement as follows:

1.1 I will plant soybeans of _____variety on an area of _____rai at the rate of _____kilos per rai using Foundation seed, which cost ฿_____ per kilo, to produce Multiplication seed for the Agricultural Extension Department.

1.2 I will cultivate the soybeans in the area which the representative of the Agricultural Extension Department has concurred.

1.3 I agree to be trained or receive orientation concerning soybean cultivation for producing Multiplication seed from personnel of the Agricultural Extension Department.

1.4 I will act strictly according to the advice of said personnel in practices such as in land preparation, plant spacing, elimination of weeds, insects and diseases, harvesting, threshing, etc.

1.5 I agree to sell the Multiplication seed produced by me according to the amount and price specified in clause 2.1 of this agreement.

1.6 I will keep the seed as best as I can while awaiting their transfer to the purchasing committee by preventing damage by pests and moisture, such as rain or dew.

2. The Agricultural Extension Department gives the statement of agreement as follows:

2.1 The Department will purchase the Multiplication seed produced in the area stated above at _____ Baht per kilo. provided the seed meet the following quality standards:

(a) Pure seed 100% (no varietal mixture)
(b) Maximum moisture content 20%
(c) Minimum germination 85%
(d) Maximum 5% green seed (unripe seed)
(e) Maximum spoiled seeds such as broken, thin, insect damaged 10%
(f) Maximum adulterating materials, i.e. stones, gravel, soil, etc. 2%

2.2 The Department will render assistance and give technical advice in connection with the cultivation and care of soybeans grown for production of Multiplication seed and give advice for the prevention and elimination of soybean pests throughout the growing season.

2.3 The Department will pay for the Multiplication seeds not more than 15 days, after the purchasing committee has approved their purchase.

2.4 Payment for the seed will be made through the Bank. (sic-indicated on the payment draft).

3. Conditions

3.1 In the event the price of soybeans guaranteed by the Department of Agricultural Extension, according to the agreement, is lower than the local market price for grain, the Department permits the cultivator to sell the grain to the local merchants, but the cultivator must pay the Department for the Foundation seed supplied, in cash, and repay any loan and interest that was incurred for producing this crop within 15 days.

3.2 Any cultivator who wishes to sell the Multiplication seed according to clause 3.1 must inform the representative of the Department of Agricultural Extension, at least 7 days before the sale.

3.3 In the event that the Purchasing Committee has considered and found that the quality of the seed produced by the cultivator, according to the provisions of this Agreement, is lower than that specified in Clause 2.1 and the Committee does not buy the seed, the cultivator has to pay the cost of the Foundation seeds to the Agricultural Extension Department equal to the amount that the cultivator has bought.

3.3.1. Pay back the loan together with the interest to the bank from which the cultivator has obtained the loan.

3.3.2. The cultivator cannot claim any compensation from the Department of Agricultural Extension whatsoever.

This Agreement is made in 3 copies, having the same provisions. One copy is kept by the cultivator; one by the representative of the Department of Agricultural Extension and one at the Changwat Agricultural Office.

The cultivator has read and understood all the provisions of this Agreement and has signed his signature in the presence of two witnesses.

Cultivator's Signature_____
( )

Signature of the
Representative of the
Dept. of Agri. Extension_____
( )

Witness' Signature_____

Witness' Signature_____

APPENDIX VIII

INITIAL STAFFING REQUIREMENTS AND JOB DESCRIPTIONS FOR THE DOAE "SEED MULTIPLICATION PROGRAM"

Location	Position or Title	Number needed	Present Status 1/	Maximum Civil Service Classification
Bangkok	Program Headquarters			
	Program Chief 2/	1	c	1st grade
	Asst. Program Chief 2/	1	b	1st grade
	Secretary	1	a	as required
Phitsanulok - Branch Headquarters, Northern Regional Extension Training and Supervisory Center.				
	Chief-Seed Service Center 2/	1	b	1st grade
	Chief, Processing 2/	1	b	2nd grade
	Chief-Seed Production & Distribution 2/	1	b	1st grade
	Chief, Quality Control 2/	1	c	2nd grade
	Senior Seed Analyst 2/	1	d	3rd grade
	Junior Seed Analyst 2/	1	d	4th grade
	Analyst's Assistants 2/	2	d	unclassified
	Processing Superintendent 2/	1	d	3rd grade
	Equipment Mechanic 2/	1	d	4th grade
	Records & Accounts clerk 2/	1	d	3rd grade
	Secretary	1	a	as required
	Driver	2	a	unclassified
	General Worker	4	a	unclassified
	Temporary labor	as needed	a	temporary

1/ a - Personnel presently employed, trained, and assigned to desired location.
b - Personnel employed and trained - transfer needed.
c - Personnel employed and assigned to desired location - specialized training needed.
d - New position - specialized training needed.

2/ Job description given on following pages

Job Descriptions

1. Chief, Seed Multiplication Program - 1st grade officer with experience as a project leader and post-graduate training and/or experience in all aspects of seed technology.[1/] As the chief administrative officer he is responsible for fiscal, personnel and technical management of the total program, coordinator of Program activities with seed related activities by other Departments of the MOAC and other Ministries, planning and implementation of educational and promotional programs concerning seed. He will act under the direct supervision of the Chief, Division of Crop Promotion and will be responsible for all personnel assigned to the Program.

2. Assistant Chief, Seed Multiplication Program - 1st grade officer with experience as a Project leader or Changwat officer and have post-graduate training and/or experience in seed technology. He will assist the Chief in meeting his obligations in planning and coordination and have the specific responsibility for developing and implementation of an educational program to encourage the development of private sector operations in seed. He shall be responsible to the Program Chief and act in his behalf during his absence.

3. Chief, Seed Service Center - 1st grade officer with experience as a Project leader or at the changwat level. He should have post-graduate training in all aspects of seed technology. As Chief of the Center he will be responsible for all fiscal, technical and educational activities at the Center. He shall be responsible for planning and implementation of in-service and on-the-job training.

   He shall be responsible to the Program Chief for all technical operations and Director, Northern Regional Extension training and Supervisory Center for educational activities. All persons whose primary activities are carried out at the Center will be under his administrative supervision.

4. Chief, Seed Production and Distribution - 1st grade officer with experience at both amphoe and Changwat levels and post-graduate training in seed technology with emphasis on production. This office will be primarily responsible for supervision and coordination of the production and distribution of seed handled by the DOAE program.

1/ Seed Technology is defined as the applied science of seed to include all aspects of production, harvesting, drying, processing, storage, quality evaluation distribution and marketing.

He shall also work cooperatively with the Assistant Chief of the Program in implementing the program for development of the private sector. Though assigned to the Center he shall operate under the direct supervision of the Program Chief. He shall act for the Chief of the Center in his absence.

5. Chief, Seed Processing - 2nd grade officer with experience at the Changwat level and post-graduate training in seed technology with emphasis on seed drying processing and storage. Primary responsibility will be for the operation of the seed drying, processing and storage units at the Center. He shall supervise the activities of all personnel assigned to his units and will act under supervision of the Chief of the Center.

6. Chief, Quality Control - 2nd grade officer with experience at the Changwat level and post-graduate training in seed technology with emphasis on seed physiology and quality evaluation. Primary responsibility will be in supervision and operation of the seed testing laboratory at the Center. He shall also act as assistent to the Center Chief in planning and implementation of training programs. This officer shall act as supervisor of all personnel assigned to the Seed Testing Laboratory and will be under the supervision of the Center's Chief.

7. Processing Superintendent - 3rd grade officer who has training and/or experience in operation and maintenance of electrical and mechanical equipment. He will be responsible for the daily operation of the seed drying-processing unit, maintenance of records of daily operations and supervision of the general and temporary workers assigned to these units. He will be under the supervision of the Chief of Seed Processing acting in his place during any absence.

8. Senior Seed Analyst - 3rd grade officer with specialized training in techniques for seed analysis, testing, and quality evaluation. This analyst will conduct routine purity and germination tests, supervise the activities of the analysts assistant's and supervise operation of the laboratory in the absence of the Chief, Quality Control. The Chief, Quality Control shall be the supervisory officer.

