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SIXTH ANNUAL TECHNICAL REPORT

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT, 211(d) GRANT

AID/csd-1921

to

UNIVERSITY OF MISSOURI, COLUMBIA

for period

June 1, 1973 to May 31, 1974

J. M. Poehlman, Project Director

Columbia, Missouri

June 5, 1974

SIXTH ANNUAL TECHNICAL REPORT  
U.S.A.I.D. 211(d) GRANT  
UNIVERSITY OF MISSOURI, COLUMBIA  
JUNE 1, 1973 TO MAY 31, 1974

AID/csd-1921

June 15, 1974

TITLE OF GRANT: A grant to Develop Within the University of Missouri, Columbia, Specialized Competency in the Breeding of Agronomic Crops in India

GRANTEE: University of Missouri, Columbia

DIRECTOR: John M. Poehlman, Professor of Agronomy

A. STATISTICAL SUMMARY:

Original period of grant: June 1, 1968 to May 31, 1973 Amount: \$200,000

Period of Grant Extension: June 1, 1973 to May 31, 1975

Expenditures: For report year: \$15,456 Accumulated: \$190,687

Anticipated for 1974-1975: \$9,313

B. NARRATIVE SUMMARY:

The objective of this 211(d) grant was to develop expertise in the University of Missouri, Columbia, to conduct plant breeding research with international applications. Implementation was to be through an International Professor and graduate students who would develop thesis studies on plant breeding problems relevant to developing countries. The initial focus was on India, but since the phasing down of the AID programs in India, the scope of this project has been extended to include other developing countries. Teaching and research has been concentrated on the mungbean species (Vigna radiata (L.) Wilczek), a widely grown but little researched pulse crop in Southeast Asia and other tropical countries. The mungbean has been utilized as the vehicle for involving students in research which would develop their capabilities to cope with a wide range of breeding problems that they might encounter in International Breeding Programs.

This project has broadened the graduate teaching and research program of the Department of Agronomy, University of Missouri, Columbia, to include an international dimension. The key to this has been the research on the mungbean which focused the student on the nature of tropical as well as temperate climate agriculture. Implementation of the International Mungbean Nursery in 1972, and its continuation, is making it possible to evaluate the genetic potential of the species in a wide range of climatic environments. International cooperation and exchange of breeding materials has been fostered among research workers in many countries. These activities, made possible by this 211(d) grant, have developed into a powerful teaching tool and provides evidence that the development of expertise in the breeding of agronomic crops as envisioned in the grant's original objectives is being accomplished.

SIXTH ANNUAL TECHNICAL REPORT OF USAID 211(d) GRANT  
USAID/csd-1921  
UNIVERSITY OF MISSOURI, COLUMBIA  
JUNE 1, 1973 TO MAY 31, 1974

This grant is one of six separate disciplinary 211(d) grants made to the six U.S. Universities involved in Agricultural development in India. The six Universities and the field of concentration of the different grants are as follows:

University of Illinois: Identification, Causes, and Control of Agronomic Crop Diseases

University of Missouri: Breeding of Agronomic Crops

Kansas State University: Improved Grain Utilization

Ohio State University: Soil-Plant-Water Relationships

Pennsylvania State University: Crop Production and Management

University of Tennessee: Economic Issues of Agricultural Development

These six Universities individually, and through the Council of United States Universities for Rural Development in India, have had a growing interest in assisting the developing nations to improve their agricultural productivity and thereby contribute to the solution of the world food problem. They were bound together originally by the fact that each was engaged in agricultural university development in India. However, they were not able to exploit their potential due to the limitation on state resources being utilized for developing the expertise necessary to engage in agricultural research on an international basis. This need was recognized not only by the Universities, but also by the Agency for International Development and the U.S. Congress. Section 211(d) of the 1966 Foreign Assistance Act made it possible for the Agency for International Development to partially meet this problem by giving support to U.S. research and educational institutions for the purpose of strengthening their capacity to develop and carry out programs to improve the economic and social well being of less developed countries.

This series of 211(d) grants to the six Universities are unique in that (a) each was aimed at developing expertise in a separate discipline, (b) all grants were focused on India where each of the Universities were involved in agricultural development, and (c) all projects have recognized the desirability of joint planning to provide for greater cross linkages.

