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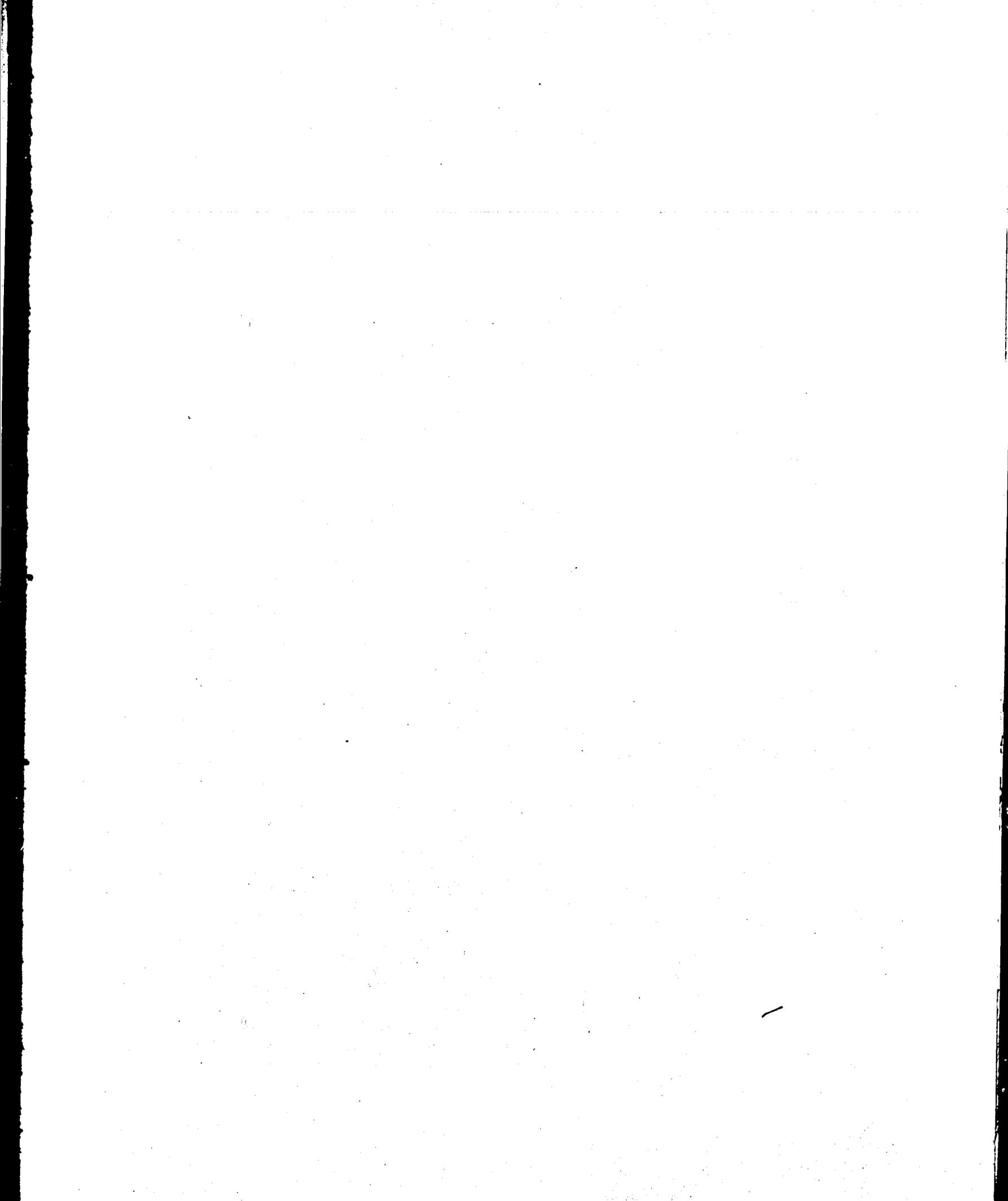
COLLEGE OF AGRICULTURE

DEPARTMENT OF AGRONOMY

ANNUAL TECHNICAL REPORT OF 211(d) PROJECT

This report was prepared prior to receipt of AID "Guidelines."
Absence from the country has delayed preparation of supplementary
material.

1971 - 1972



211(d) Annual Report

June 30, 1972

TITLE: A Grant to Develop Within the University of Missouri, Columbia
Specialized Competency in the Breeding of Agronomic Crops of India.

DIRECTOR: J. M. Poehlman, Professor of Agronomy, University of Missouri, Columbia.