9. Records and accounts clerk - 3rd grade officer with training and experience in cost accounting and maintenance of inventory records. Responsible for maintaining records of expense and sales of seed, inventory of seed supplies, and billing for sales and services. Responsible to Chief of the Center but will work cooperatively with the Chiefs of Production, Processing and Quality Control.

10. Equipment Mechanic - 4th grade officer with experience and training in maintenance and minor repairs of electrical and mechanical equipment located at the Center and supervision of maintenance for threshing machines and similar equipment under control of the Center. He shall act in the place of the Processing Superintendent during absence of the Superintendent and his activities will be supervised by the Chief of Processing.

11. Junior Seed Analyst - 4th grade officer having specialized training in techniques for seed analysis testing and quality evaluation. Primarily responsible for conducting purity and germination tests and supervision of the analyst's assistants in the absence of the senior seed analyst.

12. Other workers

    (a) Secretaries (2) - one at Program Headquarters and one at the Center trained to perform routine secretarial duties. Responsible to the respective Chiefs.

    (b) Analyst's assistant (2) - unclassified, literate, to be trained on-the-job by the senior seed analyst. Responsible for sample preparation, preparation of germination tests, cleanliness of the laboratory equipment and supplies and similar duties are assigned by the Chief of Quality Control.

    (c) Drivers (2) - must be qualified to drive vehicles including 5 ton trucks used to haul seed. May also be used as general workers operations of the processing or storage units.

    (d) General Workers (4) - unclassified, literate, primary activities will be in seed drying-processing operations but specific work assignments will be at the discussion of the Chief of Processing.

    (e) Temporary labor - hire only as needed during peak work periods. Primary activities will be to load and unload trucks, move clean seed into storage warehouses and similar activities as assigned by the Chief of Processing.

APPENDIX IX

EQUIPMENT SPECIFICATIONS AND PRELIMINARY ENGINEERING DRAWINGS FOR ALTERATIONS AND ADDITIONS TO THE SEED SERVICE CENTER (Phitsanulok)

This appendix is divided into three sections. The first section lists the equipment specifications for 24 items which were ordered by USOM in June 1973 for utilization at the Seed Service Center, Phitsanulok. It is anticipated that items on this list will arrive in Thailand and in May or June 1974.

The second section lists specifications for the equipment items which will need to be purchased to effectively utilize the "calabrian" ear-maize drying - shelling units described in Section III. D.

Section three contains reductions of the nine tracings prepared as guidelines for layout construction and installation of the equipment and buildings needed to complete the Seed Service Center.

Section I. List of equipment ordered by USOM for the Seed Service Center, Phitsanulok.

Item No.	Description	Qty	Unit Price	Total Price
1. (12) 1/	Seed Treater, similar to Gustafson Model Gl. Capacity up to 9 ton (300 Bushel) per hour and capable of applying both liquid and wettable powder formulated products. Overall dimensions approx. 56 inches (1.4 m) length; 28½ inches (0.71 m) width; 38 inches (0.96 m) height. Slurry tank capacity min. 12 gallons (47 liters). Complete with drive and motor of required horsepower operational on 220 V. 50 Hz. single phase current w/2 way bagger.	1 EA	$ 1,200.00	$ 1,200.00
	Location: Processing Plant Source: Gustafson Mfg. Co. 6500 S. County Rd. 18 Hopkins, Mn.	Burrows Equipment Co. 1316 Sherman Avenue Evanston, Illinois 60204		
2. (7)	Gravity Table, similar to Oliver Model 160, operating capacity of approx. 5,000 lbs. per hour (medium-large size seed); rectangular deck, three (3) fans; left-hand discharge; overall dimensions approx. 52 inches 1.3 m) width; 102 inches (2.6 m) length; 70 inches (1.8 m) height (to top of feed hopper.) Complete with the following: (a) Non-receprocating discharge spouts (b) Air-Filter screens (c) Screen wire deck (type A) (d) Manufacturers recommended drive and motor of required horsepower operational on 220 Volt, 50 Hz, 3 phase current. (e) Manual Starter	1 EA	3,100.00	3,100.00
	Location: Processing Plant Source: Oliver Mfg. Co. Rocky Ford Colarado			

1/ Numbers in parentheses refer to the equipment item number as shown on the preliminary engineering drawings.

Item No.	Description	Qty	Unit Price	Total Price
3.	Vacuum Cleaner, industrial type, portable. Complete with dust bag; blower nozzle; hose connector; 10' x 2" heavy duty neoprene hose; motor operation on 220 V. 50 Hz. single phase current. Similar to Tornado Model 420.	1 EA	$ 400.00	$ 400.00
	Location: Processing Plant Source: Burrows Equipment Co. 1316 Sherman Avenue Evanston, Illinois 60204	Seedboro Equipment Co. 618 W. Jackson Blvd. Chicago, Illinois 60606		
4.	1 Set of 24, 9x9 inch hand screens. complete with screen rack, screens to be sized as follows: Round hole: 6, 6½, 8, 10, 12, 14, 16, 18, 20, 24, 26, 28, 30. Slotted: 1/13 x ½, 1/14 x ½, 1/15 x ½, 1/16 x ½, 5 x 3/4, 6 x 3/4, 7 x 3/4., 9 x 3/4, 10 x 3/4, 11 x 3/4 and blank.	1 Set	100.00	100.00
	Location: Processing Plant Source: Burrows Equipment Co.			
5.	Moisture Tester, moisture range 5-37% similar to Steinlite Model DL, complete with moisture conversion charts including corn, soybeans, rice, peanuts, castor-beans, cotton; inverter for operation on 6 or 12 volt battery. Unit capable of operation on 220 V. 50 Hz current.	2 EA	650.00	1,300.00
	Location: Seed Testing Lab. Source: Seedboro Equipment Co.			
6.	Torsion Balance Scale, similar to Model DWL 2-1, Capacity 120 grams. Dial 1 gram x 0.01 gram graduations. Weight loader 9 grams x 1 gram increments without extra weights. Accuracy 5 mg. Polished stainless steel scoop; oil dash pot; metal case. Complete with class P wts. 50 grams to 1 gram in case with forceps.	2 EA	300.00	600.00

Item No.	Description	Qty	Unit Price	Total Price
	Location: Seed Testing Lab Source: Burrows or Seedboro			
7. (4)	Air-Screen cleaner; four screen, similar to Crippen Model H-442 cleaner. Cleaner to have independent upper and lower air systems; synchronized brush type screen wipers; adjustable screen pitch, variable speed screen vibration; screen frame size approx. 42 x 44 inches; average capacity for large seed 125-150 bushels (3.5-4.5 tons) per hour. Overall dimensions approx. 86 inches height, 73 inches width, 112 inches length. Complete with the following: (a) roll feed hopper (Type A). (b) fans mounted on 45° angle to rear. (c) fan outlets to have square to round adaptors 1 foot dia. (d) waste product discharge outlets on right side; clean seed vibrating conveyor discharge outlet on left side. (e) waste product bag holders. (f) manufacturers recommended drives, guards, motor mounting and TEFC motor of required horsepower operational on 220 V., 50 Hz. 3 phase current with manual on-off switch. (g) twenty-four (24) screens sized as follows: Round hole: 6, 7, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 (sixty-fourths-inch dia.) Slotted: 1/13 x ½, 1/14 x ½, 1/15 x ½, 1/16 x ½, 5 x 3/4, 6 x 3/4, 7 x 3/4, 8 x 3/4, 9 x 3/4, 10 x 3/4, 11 x 3/4, 13 x 3/4. Location: Processing Plant Source: Crippen Mfg. Co. Alma, Michigan	1 EA	$ 6,000.00	$ 6,000.00