After the involvement of the U.S. University in Agricultural University development in India was phased out, it became desirable to redirect the geographic focus of the program. Accordingly, activities of this project have evolved from a broad focus on plant breeding in India to a more specific focus on genetic improvement of one of the important pulse crops, the mungbean (Vigna radiata (L.) Wilczek). This redirection of effort has extended our involvement over a much wider geographic base than India alone.

During the current fiscal year one graduate student returned from a nine months stay in Thailand and a second graduate student spent one and one-half months at the Asian Vegetable Research and Development Center in Taiwan, both conducting research on this crop species.

## II. Objectives of Grant

The overall objective of this grant is to increase the general competency of the University of Missouri, Columbia, to generate knowledge and render assistance in the international area of plant breeding, and to establish this area of specialization as a legitimate and continuing function of the University.

The specific objectives of this grant are:

1. To increase the capability of the University of Missouri to render assistance to India (and other developing nations) in the general area of plant breeding.
2. To increase the pool of scientific manpower trained in plant breeding interested in and capable of assisting India (and other developing nations).
3. To create a professional awareness of the international dimensions of plant breeding.
4. To stimulate interest of plant breeders in international service careers as employees of private or public entities.
5. To encourage college students to seek training which would lead to careers in international plant breeding under private or public auspices.
6. To provide an opportunity for graduate students to obtain research experience on problems of particular relevance to the developing countries (to the maximum extent feasible, by assisting with research activities carried out wholly or partially in India).
7. To increase interest in and knowledge about the agricultural problems of India by drawing upon all relevant special competencies of staff members of the Department of Agronomy and other departments of the University.

### Review of objectives

The activation of the grant objectives was built around a faculty member who would teach, conduct research both in the U.S. and overseas, supervise graduate students, and carry out other activities pursuant to the grant objectives. The activities are designed to create a professional awareness of the service opportunities in the international area of plant breeding, to train graduate students for careers devoted to assisting developing nations in the discipline of plant breeding, and to provide research experiences overseas which would assist in the personal development of the professor and the graduate students and thereby increase their

competency to understand the agricultural production problems of developing nations and to contribute toward the solutions of those problems.

Our charge at the University of Missouri, Columbia, was to develop expertise in plant breeding which would have international dimensions. We felt that the objectives could best be reached by involvement of the International Professor and the graduate students in an international plant breeding project. Initially, we developed plans to assist the Orissa (India) University of Agriculture and Technology in starting wheat and pulse breeding programs. As the project matured we have concentrated on a single pulse crop, mungbeans (Vigna radiata (L.) Wilczek). Later the research was extended to cooperating with mungbean breeders in other countries in order to broaden the informational base regarding this particular species. Through this approach we have rather emphatically accomplished the overall objectives of the original project. The latter are integral facets of the general overall objective, hence, they are not amenable to being sorted out and worked on, or reported on, separately to the exclusion of the others. The greatest deterrent to reaching fully all of the specific objectives was the limitation of funds available. These were really too meager to achieve the sweeping objectives originally envisioned. Nevertheless, we are proud of the accomplishments which we could achieve by good husbandry of the funds available and by directing them toward reaching specific and important goals. The accomplishments during the initial 5-year period were fully detailed in Section III of the 1972-73 Report. Accomplishments for 1973-74 are covered in Section III of this report.

### III. Major Accomplishments (1973-74)

During 1973-74, activity was directed toward continuing the graduate study of two students already entered into the program before May 31, 1973, the date originally scheduled for terminating the Grant. On June 1, 1973, there was an unspent balance of \$24,769. USAID permission had already been received to continue the program until May 31, 1975, in order to utilize the unspent funds for continuing the study of Mr. Earl Watt and Mr. Richard Swindell, and other related needs.

Mr. Earl Watt is a Ph.D. candidate. In December 1972 he went to the Northeast Agricultural Center, Tha Phra, Thailand, to conduct thesis research. His research at that station was made possible through cooperation of the Thailand Ministry of Agriculture and Cooperatives and the University of Kentucky-USAID Thailand program. Research facilities were made available to Mr. Watt by the Northeast Agricultural Center, for which we are extremely grateful. Mr. Watt returned to the U.S. at the end of August, 1973.

