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# ANNUAL REPORT

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FOOD & FEED GRAIN INSTITUTE  
KANSAS STATE UNIVERSITY  
MANHATTAN, KANSAS 66502

## ANNUAL REPORT

### TECHNICAL ASSISTANCE IN FOOD GRAIN DRYING, STORAGE, HANDLING AND TRANSPORTATION

AID/csd-1588  
FOOD AND FEED GRAIN INSTITUTE  
KANSAS STATE UNIVERSITY, MANHATTAN, KANSAS

On July 1, 1967, an agreement was entered into between Kansas State University and the Agency for International Development under which Kansas State University agreed to provide technical assistance to the Agency for International Development and its missions in developing countries in the solution of problems involving the drying, storage, handling and transportation of grain or grain products.

The Food and Feed Grain Institute was charged with carrying out the University's responsibilities under the contract as requested and authorized by A.I.D.

#### Scope of Work

It was agreed that technical assistance would include:

1. Assistance and consultation in review and evaluation of technical assistance projects related to post-harvest grain handling practices.
2. Advise and assist in the planning, organization or reorganization and implementation of grain marketing\* programs and facilities.
3. Identification and analysis of problems in grain drying, storage, handling and transportation and recommendations of means for solution.
4. Advise on planning, design and construction of physical facilities required for grain marketing\* programs.
5. Planning and execution of grain drying, storage, handling and transportation training seminars, courses and/or conferences.
6. Functioning as an information center for questions and inquiries relating to grain marketing\* programs and technology.
7. Preparation, editing and reproduction of written and illustrated instructional, informational and reference publications on various aspects of grain marketing\* for use by AID.

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\* Grain marketing includes all operations of drying, storing, handling and transporting of grains from time of harvest until consumed.

8. Development of methodology and design criteria through research and review to minimize problems attendant to grain marketing programs.

9. Such other technical assistance as may be mutually agreed on by AID and Kansas State University.

Review of Accomplishments  
July 1, 1967 - June 30, 1968

The following review outlines, in brief, performance during the first year of the contract. It is divided into three major sections as follows:

- I. Foreign Travel Activities
- II. Foreign Non-travel Activities
- III. Domestic Activities

Section III is further subdivided into travel and activities at Kansas State University.

Each activity is discussed briefly indicating the problem, personnel involved, summary of activities and reports submitted.

I. Foreign Activities (Travel out of the United States)

A. Guyana, October 5 - 22, 1967.

Professor Arlin B. Ward traveled to Guyana to review progress on a rice development feasibility study being conducted as a joint venture by the Rhodes Corporation and Checchi Company.

During the time Professor Ward was in Guyana, he reviewed plans for plants to mill, parboil, store and/or handle rice which had been developed as part of the feasibility study. All proposals for construction and placement of the proposed facilities were considered sound recommendations. The Proposal to store rough rice was also considered a sound recommendation over the existing system. The overall proposal for rice in Guyana follows closely the general type of organization used by one of the largest rice operations in the United States.

Existing rice processing and storage facilities were studied. The recommendation that parboiling be done only at government mills and private mills where potable water supplies are available is sound from the standpoint of improving export quality of rice. This would eliminate "stinking rice" but would also adversely affect many of the 213 private mills parboiling rice at present.

An economic review of the rice development feasibility study was made by George Montgomery, Department of Economics, Kansas State University. Dr. Montgomery presented his comments and recommendations at Washington, D. C., October 24 - 27, 1967. Dr. Montgomery's review is discussed in section II. D. of this report (Domestic Activities).

Professor Ward reported his findings to Mr. Hamer USAID/Guyana, in a letter dated October 20, 1967. A subsequent report consisting of photographs, rice mills processing flows, equipment types and capacities, and market samples and prices was prepared. Three copies of this report were sent to Mr. Hamer, USAID/Guyana and Dr. Alvin Ayers, USAID/Washington.

B. Asian Productivity Organization, Tokyo, Japan, March 1968.

The Kansas State involvement with the Asian Productivity Organization began in November 1967. It was requested that Kansas State investigate a survey and training program which the APO proposed. As part of this investigation, Dr. W. J. Hoover spent 2 days in Tokyo in late March 1968, discussing the proposed survey (a prerequisite to a proposed training program) and the training program.