Item No.	Description	Qty	Unit Price	Total Price
8.	Oven, stainless steel, similar to Cenco Stainless Steel Oven No. 262. Temperature range to 218°C (425°F). Min. two inches of high density fiberglass insulation completely surrounds the inner chamber (including door). Air intake valves at both sides of the chamber, near the bottom; a metal damper on the top of the oven for control of the air circulation; provision for the mounting of thermometers to measure inside temperatures; all aluminum-clad steel int. (not painted); heavy gauge steel ext. w/hammerloid finish. Diamension, inside chamber (approximately) 18" w. x 14" d. x 14" h. Three shelves, 2 adjustable. For 230 V. 50 Hz. A.C. 1,450 watts. Location: Seed Testing Lab. Source: Burrows Cat. No. 16 P. 10	1 EA	$ 350.00	$ 350.00
9.	Divider, similar or equal to Official Boerner Sampler No. 344, for reduction the size of a sample of grain and at the same time to obtain a sample as representatives as the original. Made of brass and copper. Height approx. 31". Complete w/2 pans. Location: Seed Testing Lab. Source: Burrows Cat. No. 16 P. 23.	1 EA	175.00	175.00
10.	Bag Truck, similar or equal to All Steel Bag Truck 1030B with rubber tired wheels, roller bearings, 48" handles, 8" diameter wheels. Nose is approx. 9" long x 11" wide. Location: Seed Storage warehouse Source: Burrows Cat. No. 16 P. 119	4 EA	75.00	300.00

Item No.	Description	Qty.	Unit Price	Total Price
11.	Blower, portable, approx. 7/8 H.P input 13,650 R.P.M., waterlift 40" static, 25 3/4" at 3/4" nozzle op. Velocity at nozzle open about 23,000 ft. per min. (262 MPH). Universal type motor for 220 V. 50 Hz., single phase. Tornado Model 850 or equal complete with A 10 nozzle, standard cable 50 ft. and 25 ft. ext. cord. Location: Processing Plant Source: Burrows Cat. No. 16 P. 147	1 EA	$ 125.00	$ 125.00
12.	Respirator, made of soft white rubber to give air-tight fit on faces. Sponge type filters for protection from ordinary smoke, light condensations of fumes, vapors and nuisance dusts. Valve to be automatic in operation. Burrows No. 705 or equal. Location: Processing Plant. Source: Burrows Cat. No. 16 P. 159	12 EA	3.00	36.00
13. (5)	Belt-bucket elevator-self supporting, similar to Universal Model C2-175 "EASY DUMP". Elevator to have 5 ton (175 BPH) capacity (seed at 48 lbs/cu ft.) at 75% bucket filling and 110-125 FMP belt speed. Discharge height to be 6.0 m. (20 ft) ; O.A. height not to exceed 7.0 m (23 ft). Complete with the following : (a) required buckets, splicing, pre-punched belting and assembling hardware. (b) spacers for insertion between belt and buckets. (c) standard dump hopper on up-leg. (d) 2-way off-set valve with 15.2 cm. (6 inch) diameter outlets. (e) manufacturers recommended drive and TEBB $\frac{1}{2}$ h.p. motor operational on 220 volt, 50 Hz., 1 ph., current.	1 EA	775.00	775.00

Item No.	Description	Qty.	Unit Price	Total Price
	(f) three (3) 3.0 m. (10 ft) sections 15.2 cm. (6-inch) dia 14 ga. flanged rigid spouting. (g) four (4) clamp rings (connecting elbows to spouting). (h) two (2) 15.2 cm. (6-inch) dia adjustable elbows with clamp rings. (i) two (2) 15.2 cm. (6-inch) dia loose flanges. Location: Processing Plant Source: Universal, Inc. 516 Grand Blvd. Cedar Falls, Iowa, U.S.A. — Burrows Equipment Co. 1316 Sherman Ave. Evanston, Ill. 60204			
14.	(9) Belt-bucket elevator-self supporting, similar to Universal Model C2-175 "EASY DUMP" Elevator to have 5 ton (175 BPH) capacity (seed at 48 lbs/Cu. ft.) at 75% bucket filling and 110-125 FPM belt speed. Discharge height to 6.0 m (20 ft.); O. A. height not to exceed 7.0 m. (23 ft). Complete with the following: (a) required buckets, splicing prepunched belting and assembling hardware. (b) spacers for insertion between belt and buckets. (c) Standard hopper on up-leg. (d) manufacturers recommended drive and TEBB $\frac{1}{2}$ h.p. motor operational on 220 volt, 50 Hz., 1 ph, current. (e) one (1) 3.0 m. (10 ft) section 15.2 cm. (6 inch) dia 14 ga. flanged rigid spouting. (f) one (1) 15.2 cm (6 inch) dia. adjustable elbows with clamp rings. (g) two (2) 15.2 cm. (6 inch) dia. loose flanges. (h) four (4) clamp rings (connecting elbows to spouting). Location: Processing Plant Source: Universal, Inc. 516 Grand Blvd. Cedar Falls, Iowa U.S.A. — Burrows Equipment Co. 1316 Sherman Ave. Evanston, Ill. 60204	1 EA	$ 725.00	$ 725.00

Item No.	Description	Qty.	Unit Price	Total Price
15. (8)	Vibrator conveyor for No. 7 (A. T. Ferrell) cleaner with 1/3 hp motor operational on 220 V. 50 Hz., 1 ph current. Location: Processing Plant Source: Ferrell-Ross 1621 Wheeler St. Saginaw, Michigan	1 EA	$ 500.00	$ 500.00
16.	Warehouse platform scales, 2,000 lbs. capacity; 42" x 42" platform size; equipped with full capacity double-bar weighbeam; complete with outside frame, structural steel weighbridge, safety plate steel platform, lever assemblies, corner assemblies, weigh beam and mounting. Similar to McMaster-Carr No. 1767Y11 (Catalog 78); Calibrated in Kilograms. Location; Processing Plant Source: McMaster - Carr P.O. Box 54960 Los, Angeles, California Burrows Equipment Co. 1316 Sherman Ave. Evanston, Ill.	1 EA	1,500.00	1,500.00
17..	Seed Blower, similar to South Dakota Blower Model B. Complete with column No. 1 and extension Section and column No. 2. Mounted on stand with casters. Operational on 220 V., 50 Hz., 1 ph current. Location: Seed Testing Lab. Source: E. L. Erickson Products 513 Main Street Brookings, South Dakota	1 EA	600.00	600.00
18.	Dazor Lamp, desk type, two (2) 15 w. fluorescent tubes; reflector and adjustable multiposition arm. Complete with tubes for operation on 220 V. 50 Hz. current. Location: Seed Testing Lab. Source: Burrows Equipment Co.	2 EA	60.00	120.00

Item No.	Description	Qty.	Unit Price	Total Price
19.	Magnifer: Burrows No. 2808 or equivalent magnifier with stand, 5" dia lens; 13" focus. Location: Seed Testing Lab. Source: Burrows Equipment Co.	2 EA	$ 25.00	$ 50.00
20.	Weight/hectoliter Tester: Hand type No. 26 M graduated in Kilos/hectoliter complete with No. 42 anchor grain testing-hopper. Location: Seed Testing Lab. Source: Burrows Equipment or Seedboro Equipment Co.	1 EA	75.00	75.00
21.	Seed Forceps:			
	(a) 4½" long, medium serrated point for large seed.	1 Doz.	22.00	22.00
	(b) 43/4" long, fine smooth points for small seed. Location: Seed Testing Lab. Source: Burrows Equipment or Seedboro Equipment Co.	1 Doz.	25.00	25.00
22.	Sling psychrometer: Taylor 9" sling psychrometer complete with plastic case table and 4 refill thermometers. Location: Conditioned Seed Storage warehouse Source: Harry Alter Co. Chicago, Illinois	2 EA.	35.00	70.00
23.	Bag closer, portable, single thread similar to Fischbein Model D. Bag closer to have direct drive motor operational on 220 V. 50 Hz, 1 phase current. Complete with one (1) carton (32 cones) 8 Oz. thread and replacement parts kit for one year operation. Location: Processing Plant Source: Seedboro Equipment Co.	1 EA	450.00	450.00

Item No.	Description	Qty	Unit Price	Total Price
24.	Bag Cleaner, similar or equal to Burrows Bag Cleaner No. 1214, vertical or horizontal mounting, at any angle. Fan approx. 24 in. diameter. Speed 1,800 R.P.M. Ball bearing and V-belt drive - Motor min. 5 HP for 220 V. 50 Hz. Location: Processing Plant Source: Burrows Cat. No. 16 P. 167	1 EA	$ 700.00	$ 700.00
25.	Automatic Hammer Tacker, hand operated all steel, light weight, nickel plated; with 25,000 staples, 5/16 in length. Similar to Burrows Model 1401. Location: Workshop Source: Burrows Cat. No. 16 P. 162	1 EA	23.50	23.50
26.	Mighty Mac compost shredder Grinder Model 9-P with 5 H.P. self powered unit Amerind. Location: Maize sheller Source: Mac Kissie Parker Ford, PENNA. 19457	1 EA	800.00	800.00
		Total		$20,121.50
		40% surcharge & Freight estimated		8,048.60
		Grand Total		$28,170.10