A. STATISTICAL SUMMARY:

Period of Grant: June 1, 1968 to May 31, 1973.

Amount of Grant: \$200,000.

Expenditures for Report year: \$34,754. Accumulated: \$133,013.

Anticipated for next year: \$47,920.

B. NARRATIVE SUMMARY:

This grant is one of six separate disciplinary grants being coordinated through the Council of United States Universities for Rural Development in India.

The activation of this grant has been built around a faculty member to conduct research in plant breeding, both in the U.S. and overseas, supervise graduate students, and carry out other activities designed to develop competence in the Department of Agronomy, University of Missouri, for continued consultation and service in crop breeding research on an international scale.

The teaching program of the Department has been strengthened with addition of courses pertaining to tropical agriculture, and the depth of existing course offerings has been broadened to include international agronomic problems. A textbook "Breeding Asian Field Crops" has been completed and published.

Graduate students on the 211(d) program are conducting thesis research in India on mungbeans in order to study problems relevant to Asian agriculture. Through our graduate student research we have developed an International Mungbean Testing Nursery to identify strains adapted to India and countries of Southeast Asia. We are seeking to identify the genetic variability in mungbeans, the parameters for evaluating yield and adaptation, and to find germplasms superior in these characteristics. Significant findings thus far include varieties with photoperiod insensitivity, resistance to disease, and superior seed quality.

I. INTRODUCTION

This grant is one of six separate disciplinary grants being coordinated through the Council of United States Universities for Rural Development in India. The UMC grant is focused on the development of educational competence and research expertise in plant breeding as related to agricultural development in India.

The period covered by this report is from July 1, 1971 through June 30, 1972.

II. GRANT OBJECTIVES

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 the 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 leading 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.

The activation of the grant objectives has been built around a faculty member who will 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 (in India) which will 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.

III. MAJOR ACCOMPLISHMENTS (1971-72)

At the University of Missouri, Columbia, we are accomplishing the overall objective of this grant, "to increase --- competency --- to generate knowledge and render assistance in the international area of plant breeding" by active participation in plant breeding research on an international scale. In the process we are generating new knowledge, increasing the perspective of our plant breeding staff, training graduate students with broad experience in international agriculture, fostering international cooperation among plant breeders, and increasing our competency through participation in these activities.

This grant program was initiated by the grant professor offering assistance to the Orissa University of Agriculture and Technology, Bhubaneswar, India (where UMC has an Agricultural University development contract) and the State Department of Agriculture of Orissa in development of wheat and pulse breeding projects. The assistance would be in the form of informal consultative discussions between the grant professor and OUAT staff assistance in obtaining for OUAT genetically broadbased breeding materials, and by sending graduate students to work with the Orissa professor. In the process we would use these crops as vehicles to generate thesis research relevant to India for graduate students. The mungbean (*Vigna radiata* (L.) Wilczek) was chosen as the species on which to concentrate since it was the principal pulse crop in Orissa. The extensive wheat improvement programs at CIMMYT (Mexico) and in India made it relatively easy to accumulate breeding materials for OUAT to initiate the wheat project. With mungbeans there is a paucity of basic information regarding the species. Breeding materials had to be identified which could be used to develop a broad-based program for genetic improvement. This has necessitated extending the search for germplasm to other countries of Southeast Asia where mungbeans are grown and to expanding our observations in order to identify characteristics basic to the adaptation of strains of this species. As a result we have been involved in mungbean research during the current year to a greater extent than with wheat.

In this report the activities of the Professor and each student will be reviewed briefly first. In the sections to follow we will explain how these activities are contributing to the development of competence at UMC in teaching, research, graduate student programs, and consultation service, thereby fulfilling the grant objectives.

Activities in 1971-72

In the previous technical reports, Dr. J. M. Poehlman, Professor of Agronomy (Plant Breeding), was identified as the International Professor on this project. Professor Poehlman has continued to be identified with the 211(d)

project in 1972 with one-half of his salary paid from the grant and the remainder from University of Missouri salary funds. During the year he taught a course in "Field Crop Breeding", supervised the seminars for graduate students in plant breeding and genetics, served as major advisor to seven graduate students, organized a cooperative International Mungbean Testing Nursery with assistance of graduate students supported by this grant, distributed seed of superior strains to eight foreign countries, traveled to Romania on invitation of Romanian Ministry of Agriculture to lecture on wheat and soybeans, and served on Departmental and other committees.