While in Thailand Mr. Watt (1) grew the USDA germ plasm collection of mungbeans in order to evaluate the strains in the climatic conditions of Thailand, (2) grew segregating generations of his thesis materials in order to evaluate them under climatic conditions of Thailand, and (3) in cooperation with Dr. V.C. Finkner of the University of Kentucky-Thailand staff and Dr. Arwooth Nalampan, Grain Legume Specialist in the Department of Agriculture of Thailand, make an extensive mung collection trip into the major

production areas in Central and Northern Thailand. As a result of the latter activity more than 100 native strains of mungbean have been added to the USDA Plant Introduction collection. The latter is important because less than a dozen strains of this species from Thailand were in the USDA germplasm collection, even though Thailand is a major producer of mungbeans and is the major exporter of mungbeans to the U.S.A.

Mr. Richard Swindell, who completed an M.S. degree in May 1973, has since entered into a Ph.D. program. During July and August, 1973, Mr. Swindell spent one and one-half months at the Asian Vegetable Research and Development Center working with Dr. David R. MacKenzie who was initiating a major mungbean breeding project at that Institute. He also visited the International Mungbean Nurseries in Korea, Philippines and Thailand.

Dr. John M. Yohe who completed a Ph.D. degree in 1973 accepted a position with the University of Wisconsin team working in Recife, Brazil, where he is now conducting research on soybeans and other grain legumes. Dr. Yohe's thesis study was concerned with plant type in the mungbean.

Mr. Moheb M.H. Bashandi received an M.S. degree in 1973 and is now employed by the Foss Grain Company in Gorin, Missouri. Mr. Bashandi's thesis problem concerned the photoperiod response on the mungbean. In this study it was demonstrated that strains of mungbeans did not differ in "days to flower" at the 8- and 12- hour photoperiods, but flowering was delayed differentially when the photoperiod was increased beyond 12 hours. Some strains exhibited only slight sensitivity over the range of photoperiods studied. Other strains failed to flower at the 16-hour photoperiod. The results provide evidence that response to photoperiod is important in the adaptation of mungbean strains at different latitudes. Height of plants was increased differentially among strains as the photoperiod was increased. A manuscript prepared from this thesis research has been accepted for publication by Euphytica, The International Journal of Plant Breeding.

The genetic evaluation of the mungbean species, initiated with grant funds, was continued in 1973-74 with additional financial support from a USAID contract. Also, the International Mungbean Nursery distributed in 1972 and again in 1973 through this grant project was continued in 1973-74 with financial support from the new USAID contract.

Two additional students started graduate study during 1973 with thesis problems concerning mungbeans. Mr. Vas Dev Aggarwal, from the Vegetable Research Station, Katrain (Kulu Valley), India, has started on a Ph.D. program. He will continue the photoperiod sensitivity studies of Mr. Bashandi. These have been expanded to include thermoperiod studies.

Mr. Wachara Purivirojkul, from Thailand, is starting on an M.S. program. He is supported financially by the University of Kentucky-USAID Thailand Project. He will attempt to identify insect vectors of the mungbean virus in the field at Columbia.

#### IV. Impact of Grant Supported Activities in Developing Institutional Capabilities.

In the 1972-73 report we described the far reaching effect of the grant in developing institutional capabilities. These have not slackened, in fact they have increased. A major example is the International Mungbean Nursery which was grown at 23 locations in 14 countries in 1973-74 as compared to 10 locations in 7 countries in 1972-73. The development of this nursery has permitted evaluation of specific strains of the mungbean in diverse environments on a global basis and has contributed to the identification of parameters for defining the characteristics that contribute to adaptation in the mungbean. This would not be possible if variety evaluation was limited to one location. In essence, the program initiated through this grant has forced our graduate students to think about agricultural environments on a global basis rather than on a provincial basis.

#### V. Utilization of Institutional Resources in Development

The following are examples of how institutional resources have been utilized on activities related to subject matter of the grant.

1. Seed for growing the Third International Nursery in 1974-75 has been distributed to 34 cooperators in 17 countries. Seed of most of the varieties included in the nursery was grown on the University of Missouri, Bradford Farm.
2. Seed of elite genetic strains are distributed on request to many sources around the world.
3. Performance data from the 1st International Mungbean Nursery was published as a University of Missouri, Agricultural Experiment Station Special Report.
4. Visitors in 1973 to see mungbean research included, among others;
  - Dr. V. Sapra, Alabama A&M Institute, Normal, Alabama
  - Dr. Gill, Punjab Agricultural University, Punjab, India
  - Dr. David MacKenzie, Asian Vegetable Research and Development Center, Shanhua, Taiwan
5. Fourteen graduate students from foreign countries are pursuing graduate study in the Department of Agronomy.
6. Seminars on mungbeans were given during the year as follows:
  - Mr. Earl E. Watt, Kesetsart University, Thailand
  - Mr. Richard Swindell, AVRDC, Taiwan
  - Dr. J.M. Poehlman, AVRDC, Taiwan

## VI. Other Resources for Grant Related Activities

The distribution of 211(d) Grant Funds and contributions from other sources of funding are shown in Table I.