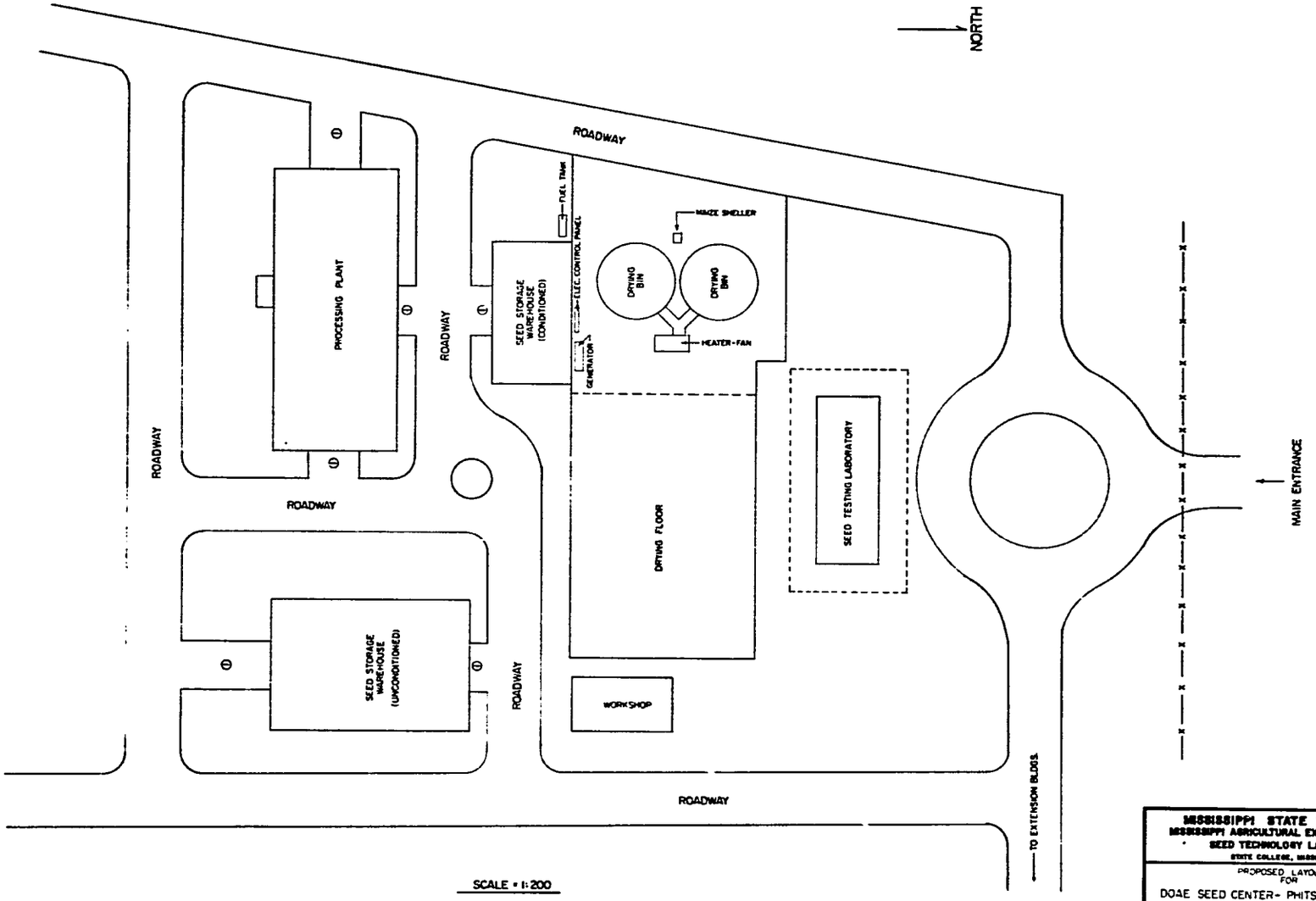
Section II. Equipment Specifications for Ear-Maize Drying-Shelling Unit

ITEM NO.*	No. Req'd	Description	Unit Price **
1	1	Heater-fan (available)	----------
2	2	Drying bin (available)	----------
3	1	Lightweight, portable, link chain rubber flight conveyor, 5m length, approximate 5 ton per hour capacity (ear maize). Complete with drive and motor of required horsepower operable on 50 Hz. 240 Volt current.	$500.00
	(Ref. Burrows Co. Series 2200 -- Burrows Catalog No. 16)		
4	1	Lightweight, portable, link chain rubber flight conveyor, 7.3m length, approximate 5 ton per hour capacity (ear-maize). Complete with drive and motor of required horsepower operable on 50 Hz, 240 volt current.	$550.00
	(Ref. Burrows Co. Series 2200 -- Burrows Catalog No. 16)		
5	1	Corn (maize) sheller, minimum capacity 5 ton per hour. Complete with gathering screw, stand, cob pipe, drive and motor of required horsepower operable on 50 Hz, 240 volt, 3 ph current.	$1700.00
	This item to be purchased only if "Calabrien" sheller is not satisfactory.		
	(Ref. Burrows Co. Model 11 -- Burrows Catalog No. 16)		
6	1	(same as item number 4)	$550.00

* Item numbers correspond to those shown on dwg. sheet 8

** Approximate price FOB Manufacturer U.S.A. (1973)

NOTE: Similar equipment items can be purchased from other manufacturers. Reference to the Burrows Co. products is included only because their



LEGEND

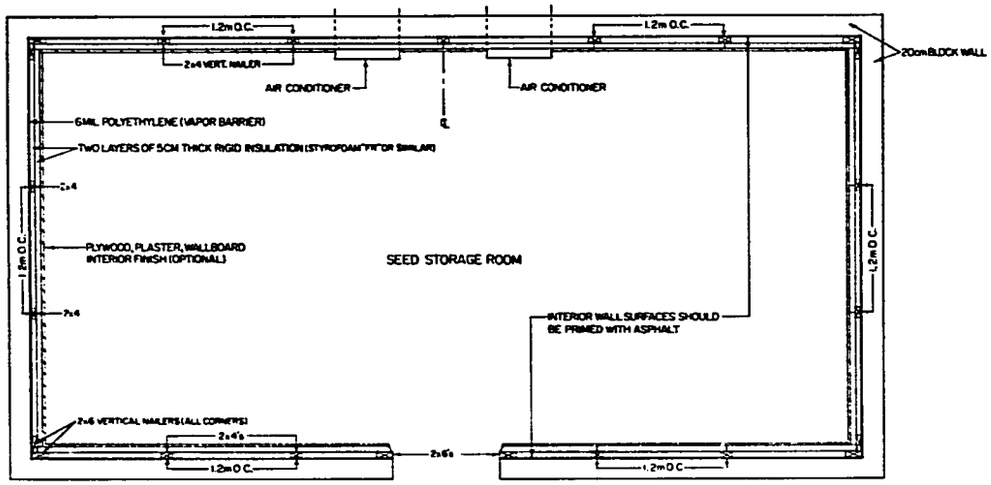
① PAVED APRON

SCALE = 1:200

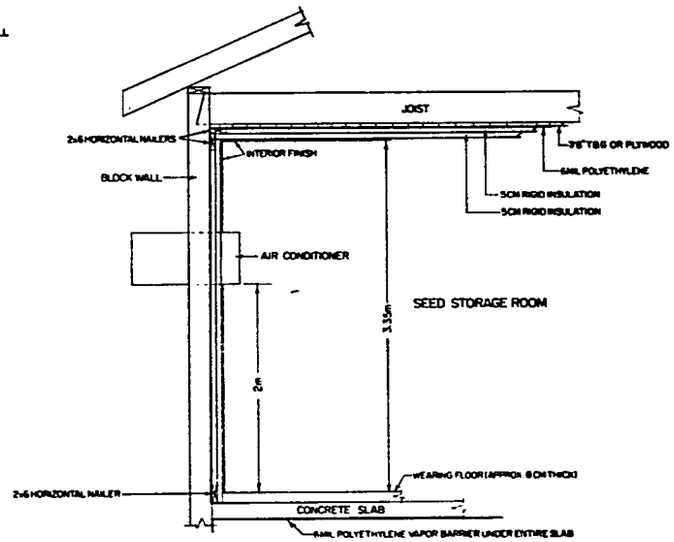
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
SEED TECHNOLOGY LABORATORY
STATE COLLEGE, MISSISSIPPI