The survey was designed to determine the "wastage and loss of food grains during the period of transportation and storage". The survey proposal was reviewed independently by Dr. W. J. Hoover and John R. Pedersen at Kansas State with the following conclusion:

The survey would tabulate the types and methods of storage as well as tabulate capacities and distribution of storage facilities and drying equipment.

The survey would not accurately determine the waste and loss of grains during harvest, transportation, and storage.

It was recommended that although information from the survey would be helpful, it was not a necessary prerequisite for the training program on "Preservation and Marketing of Food Grains". Subjects such as fundamentals of grain storage, inventory records, operating procedures, sanitation and housekeeping, safety, etc. were suggested as program subjects. It was also recommended that the length of the training program could be reduced from four to three weeks and that 20 instead of 12 participants could be accommodated in such a training program.

Dr. Hoover's letter to Dr. Alvin D. Ayers, Office of the War on Hunger, AID, in presenting these comments on the survey and training program suggested that a revised budget be requested for the training program since the course duration had been shortened and point of instruction changed. Dr. Hoover further indicated the Kansas State University team providing Technical Assistance in Food Grain Drying, Storage, Handling and Transportation could prepare and/or participate in the training program under the existing agreement between AID and Kansas State University.

C. Philippines, March 24 - 29, 1968

Professor Arlin B. Ward was requested to stop in the Philippines for 5 days to evaluate the practicality of a specific grain dryer. This stop was made while Professor Ward was enroute home from other assignments in Morocco and West Pakistan.

Work accomplished in the Philippines exceeded the evaluation of the grain dryer. Professor Ward was accompanied in the Philippines by Mr. M. J. Morgan, AID/Agriculture Advisor to South Vietnam and Mr. Lewis Swanson, AID/Agriculture Advisor to the Philippines.

The Kwik-Dry, Continuous Flow Mechanical Grain Dryer, manufactured by F. C. Ordoveza and Sons, Inc., Bay Laguna was the dryer evaluated by Professor Ward. It was reported that the main advantage of this dryer was its low head room requirement. A major disadvantage was its relatively low drying capacity in comparison to other type dryers. It was also reported that refinements were needed before the dryer could be used effectively.

In addition to evaluating the Ordoveza Dryer, rice storage, drying and milling facilities, were toured. During the visits to these facilities good and bad practices were pointed out to Mr. Morgan and Mr. Swanson giving them an increased knowledge of rice handling.

Samples of various products were picked up at many of the mills and product flow through the facilities diagramed. The flows and samples have been compiled into a report which also includes market samples and prices and pictures of storage, drying and milling conditions in the Philippines.

Two Rice and Corn Administration storage and drying sites were examined during the tour. Both of the facilities, (one at Solano and the other at San Jose) had been built by the United States but were not in use.

In general, rice storage and drying practices were poor and will need considerable improvement if the Philippines is to compete successfully in export trade.

The following six areas are suggested as potential future services which can be rendered under the AID Contract for Technical Assistance in Food Grain Drying, Storage, Handling and Transportation:

#### Potential Services of KSU Team

1. Review Weitz-Hettelsater and other studies as an independent evaluator.
2. Scientific evaluation of losses during marketing of rice and corn; compare good or recommended vs. typical systems.
3. Provide training for operators and managers in the Philippines.
4. Provide engineering and economic evaluation of dryer types available in the Philippines.
5. Develop training and visual aids for storage and drying courses.
6. Develop dryer operating instructions and sanitation procedural manuals for storage sites and mills.

A verbal report was presented on Friday, April 26, 1968, in Washington, D. C. Those present were:

Don Davis, EA/TECH/AG  
W. F. Johnson, EA/TECH/AG  
Wade Hall, EA/SWP  
Charles Seckinger, LA/ID/AG  
C. R. Horton, NESA/ID/AG  
A. D. Ayers, WOH/ARDS  
A. Ward, Kansas State University

D. Dominican Republic, June 10 - 22, 1968.

Dr. T. O. Hodges and John R. Pedersen traveled to the Dominican Republic to make a preliminary survey of corn and rice storage and marketing problems with the aim of planning further technical and training assistance.