Mr. John M. Yohe (Ph.D. student) spent the period November through May in India conducting thesis research on mungbeans. He presented papers on his research at the American Society of Agronomy Annual Meeting, New York; Kasetsart University, Bangkok; and OUAT, Bhubaneswar.

Mr. Earl Watt completed an M.S. thesis, June 1972, on inheritance of height in Mexican semidwarf and standard wheat varieties. He will evaluate local and introduced strains of mungbeans at Columbia in the summer of 1972 and develop breeding materials for a Ph.D. thesis to combine disease resistance and short photoperiod response of varieties adapted to Orissa, India, with high yield and seed quality of strains from the USDA collection.

Mr. Richard Swindell started graduate study in June, 1971, on a fellowship provided by the UMC Graduate School. He is developing an M.S. thesis concerned with heterosis and inheritance of high yield components in mungbeans. He has identified a tetraploid strain of mungbean from the USDA collection which is highly resistant to mildew and bean yellows mosaic virus.

Mr. Moheb Bashandi is studying photoperiod response of mungbean strains. Photoperiod response appears to be a major factor in genetic adaptation of strains of mungbeans to different production areas and limits the latitude at which they can be grown successfully. Mr. Bashandi has identified a strain originating from Orissa to be photoinsensitive. This study will be his M.S. thesis research.

Mr. Mohamed Elmigra (a Libyan student supported by Friends of the Middle East) has completed an M.S. thesis study on the relationship between coleoptile length and culm length in crosses among standard and semidwarf wheat varieties. Most semidwarf wheat varieties have short coleoptiles which result in poor seedling emergence when planted in dry soil. This may reduce the usefulness of such wheats in rainfed areas of Libya (and Orissa).

A. Development of Teaching Competence

Teaching competence is improved by increasing the breadth of the course offerings, by increasing the depth and relevancy of specific courses, and by stimulating interest of teachers and students in the area of concentration. The USAID grant from 211(d) funds to UMC has enhanced the teaching competency of the Department of Agronomy in each of these respects.

The breadth of course offerings has been augmented by two new courses pertaining to international agronomy. During 1971-72, a seminar was developed and taught on the 'Philosophy of Extension' by Professors Faloon, Murphy, Upchurch, and Sechler. All of these men have had overseas tours in India on UMC contracts. This course was developed primarily for foreign students in Agronomy and was designed to teach the foreign student an awareness of the linkages between a successful agricultural extension program and the relevance of the research and teaching programs in an agricultural university.

A new course, Agronomy 202, International Agronomy, was developed and approved by the College of Agriculture and the Graduate School and will be taught for the first time in 1972-73. The purpose of this course is to acquaint the undergraduate student with basic differences in temperate and tropical climate agronomy.

The depth of our course offerings, with respect to the international dimension has been enhanced as a result of the 211(d) program. An example is in the plant breeding courses taught by the International Professor. This development resulted from increased perspective and experiences provided through the opportunity for travel, study, and participation in plant breeding research in India and other countries. Principles and examples in breeding of rice, wheat, sugarcane, and pulses as related to food production in underdeveloped countries are developed and illustrated with slides taken in India and other countries. Another example is in our graduate student seminars. Research being conducted with Mexican spring wheats and with the pulse crops provide new and timely knowledge, which is giving an international dimension to the graduate school teaching program.

The interest and perspective of the students has also been broadened. For example, research on the pulse crops requires the student to think about their potential areas of adaptation. Often, for the first time, he is intimately concerned about the economy of the tropical areas of the world, and considers how the climates and soils of those areas differs with the climate and soils of the areas with which he is already familiar. It leads him to read foreign journals, converse with his fellow graduate students from tropical countries, and this interest does not stop there, but permeates the interests of other graduate students not on this program. The knowledge that the student is working with a crop that is little known, and that he may have the opportunity to make some major contribution which will improve the welfare of the cultivator in an underdeveloped country, makes his research relevant and exciting, all of which provides a powerful teaching tool not available otherwise.

The Department of Agronomy is broadening its perspective and enhancing its competency by inclusion of foreign nationals on its staff. These include one Associate Professor (from England), three Visiting Professors (from Australia, Denmark, and Wales), one Post Doctoral (Italy), and two Research Associates (Taiwan). These appointments give a greater international representation to our teaching and research staff.