PROPOSED LAYOUT FOR
DOAE SEED CENTER - PHITSANULOK, THAILAND

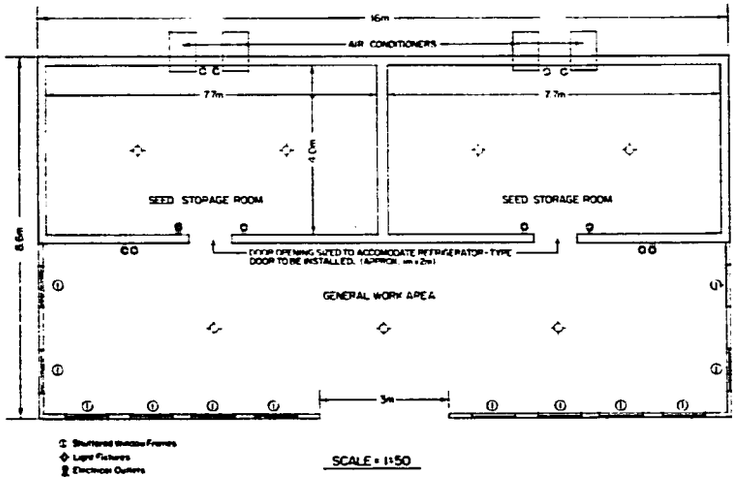
DESIGNED BY: GMD	DATE: JULY, 1973	SHEET 1 of 9
DRAWN BY: GMD	FILE NO. TA73-8	
APPROVED BY: JCD		



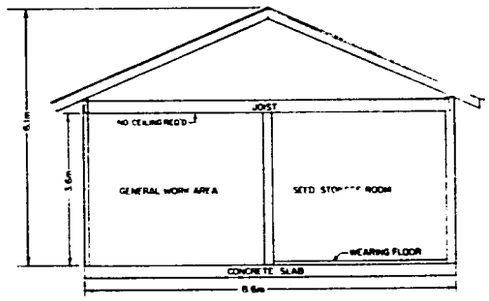
SCALE = 1:20



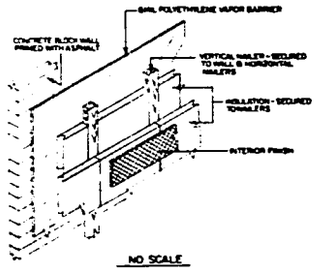
SCALE = 1:20



SCALE = 1:50



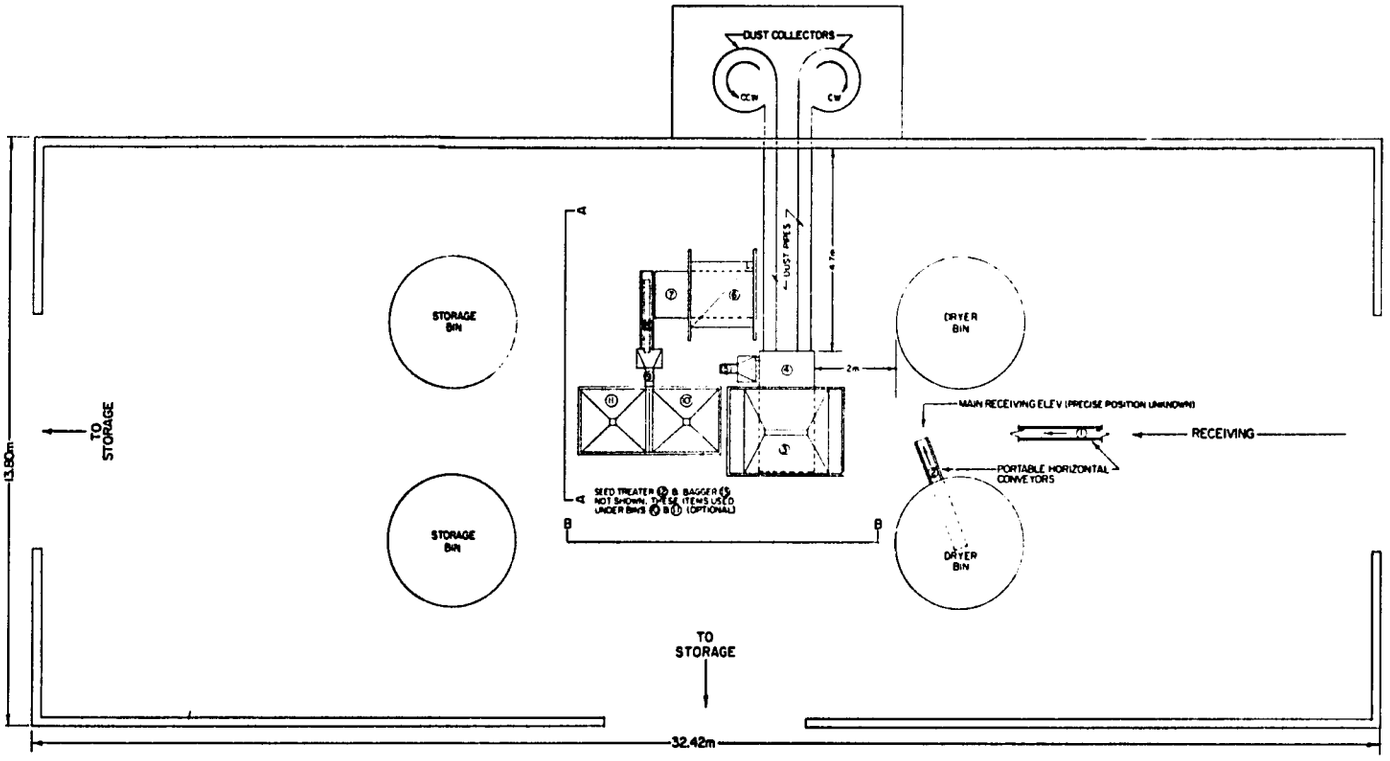
SCALE = 1:50



NO SCALE

MISSISSIPPI STATE UNIVERSITY MISSISSIPPI AGRICULTURAL EXPERIMENT STATION SEED TECHNOLOGY LABORATORY STATE COLLEGE, MISSISSIPPI		
CONDITIONED STORAGE WAREHOUSE BLDG. FOR DOAE SEED CENTER – PHITSANULOK, THAILAND		
DESIGNED BY: GMO	DATE: JULY, 1973	SHEET 2 of 9
DRAWN BY: GMO	FILE NO. TA73-8	
APPROVED BY: JCD		