During the visit, background data and previous reports on grain storage and marketing were studied. Grain storage sites, rice mills and areas of rice, corn and sorghum production were visited.

A small commercial feed manufacturer was visited and recommendations for conversion of storage bins to drying bins made. Pest control and grain fumigation were also discussed.

Plans of bulk storage elevators for three sites in the Dominican Republic were examined and considered adequately designed for bulk storage of grain.

The following general recommendations were made:

1. In addition to on the job training, elevator operator trainees should be given a short course in fundamentals of grain storage.
2. Investigate practicality of on farm rice drying and storage.
3. Develop climatic records of temperature and relative humidity for major storage areas so that effective rice drying and aeration periods may be established.
4. Develop and establish sound sanitation programs at warehouses, elevators and mills to prevent loss of grain to rodents, insects and deterioration.
5. A functional organization within the government must be established to administer the proposed grain storage program.

It was indicated that the Food and Feed Grain Institute at Kansas State University under the AID Contract to provide Technical Assistance

in Food Grain Drying, Storage, Handling and Transportation could assist the AID/Dominican Republic Mission in implementing the recommendations.

A report of the preliminary survey was made in letter form to Mr. Robert Brovo, Deputy Chief, Agriculture Development Division, USAID Mission to the Dominican Republic, Santo Domingo, Dominican Republic June 21, 1968. Copies of this report were sent to:

John Boddy, Grain Storage Advisor  
USAID/Dominican Republic

Dr. Alvin Ayers  
USAID/Washington

E. Jordan, July 4 - 18, 1968.

John R. Pedersen spent 14 days in Jordan evaluating the grain storage and marketing situation in this country.

The original request for technical assistance from AID/Jordan was for one man to spend 8 to 10 weeks in Jordan to resolve grain storage problems, including (1) inefficient handling of grain throughout all phases of storage and transportation, (2) inadequate storage capacities in farm, commercial and government sectors, (3) inadequate terminal facilities, (4) an inadequate marketing system and (5) a lack of pure seed laws.

Undertakings of this magnitude have, in the past, required considerably more time and manpower than that suggested by AID/Jordan. For this reason AID/KSU recommended one man be sent to Jordan to assess the grain storage and marketing situation and to make recommendations for immediate action and for further study.

Recommendations for immediate action included the establishment of a program to inform and advise individuals involved in farm, commercial and government storage in the proper management of grain in storage. Kansas State University assistance was offered to provide technical information and training if requested.

It was also recommended that existing metal storage silos be modified and used for storage. At least 35 existing 100 metric ton capacity silos are not used for storage because of previous grain losses in the silos. Another 40 to 50 of the aluminum silos have never been assembled. With proper management of the grain, metal silos can be successfully used in Jordan.

As a first step toward bulk handling of grain in Jordan it was recommended that unloading and transport of grain from Port of Aqaba to government storage at Ruseifa should be considered.

A feasibility study was recommended to evaluate the overall grain production, marketing, storage, handling and transportation in Jordan

and to recommend storage requirements and location, a marketing and storage program, adviseability of change from bag to bulk handling and need for development of a port facility.

Two reports were submitted in support of the recommendations made:

- (1) Report on Food Grain Storage, Marketing, Handling and Transportation in Jordan. Food and Feed Grain Institute, Kansas State University, July 1968.
- (2) A Proposal to Equip Metal Silos in Jordan with Aeration and Temperature Monitoring Equipment. Food and Feed Grain Institute, Kansas State University, August 1968.

## II. Foreign Non-travel Activities

### A. Ghana, September 19, 1967.

At the request of Mr. James P. Emerson, Agriculture Division, Office of Institutional Development, Bureau for Africa, a proposal for grain storage and drying facility in Ghana was evaluated. The proposal was contained in a report entitled, "Memorandum - Pioneer Farms (Ghana) Limited," submitted in Support of Extended Risk Guarantee Application, September 1, 1967.

The report was reviewed by Drs. W. J. Hoover, H. B. Pfost and T. O. Hodges. Background knowledge of the proposal was not sufficient for a thorough evaluation, however, some parts of the proposal were questioned and commented on under two headings: (1) Drying and Storage and (2) General Observations.

Drying plant costs appeared to be excessive and operating costs under estimated. Alternative storage structures were proposed to reduce initial and maintenance costs. Aeration of corn under Tropical conditions was also questioned and a suggestion for cooling aeration air made.