B. Development of Research Competence

The competence of the Department of Agronomy to participate in International Agricultural research activities continues to grow. This competence has been enhanced by the 211(d) grant since it provides an opportunity for the International Professor and his students to actively participate in and contribute to the development of wheat and pulse breeding projects in India and elsewhere.

The arrangement for cooperative research and training of graduate students at the Orissa University of Agriculture and Technology, Bhubaneswar, Orissa State, India, was reported in previous Annual Technical Reports and earlier in this report. OUAT was selected because the University of Missouri, Columbia, has an AID contract to assist with development of that Indian university. Informal cooperation was established between Dr. Poehlman and Dr. Sinha, Chairman, Department of Agricultural Botany, OUAT, with Dr. Sinha serving as the students' overseas research advisor.

(1) Research on Wheat

The third Annual Technical Report described the assistance that has been given to OUAT by the International Professor in developing a wheat breeding program for Orissa. The best breeding materials from CIMMYT and India were assembled, the major breeding objectives identified, and crosses were made in India among Mexican and Indian spring wheats and at Columbia between Mexican spring wheats and U.S. winter varieties. Segregates from these crosses are being examined both in India and Missouri. During the 1971-72 season this program was carried forward in Orissa with minimum assistance from us. Two problems identified in Orissa were studied in M.S. theses. Mr. Watt (supported by this project) confirmed the observation that height inheritance in a Stadler (tall winter variety) x UP 302 (dwarf Indian variety) did not follow the simple recessive gene theory popularly accepted by wheat breeders. Mr. Elmigra (support by Friends of Libya) confirmed a relationship between coleoptile and culm length in crosses of standard x semidwarf wheat varieties. The thesis research of Mr. Elmigra is another positive example of how this grant has increased competency at UMC. Mr. Elmigra wanted a thesis research problem pertaining to wheat since this is the crop with which he expects to work when he returns to Libya. With our Orissa experience we were able to identify a problem relevant to the conditions under which he will be working in Libya and to utilize germplasms that will be adapted to his production areas.

The impact of the Orissa cooperation on Missouri wheat improvement may be far-reaching also. The most exciting development has been the identification of superior semidwarf winter types coming from a cross of a three-gene dwarf spring variety from India and a winter wheat from our nursery. Previous crosses of this type have been notoriously unrewarding. Through the 211(d) program we were able to observe these advanced wheat types in an area where they were adapted and to recognize their useful characteristics. This led us to evaluate them in Missouri, even though they were unadapted, and to utilize them in the Missouri program. The three-gene dwarf parent used in this cross came to us

from India. The utilization of these wheats may necessitate our changing cultural practices for growing wheat. This is being studied in an M.S. thesis at the University of Missouri under the direction of Dr. Dale T. Sechler. Dr. Sechler also has an M.S. student studying the stability of plant characters associated with nitrogen responsiveness in wheat and a non-thesis student from Brazil studying wheat breeding procedures. All of these studies have evolved as a result of our India experiences. In the process our knowledge of wheat and its breeding potential is being broadened and our competency as plant breeders enhanced.

2. Research on mungbeans

During the current year more of our activity has been devoted to mungbeans than to wheat. In the Third Annual Technical Report the evaluation of 321 strains of mungbeans at Columbia in 1970 was reported. The results have been summarized and distributed to mungbean research workers in the U.S. and foreign countries. In 1971, 160 strains were regrown and 43 new strains tested at Columbia. The results of the 1971 tests have been summarized and distributed, also. Mr. John Yohe, a graduate student, grew these strains in Orissa, India, during the winter of 1971-72 and they will be grown again by Dr. R. C. Misra, Pulse Specialist, Orissa, during the 1972 Kharif season. As a result of a paper presented by Mr. Yohe at the annual meeting of the American Society of Agronomy, seed of strains superior in our tests have been sent to 11 locations in 3 countries.

Our experiences in Missouri, Mr. Yohe's experience in Orissa, and data sent to us by those to whom we sent seed of mungbean strains permit us to make some generalizations at this time regarding developments from the mungbean research. These follow:

(a) Basic research on this species is rather meagre, particularly regarding genetics of characteristics useful in developing a viable breeding program.

(b) Characteristics we have found useful in evaluating yield potential are plant size on which to hang a large number of pods (measured by plant height and spread of branches), number of pods, number of seeds per pod, and seed size. Adaptation to photoperiod and disease resistance are essential for the plant to reach its yield potential.

(c) Genetic diversity within the species is greater than originally reported. Most breeders in Southeast Asia are working with a very narrow range of genetic diversity, which has given rise to opinions that wide genetic diversity does not exist.