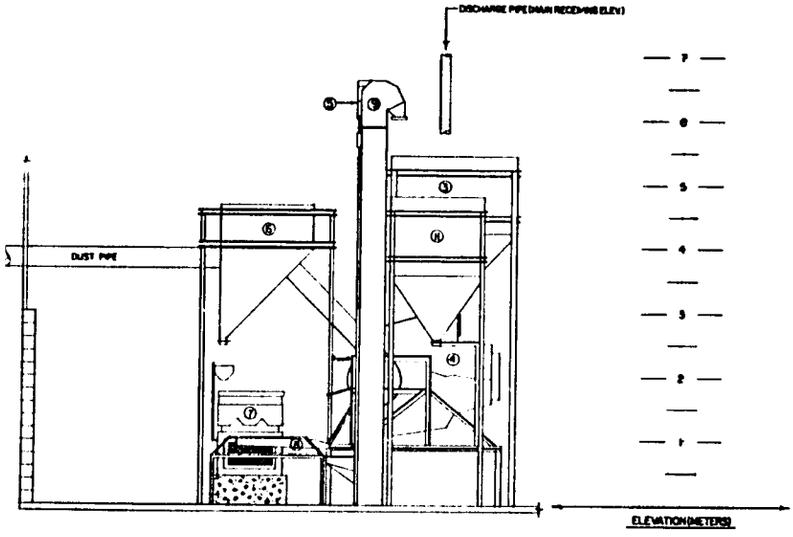
FOR LEGEND SEE EQUIPMENT DESCRIPTION LIST — REPORT TA73-8



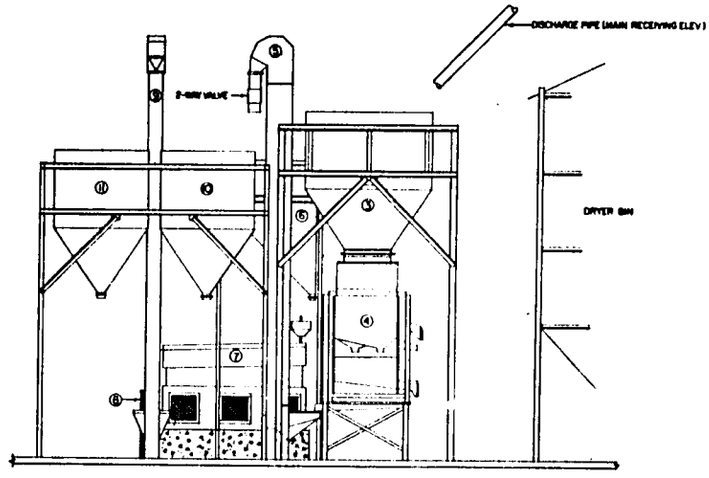
SCALE = 1:50

MISSISSIPPI STATE UNIVERSITY MISSISSIPPI AGRICULTURAL EXPERIMENT STATION SEED TECHNOLOGY LABORATORY STATE COLLEGE, MISSISSIPPI		
PROCESSING PLANT — EQUIPMENT LAYOUT FOR DOAE SEED CENTER — PHITSANULOK, THAILAND		
DESIGNED BY: GMD, HCP	DATE: JULY, 1973	SHEET 3 of 9
DRAWN BY: GMD		
APPROVED BY: JCD	FILE NO. TA73-8	

FOR LEGEND SEE EQUIPMENT DESCRIPTION LIST – REPORT TA73-8



SECTION A-A

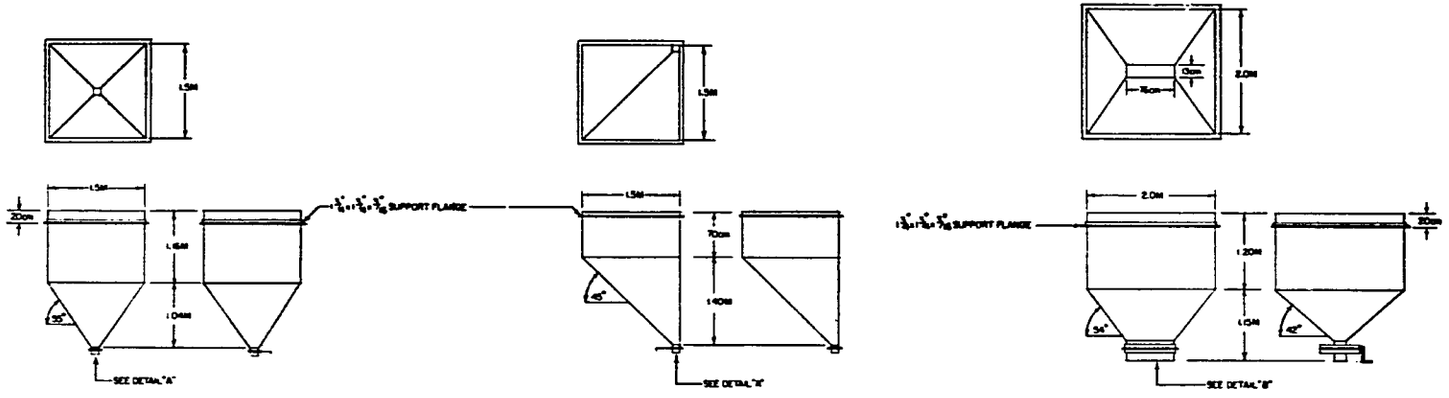


SECTION B-B

SCALE = 1:33 1/3

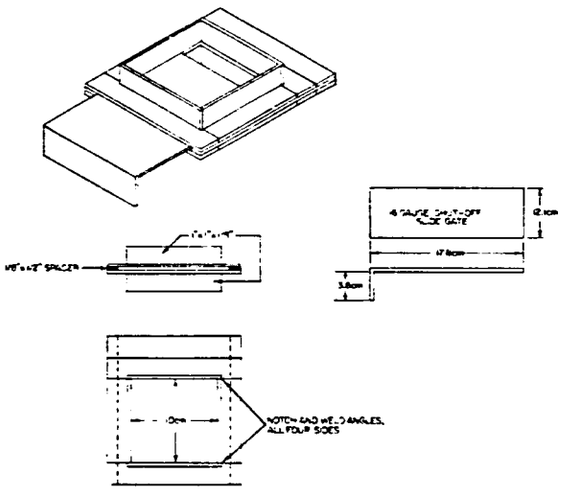
MISSISSIPPI STATE UNIVERSITY MISSISSIPPI AGRICULTURAL EXPERIMENT STATION SEED TECHNOLOGY LABORATORY STATE COLLEGE, MISSISSIPPI			
PROCESSING PLANT – EQUIPMENT LAYOUT FOR DOAE SEED CENTER – PHITSANULOK, THAILAND			
DESIGNED BY: OMD, HCP	DATE: JULY, 1973		SHEET
DRAWN BY: OMD			4 of 9
APPROVED BY: JCD	FILE NO. TA73-8		

SCALE = 1:33 1/3

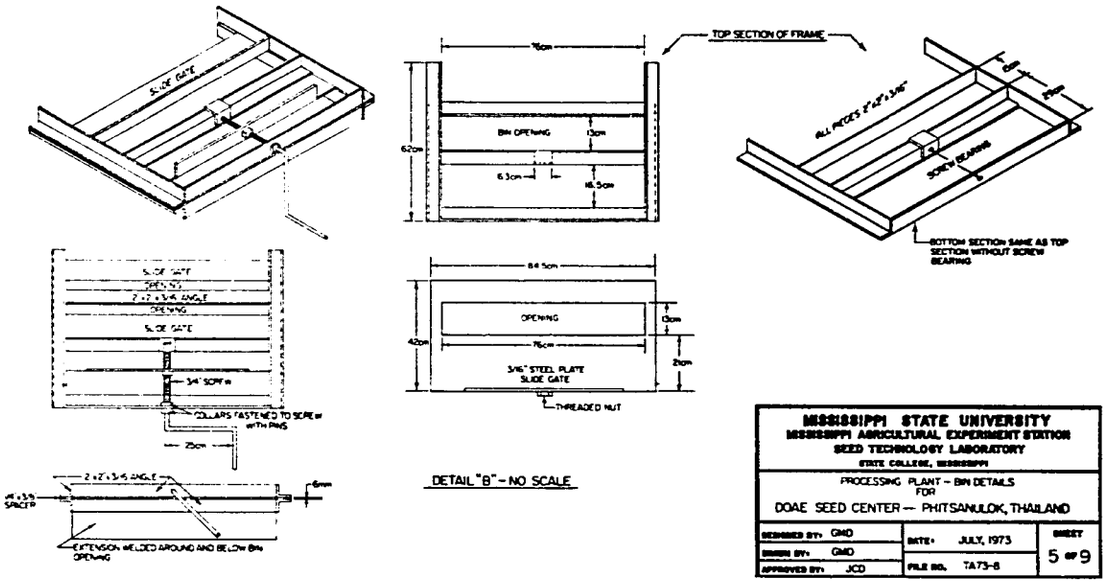


BINS 10 & 11 — BIN 6 — BIN 3

NOTES:
1 - USE 5/16 x 1/2 MACHINE BOLTS TO FASTEN SUPPORT FLANGE TO BIN
2 - BINS CONSTRUCTED OF 18 GAUGE SHEET METAL. ALL SEAMS SOLDERED
3 - FOR LEGEND SEE REPORT TA73-8 & DWG SHEETS 3 AND 4