The following are examples of use of non-grant funds to support the activities reviewed in this report. All of the funds were supplied by the University of Missouri.

- a. Salary for the International Professor
- b. An experiment station project on "Breeding Agronomic Crops of International Importance".
- c. Computer facilities for processing data.
- d. Office space, supplies, photo-copy work and secretarial help for the International Professor and his graduate students.
- e. Library facilities for International Professor and graduate students.
- f. Field plots, harvesting equipment, crop drying equipment, irrigation equipment, etc. for conducting research.
- g. Greenhouse facilities.

## VII. Report of Expenditures

Expenditures for the current review period (June 1, 1973 to May 31, 1974) and cumulative totals for the project are reported in Table II.

The expenditures include:

1. Graduate Research Assistant stipends for Mr. Earl Watt and Mr. Richard Swindell.
2. Expenses for Mr. and Mrs. Earl Watt in Thailand from June 1, 1973 until their return home in August.
3. Expenses for Mr. Richard Swindell's visit to the International Mungbean Nurseries in Korea, Thailand, and Philippines, and his visit to the Asian Vegetable Research and Development Center in Taiwan.
4. Miscellaneous expenses related to the conduct of graduate student research on the mungbean.

## VIII. Next years Plan of Work and Anticipated Expenditures

Mr. Earl Watt has completed course work and comprehensive examinations for the Ph.D. degree. He currently is working on his thesis research with an anticipated date of completion of December, 1974.

Mr. Richard Swindell will be pursuing his second year of graduate study toward the Ph.D. degree. Thesis research will begin during the summer of 1974.

Mr. Vas Dev Aggarwal will be pursuing the second year of graduate study toward the Ph.D. degree. His thesis research on photoperiod and thermoperiod sensitivity of mungbean is underway and will be continued.

Mr. Wachara Purivirojkul, Thailand, has completed two semesters of course work toward the M.S. degree. He will begin his thesis research during the summer of 1974.

Mr. Prathes Sittiyes, Thailand, is expected to start study toward the Ph.D. degree in August, 1974.

Graduate research assistantships for Mr. Watt and Mr. Swindell are supported from this grant. Mr. Aggarawal is supported from the USAID contract on "Evaluation of the Genetic Potential of the Mungbean". Mr. Wachara is supported by the University of Kentucky-USAID Thailand project and Mr. Prathes will be supported by the same source.

The anticipated budget for 1974-75 is given in Table III.

Table I

Distribution of 211(d) Grant Funds and Contributions from Other Sources  
of Funding

Institution: University of Missouri, Columbia  
Grant: AID/csd-1921 Amount of Grant: \$200,000  
Period of Grant: June 1, 1968 to May 31, 1973  
(with extension to May 31, 1975)  
Review Period: June 1, 1973 to May 31, 1974

211(d) Expenditures				
Grant Related Activity	Period Under Review	Cumulative Total	Projected 1974-75	Non* 211(d) Funding
Teaching	972	55,972		5,000
Research	1,537	73,427		5,000
Graduate Student Training	12,947	61,288	9,313	5,000
<b>Totals</b>	<b>15,456</b>	<b>190,687</b>	<b>9,313</b>	<b>15,000</b>

\*Estimated



Table III

## Projected Expenditures for 1974-75

Institution: University of Missouri, Columbia  
Grant: AID/csd-1921      Amount of Grant: \$200,000  
Period of Original Grant: June 1, 1968 to May 31, 1973  
Period of Grant Extension: June 1, 1973 to May 31, 1975  
Amount Expended to May 31, 1974: \$190,687  
Balance Remaining to be Expended During Period June 1, 1974  
to May 31, 1975: \$9,313

Budget Line Item	Projected Expenditures for 1974-75 <sup>a</sup>
Salaries	-
Stipends	\$7,500
Travel	-
Equipment, Supplies, and Miscellaneous	\$1,813
<b>Total</b>	<b>\$9,313</b>

<sup>a</sup>Expenditures for 12-month period June 1 through May 31.