General observations included questioning harvest of corn above 25 percent moisture content and the use of Crotalaria, (a plant whose seed is highly toxic) as terracing instead of grass.

The review of the proposal was reported in a letter to Mr. James P. Emerson on August 2, 1967.

### B. Honduras, November 28, 1967.

A report "Evaluation of Banco Nacional de Fomento," prepared by Mr. Norman M. Ward, August 22, 1967, was reviewed with special emphasis on the section dealing with grain storage and marketing facilities in the Honduras.

On November 28, 1967, Dr. W. J. Hoover, Director, Food and Feed Grain Institute indicated by letter that "to be meaningful, an evaluation of the grain marketing in Honduras by necessity should be made by a team of competent individuals representing several backgrounds". He indicated a team composed of an agricultural engineer, an agricultural marketing economist and a grain scientist could be supplied by KSU under the AID contract to make such an evaluation if requested to do so by AID/Honduras or the Banco Nacional de Fomento.

A request for further assistance during this fiscal year was not received, however, we look forward to providing assistance in the future.

C. Indonesia, October 12, 1967.

Kansas State University was requested by AID/Indonesia to outline a facility for processing about 300-350 metric tons of corn per week with the goal of bringing the grain up to export standards.

A preliminary design for a processing flow was developed by Dr. T. O. Hodges and Dr. H. B. Pfost to provide for receiving, cleaning, drying, storage and sacking of shelled corn. Each of the pieces of equipment needed was described, an equipment list included and an overall cost estimate provided.

The preliminary design for a corn handling facility was forwarded to Dr. Robert L. Fowler, AID/Washington on October 23, 1967. The work done in conjunction with this request was further utilized in preparation of a publication for general distribution to tropical areas. The publication is entitled "Brief Description for a Corn Handling Facility in Tropical Areas" Food Grain Drying, Storage, Handling and Transportation, No. 2, June 1968, and is available on request from the Food and Feed Grain Institute, Kansas State University.

D. Guyana, October 24 - 27, 1967.

Dr. George Montgomery, Department of Economics, Kansas State University made an economic review of the feasibility study on the modernization of the storage and marketing of rice in Guyana prepared by Rhodes-Checchi.

Dr. Montgomery made the following comments regarding the feasibility study report:

1. Provision for insuring full understanding, acceptance of the system, and cooperation on the part of the rice producers and the independent rice millers is not evident in the proposed plan.
2. A system of change, even though it involves modernization and effective improvement, seldom succeeds if imposed by government or a central authority.
3. An improvement in the system of storage and maintenance of quality of rice is imperative if Guyana is to improve or even maintain its position in the world market

4. If it is essential to invest some 20 million U.S. dollars to improve the quality of rice for export, which apparently is the situation, it would be effective insurance to spend another one or two million to develop the good will and effective cooperation of both the producers and the independent rice millers.

This aspect is not recognized, in fact, is not a part of the Rhodes-Checchi feasibility study and was not discussed in the evaluation of the feasibility of the proposed system of change.

Dr. Montgomery reported on his review of the study in Washington, D. C., October 24 - 27, 1967.

### III. Domestic Activities.

#### A. Travel

1. Farmers Cooperative Association, Hutchinson, Kansas, January 31, 1968.

John R. Pedersen visited the Farmers Coop Association grain elevator and bulgur processing plant to gain knowledge of bulgur processing techniques and to assess infestation and product contamination potentials.

The Department of Entomology, Kansas State University and U.S.D.A. Midwest Grain Insects Investigation Laboratory, Manhattan, Kansas have a cooperative project, studying the potential for insect infestation of bulgur under various environmental conditions. First hand information on research findings are available and are of value to the project in view of programs to establish bulgur markets in developing areas of South East Asia.

2. U.S.D.A. Stored Product Insects Research and Development Laboratory, Savannah, Georgia, February 14 -15, 1968.

Team entomologist, John R. Pedersen spent two days at the laboratory conferring with U.S.D.A. staff personnel. Discussion centered around current research on new and improved methods of grain storage to reduce damage and losses caused by insects.