DETAIL "A" - NO SCALE

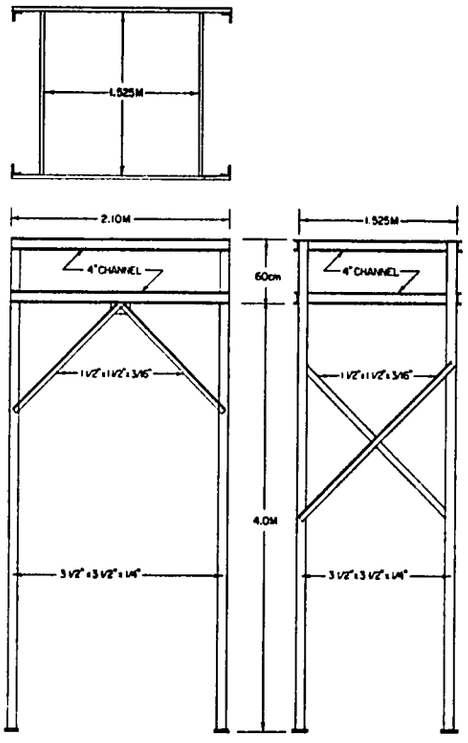


DETAIL "B" - NO SCALE

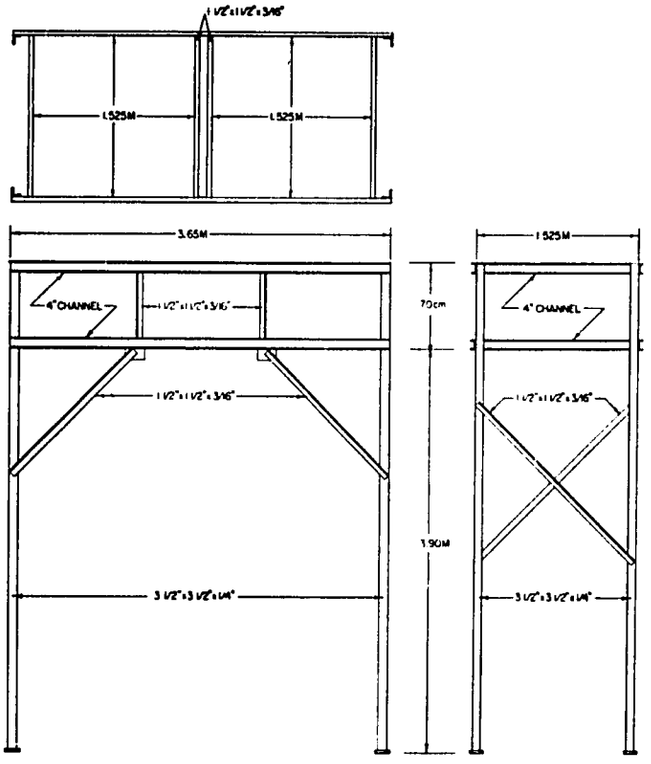
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
SEED TECHNOLOGY LABORATORY
STATE COLLEGE, MISSISSIPPI

PROCESSING PLANT - BIN DETAILS
FOR
DOAE SEED CENTER — PHITSANULOK, THAILAND

DESIGNED BY: GMD	DATE: JULY, 1973	SHEET 5 OF 9
DRAWN BY: GMD		
APPROVED BY: JCD	FILE NO. TA73-8	



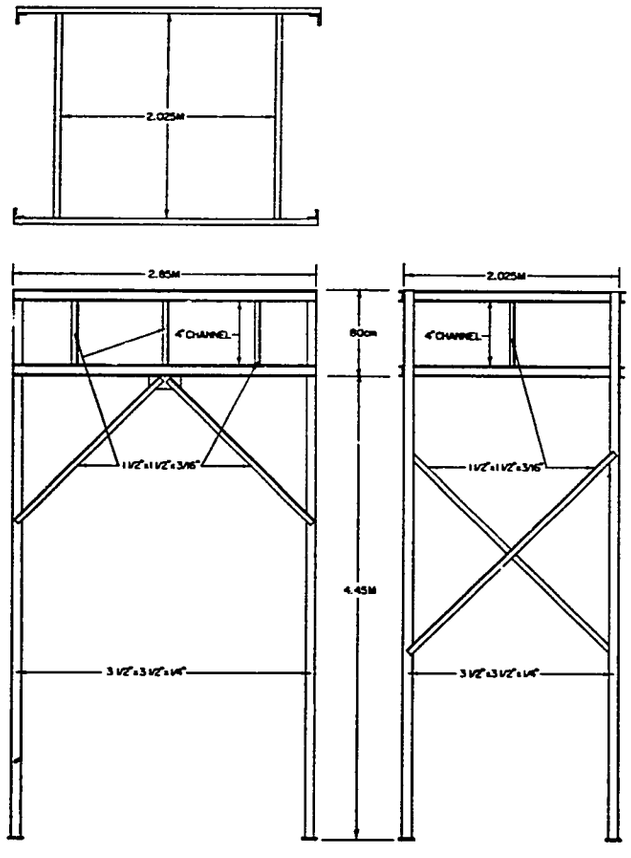
SUPPORT FRAME
FOR
BIN 6



SUPPORT FRAME - BINS 10 & 11

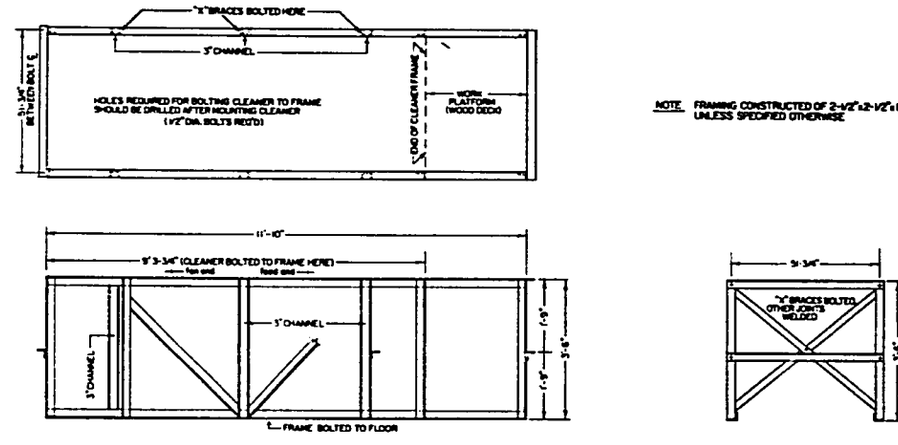
SCALE = 1:20

MISSISSIPPI STATE UNIVERSITY MISSISSIPPI AGRICULTURAL EXPERIMENT STATION SEED TECHNOLOGY LABORATORY STATE COLLEGE, MISSISSIPPI			
PROCESSING PLANT — BIN FRAMES FOR DOAE SEED CENTER — PHITSANULOK, THAILAND			
DESIGNED BY: GMD	DATE: JULY, 1973		SHEET
DRAWN BY: GMD			6 of 9
APPROVED BY: JCD	FILE NO. TA73-8		

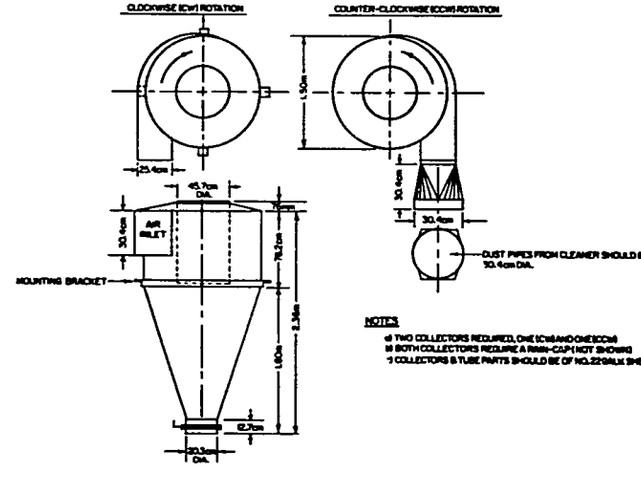


SUPPORT FRAME – BIN 3
SCALE = 1:20

FRAMING FOR H442 CLEANER
SCALE = 3/4" = 1'-0"