Research in progress indicated controlled atmospheres of CO<sub>2</sub>, O<sub>2</sub> and N<sub>2</sub> showed promise for insect control. By adjusting CO<sub>2</sub> levels in elevator stored wheat, corn and ground nuts, insects were destroyed at nominal costs.

Research just starting was concerned with aeration using artificially cooled air to lower grain temperatures to safe storage levels immediately after harvest. Current research at Kansas State University is also proceeding generally along these lines but with emphasis on high moisture grain storage.

Insulated storage was also discussed although no research along these lines is currently planned at the laboratory.

3. American Association of Cereal Chemist (Central States Section) 9th Annual Symposium. Infestation and Microbiological Control of Cereals and Cereal Products, St. Louis, Missouri, February 16, 1968.

John R. Pedersen, Entomologist member of the grain storage team attended this symposium. As the title indicates, the symposium covered infestation and microbiological control in cereal grains.

Application of laws and regulations to insect and microbial control and how they can be applied most effectively were discussed both from the standpoint of grain sanitation in storage, handling processing, and transportation and from the standpoint of human health hazards resulting from bacterial and mold formed toxins. Laws and regulations should be designed to function preventively rather than punitively to be most effective.

Current microbiological research on wheat and flour was reviewed. Emphasis was placed on sources of microbiological contamination in grain and flour and on various methods of control. Grain storage conditions which inhibit or minimize microbial growth such as dry grain, clean grain and cool temperatures were pointed out. Grains are generally stored at moisture levels which do not promote bacterial growth. Grains are exposed to contamination by bacteria and molds in the field and in handling but are stored safely with proper management. Bacteria generally tends to decrease in number in storage, however, molds will increase if grain is not stored under proper conditions of temperature and moisture. Molds are much more likely to grow and destroy grain in storage because of their ability to grow at near storage moistures and because they are capable of producing an environment conducive to increased mold growth.

4. U.S.D.A. Rice-Pasture Research and Extension Center, Beaumont, Texas, March 19 - 20, 1968.

Dr. T. O. Hodges and John R. Pedersen, agricultural engineer and entomologist, respectively, visited this station to review current research on rice storage.

The engineering contact at the Rice Experiment Station at Beaumont was David L. Calderwood. Discussions on engineering aspects of grain drying and storage were held with Mr. Calderwood and his co-worker Faris J. Louvier. Most of the research on rice drying techniques is done in a pilot plant using a columnar dryer and several 250 barrel bins. Much of the current research is concerned with the effects of aeration and tempering on milling quality of rice. Recent research reported by Calderwood indicates that aeration used between multiple dryer passes as a supplementary treatment can reduce the number of dryer passes by one or two.

This finding could have profound effect on marketing of rice in developing countries by reducing dryer time and providing higher quality rice.

Other research in progress is directed at determining aeration air flow rates to prevent spontaneous heating in damp (freshly harvested) rice. This research provides information of value for use in areas where rice may require temporary storage prior to drying. In general, preliminary results indicate that air flow rates of at least 1 CFM per barrel of rice will be required to prevent spontaneous heating under certain climatic conditions.

A new Rice Insects Laboratory was being established here and was under construction. Dr. William McGaughey will head the laboratory. Research will be directed toward control methods and pesticide residues on rice. Dr. McGaughey said one of the first problems will be to study alleged accumulation of malathion residues in rice bran when rough rice is treated with malathion as a protectant.

5. Seed Technology Laboratory, Mississippi State University State College, Mississippi, March 21 - 22, 1968.

Dr. T. O. Hodges and John R. Pedersen visited the Seed Technology Laboratory headed by Dr. James C. DeLouche to discuss operations under the Mississippi State University contract with AID.

Discussion with personnel from the Seed Technology Laboratory centered around their activities in providing technical assistance in seed technology to developing nations. They have been in their program for 10 years and have developed a method of operation that we will be able to draw from in the conduct of our project.

Over the past 10 years they have built up a supply of printed materials which they draw from to answer inquiries and also to back up short courses they conduct at Mississippi State. Our information retrieval system should help to bring our source material together for much the same purpose and will eventually be broader in scope than the Mississippi State system.

The approach taken by the Mississippi State team has been to provide the needed services when the opportunity was presented. In some instances it requires assembly of printed materials; in other instances it requires a full scale effort involving development of seed processing, testing and laws together with engineering and construction supervision of seed handling facilities and training of personnel. This has been the result of a ten year effort.

Much of the initial work done by the Mississippi State team was along the lines of technical consultation and training programs in seed testing

At the time of our visit, the Mississippi State team was staffed by Dr. James C. DeLouche, Head, Burns Welsh, Kenneth Mathes, George Dougherty, Don Grabe, Howard Potts and Bill Gregg. In addition, graduate students assist in research that is conducted at the Seed Technology Laboratory.

6. Weitz-Hettelsater Engineers, Kansas City, Missouri,  
April 24, 1968.

Professor Arlin B. Ward, Dr. T. O. Hodges and John R. Pedersen met with Mr. John Heimovics of Weitz-Hettelsater Engineers to discuss the conduct of their feasibility studies in developing countries. Our initial discussion with Mr. Heimovics was to obtain knowledge of the extent of the grain storage feasibility study being conducted by Weitz-Hettelsater Engineers in East Pakistan and to get a broad concept of feasibility study involvement.

The staffing of our team providing technical assistance in grain drying, storage, handling and transportation does not allow conduct of full scale feasibility studies at present. From our discussions with Mr. Heimovics it was concluded that we could offer technical assistance in certain areas of this type feasibility study that would compliment the study. Although training for East Pakistan elevator operations personnel had already been arranged, it is felt that the Kansas State team using facilities available at Kansas State University could provide excellent training of the type required. This is an aspect which should be considered by AID/Washington in negotiating future feasibility study contracts.

In addition to our general discussion on the East Pakistan feasibility study, arrangements were made to meet later and discuss grain fumigation and fumigation equipment installation in elevators designed by Weitz-Hettelsater in conjunction with the East Pakistan study.

7. Industrial Fumigant Company, Kansas City, Missouri,  
March 26, 1968.

John R. Pedersen visited the Industrial Fumigant Company to discuss their fumigation experiences in Guyana. Discussion with Mr. T. F. Winburn indicated certain problems encountered in fumigation of infested rice in Guyana. The rice was parboiled rough rice stored in jute sacks. Storage structures were generally in poor condition and infestation of the rice was heavy. Technically, the problems encountered in fumigation were related to the storage practices, primarily the method of stacking the bags of rice. Stacks of rice were too close together, too close to walls and piled into roof rafters making it difficult, if not impossible, to fumigate the rice. Proper inspection, realization of the loss possible from infestation, and knowledge of proper storage methods could have prevented much of the loss.

One of the capabilities of the Kansas State team is to provide technical training in proper storage, drying, and handling methods. It is obvious from observations in other developing countries that knowledge of proper management of grain in storage is needed and can be supplied by the Kansas State team.

## B. Activities at Kansas State University.

### 1. Visitors to Food and Feed Grain Institute.

One of the functions the technical assistance team at Kansas State University has been performing is meeting with visitors to the University from developing countries. It is felt that this function will provide numerous valuable contacts between the developing countries and the technical assistance program. Some of the visitors are listed below.

- a. Mr. Vincente Errazuriz, Agricultural Marketing Specialist, Chile, November 9, 1967.

Mr. Errazuriz spent four days in the Manhattan, Kansas area touring grain and feed handling facilities and conferring with Kansas State University faculty.

Grain storage problems were discussed with Mr. M. M. MacMasters and Dr. T. O. Hodges. Grain storage in Chile was discussed in general. Specific problems were discussed in detail. Research in grain drying being conducted at Kansas State University was also discussed and application of the research results to Chilean problems considered.

- b. Colonel Osmundo Mondonêdo, Director, Rice and Corn Administration, Philippines, and Dr. George P. Summers, USAID/Philippines, March 25, 1968.

Colonel Mondonêdo and Dr. Summers stopped at Kansas State University and conferred with Dr. John A. Shellenberger, Dr. T. O. Hodges and John R. Pedersen. They were particularly interested in discussing advantages and disadvantages of drying rice in bin dryers and columnar dryers. Specifically Colonel Mondonêdo wanted to know whether bin dryers would work in the Philippines. Dr. Hodges indicated bin dryers could be used but that greater care was needed in their operation than columnar dryers.