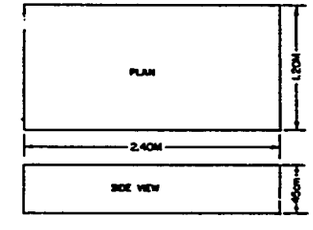


NOTE: FRAMING CONSTRUCTED OF 2-1/2" x 2-1/2" x 1/4" ANGLE UNLESS SPECIFIED OTHERWISE



NOTES:
1) TWO COLLECTORS REQUIRED, ONE (CW) AND ONE (CCW)
2) BOTH COLLECTORS REQUIRE A RAIN-CAP (NOT SHOWN)
3) COLLECTORS & TUBE PARTS SHOULD BE OF NO. 22 GAUGE SHEET METAL

DUST COLLECTOR FOR AIR-SCREEN CLEANER
NO SCALE

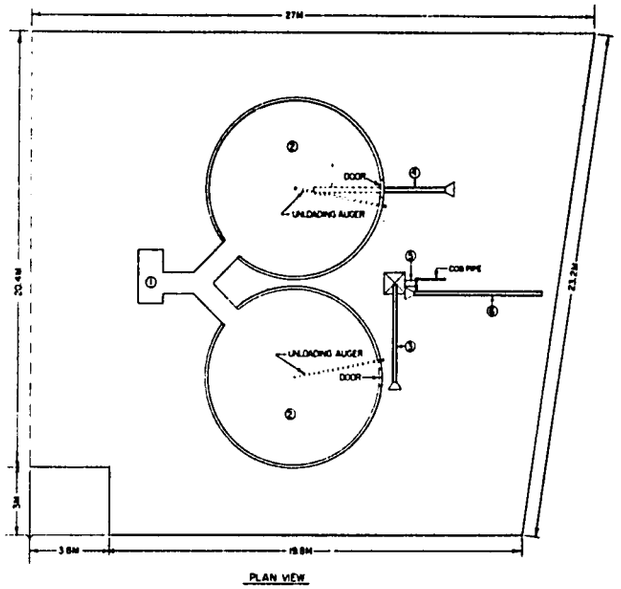


CONCRETE FOUNDATION FOR GRAVITY TABLE
(OLIVER, MODEL 160)

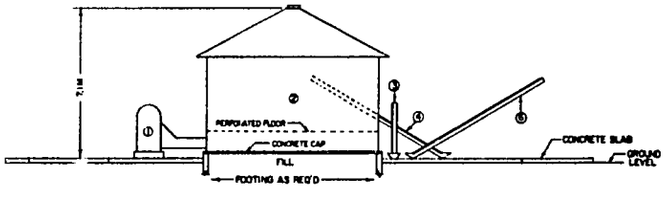
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
SEED TECHNOLOGY LABORATORY
STATE COLLEGE, MISSISSIPPI

PROCESSING PLANT — MISC. DETAILS
FOR
DOAE SEED CENTER — PHITSANULOK, THAILAND

DESIGNED BY: GMD	DATE: JULY, 1973	SHEET 7 of 9
DRAWN BY: GMD		
APPROVED BY: JCD	FILE NO. TA73-8	

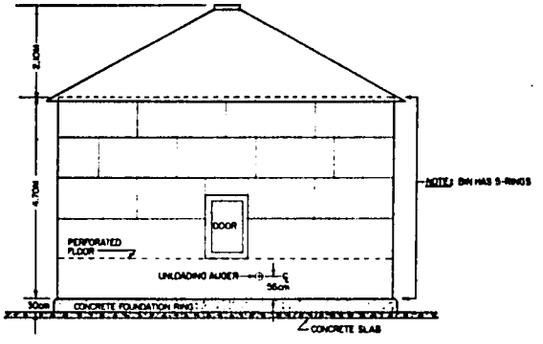


PLAN VIEW



SIDE VIEW

SCALE = 1:100



MODIFIED 27ft. DIA. CALABRIAN DRYING-STORAGE BIN

SCALE = 1:50

LEGEND

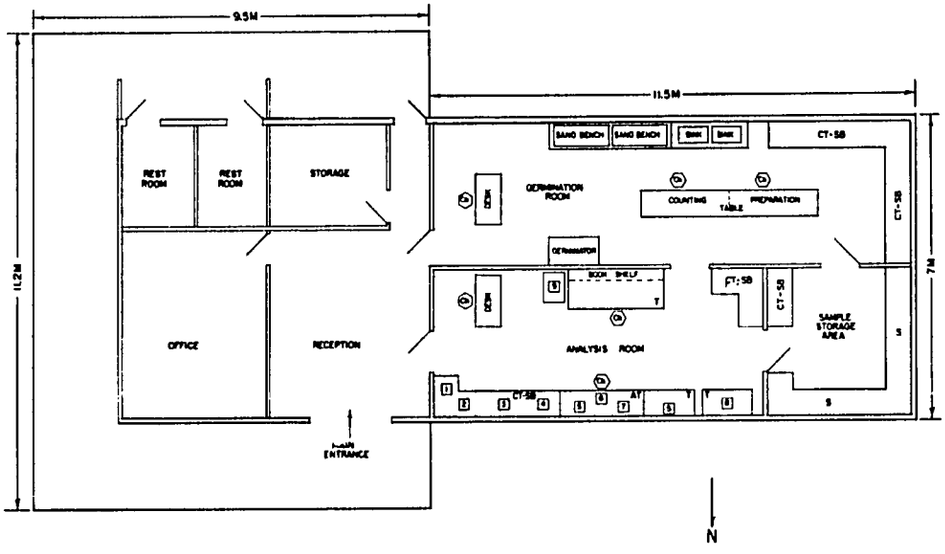
1 HEATER-FAN
2 DRYING BINS
3 UNLOADING CONVEYOR
4 LOADING CONVEYOR
5 MAIZE SHELLER
6 SHELLED SEED CONVEYOR

(FOR COMPLETE DESCRIPTION SEE REPORT TA73-8)

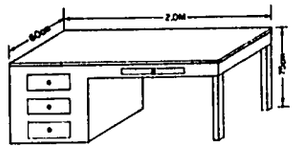
MISSISSIPPI STATE UNIVERSITY MISSISSIPPI AGRICULTURAL EXPERIMENT STATION SEED TECHNOLOGY LABORATORY STATE COLLEGE, MISSISSIPPI		
PROPOSED MAIZE DRYING-SHELLING FACILITY FOR DOAE SEED CENTER — PHITSANULOK, THAILAND		
DESIGNED BY: GMD DRAWN BY: GMD APPROVED BY: JCD	DATE: JULY, 1973 FILE NO. TA73-8	SHEET 8 of 9

KEY

1 DIVIDER
2 SCALES
3 WEIGHT/HECTOLITER APPARATUS
4 MOISTURE TESTER
5 DAZOR LAMP
6 PURITY WORKBOARD
7 TORSION BALANCE
8 ELECTRIC OVEN
9 SEED BLOWER
AT ANALYST TABLE (SEE DETAIL "A")
Ch CHAIR
CT-SB COUNTER TOP W/SHELVES BELOW
S SHELF STORAGE (FLOOR TO CEILING)
T TABLE (HEIGHT 75cm)



PLAN
SCALE 1:50



DETAIL "A"
NO SCALE

MISSISSIPPI STATE UNIVERSITY MISSISSIPPI AGRICULTURAL EXPERIMENT STATION SEED TECHNOLOGY LABORATORY STATE COLLEGE, MISSISSIPPI		
SEED TESTING LABORATORY - EQUIPMENT LAYOUT FOR DOAE SEED CENTER – PHITSANULOK, THAILAND		
DESIGNED BY: GMD	DATE: JULY, 1973	SHEET 9 of 9
DRAWN BY: GMD	FILE NO. TA73-8	
APPROVED BY: JCD		