- c. South East Asian Miller Orientation Mission. Sponsored jointly by the Western Wheat Association, U.S.A., Great Plains Wheat, and Foreign Agricultural Service of the United States Department of Agriculture, May 26 - 28, 1968.

The following three gentlemen visited the Department of Grain Science and Industry:

Ching-Tseng Keng (Mission Leader)  
 Mill Manager  
 Malayan Flour Mills Limited  
 Chartered Bank Building  
 9th Floor, Jalan Ampang  
 Kuala, Lumpur

Robert C. T. Ang  
 Director and Factory Manager  
 Khong Guan Flour Milling Ltd.  
 No. 120 Tanjong Rhu Road  
 Singapore, 15

Grant A. Sansom  
 Mill Manager  
 Federal Flour Mills Ltd.  
 Port Swettenham  
 P. O. Box 141  
 Malaysia

The men spent two days at Kansas State University and vicinity touring and discussing grain storage and processing. Dr. W. J. Hoover, Arlin B. Ward and John R. Pedersen conferred with these men regarding processing and prevention of losses to food grain.

- d. Mr. John Heimovics, Weitz-Hettelsater Engineers,  
 Kansas City, Missouri, May 17, 1968.

Mr. Heimovics visited John R. Pedersen to discuss fumigation equipment and procedures in relation to elevators Weitz-Hettelsater is to build in East Pakistan.

Original drawings of the elevators showed special bins included in the design for methyl bromide fumigation. The necessity of these bins was questioned on the basis that they require space which is not utilized for storage. Fumigants other than methyl bromide are available which do not require special bins for grain fumigation.

- e. Mr. Elie S. Touma, Director General, Cereal and Sugar  
 Beet Office, Ministry of National Economy, Beirut, Lebanon.

Mr. Touma was particularly interested in wheat producing areas and related flour milling operations. He was also interested in latest developments and research in automated cereal product processing. Mr. Touma had visited the United States in 1961 in conjunction with grain storage problems. Past work done on grain storage by Mr. Harvey Bross, USOM Grain Storage Advisor, was discussed. Progress made in conjunction with grain storage in Lebanon was also discussed.

## 2. Publications.

The following publications have been prepared for general distribution to interested parties. They are based on specific AID Mission requests with modifications to make them applicable to wider geographical areas. They are prepared by the Food and Feed Grain Institute, Kansas State University, Manhattan, Kansas as part of the project on technical assistance in Food Grain Drying, Storage, Handling and Transportation.

a. Rice Drying Technology and Equipment which might be Applicable to Tropical Developing Countries. Food Grain Drying, Storage, Handling and Transportation, No. 1, 43 p. June 1968. Prepared by Dr. T. O. Hodges.

b. Brief Description for a Corn Handling Facility in Tropical Areas. Food Grain Drying, Storage, Handling, and Transportation, No. 2, 7 p. June 1968. Prepared by Dr. T. O. Hodges and Dr. H. B. Pfost.

c. Structural Requirements of Grain Bins. Food Grain Drying, Storage, Handling and Transportation, No. 3, 8 p. July 1968. Prepared by Dr. T. O. Hodges.

## 3. Information Retrieval System.

A Royal McBee Keydex Information Retrieval System is being developed. This system is based on a key word system of abstracting literature and will be aimed primarily at the literature dealing with grain drying, storage, handling, transportation, processing and marketing.

A key word dictionary has been developed and literature is in the process of being abstracted and placed in the retrieval system. When fully operative this system will allow rapid development of bibliographies on specific areas of interest within the literature dealing with grain drying, storage, etc. This will be a continuing program.

## 4. Slide File for Training Purposes.

With each of our activities outside the United States, we have photographed grain drying, storage, handling, marketing and transportation operations. In addition, we have accumulated slides on grain storage, etc. from other developing areas. This is a continuing program.

Prepared for the

AGENCY FOR INTERNATIONAL DEVELOPMENT

AID/csd-1588

Technical Assistance in  
Food Grain Drying, Storage, Handling and Transportation

at the

FOOD AND FEED GRAIN INSTITUTE  
KANSAS STATE UNIVERSITY  
MANHATTAN, KANSAS 66502

Dr. William J. Hoover, Director  
John R. Pedersen, Entomologist