(d) Photoperiod response is an important characteristic in adaptation to particular latitudes. We doubt that we can, in the field at Columbia, identify the strains adapted to very low latitudes, or for growing during short winter months in tropical climates. Using controlled environmental chambers we have identified what appears to be a photoperiod insensitive strain.

(e) We have identified a tetraploid strain which has shown near immunity to mildew, a foliar disease, at Columbia and Orissa, and resistance to bean yellows mosaic (BYM) disease in Orissa. The latter is the most serious disease of mungbeans in India and severely limits the production of the species in that country.

In order to broaden our knowledge of the genetic adaptation of strains of the mungbean species we have organized and distributed an International Mungbean Nursery which will be grown this summer at 7 locations ranging in latitude from 10 to 49 degrees North. From the performance records of the strains at the various locations we hope to learn more about the specific adaptation of particular strains.

During the summer we will have two M.S. theses studies and two Ph.D. theses studies in progress. Three of these studies are concerned with more specific identification and inheritance of yield components in particular strains and how these may be combined into germplasm pools for distribution to mungbean breeders throughout the world. The fourth thesis is a growth chamber study of photoperiod sensitivity.

3. List of Papers and Publications

Yohe, John M. and J. M. Poehlman, 1971. Breeding Mungbeans, a Food Grain Legume in India (Abstract). Transactions, Missouri Academy of Science 5:126.

Yohe, John M. and J. M. Poehlman. 1971. Breeding mungbeans: A Food Grain Legume in India. Agronomy Abstracts, 1971 Annual Meetings, American Society of Agronomy. p. 18.

Yohe, John M., Earl E. Watt, Moheb M. H. Bashandi, Dale T. Sechler, and J. M. Poehlman, 1971. Evaluation of Mungbean Strains at Columbia, Missouri, in 1970. UMC, Dept. of Agronomy Misc. Pub. 71-4. 34 pages.

Yohe, John M., Richard E. Swindell, Earl E. Watt, Moheb M. H. Bashandi, Dale T. Sechler, and J. M. Poehlman. 1972. Evaluation of Mungbean Strains at Columbia, Missouri in 1971. UMC Dept. of Agronomy Misc. Pub. 72-9. 21 pages.

Watt, Earl E. 1972. The Inheritance of Height in Semidwarf Wheat, Triticum aestivum L. M.S. Thesis, University of Missouri, Columbia.

4. How does this Research Contribute to the Grant Objectives?

The overall objective of this grant as stated earlier is "to increase the competency of UMC to generate knowledge and render assistance in the international area of plant breeding." Using a major cereal grain, wheat, and an important and widespread grain legume, mungbeans, as the vehicles of our research efforts, we are generating new knowledge useful to the breeder of these species and assisting breeders on four continents to use it. Our thesis is that competency is developed by active participation in a program where results can be assessed, mistakes recognized and corrected, and accomplishments recorded. We believe that the results demonstrate that this project is beginning to mature and that substantial competency is being achieved.

C. TRAINING OF GRADUATE STUDENTS

During 1971-72 there were 57 graduate students in the Department of Agronomy. Of these, 18 were foreign nationals. Six were supported by AID funds; one each by Governments of Brazil, Thailand, Nigeria, and Liberia; four on Agronomy Department funds, and three on personal funds.

The International Professor served as advisor to seven of these students, four of whom (Mr. Yohe, Mr. Watt, Mr. Swindell, and Mr. Bashandi) are currently associated with this project. Their activities have been previously described as well as those of Mr. Elmigra from Libya. In addition, Dr. Praphase Weerapat, a Rockefeller scholar, received a Ph.D. degree in August of 1971 and returned to Thailand as Rice Breeder in the Thailand Ministry of Agriculture. His thesis concerned the inheritance of resistance to barley yellow dwarf virus disease in oats. Dr. W. A. Elliott completed his Ph.D. degree in June, 1972 under the supervision of Dr. Poehlman and has accepted a position as wild rice (*Zizania aquatica*) breeder in the Department of Agronomy and Plant Genetics, University of Minnesota. Dr. Elliott's thesis concerned the genetic improvement of seed size in barley. Two other recent Ph.D. graduates advised by Professor Poehlman are now in plant breeding positions. Dr. Shu-Ten Tseng (1976) is rice breeder for the Rice Growers Association, Biggs, California, and Dr. George A. Berger (1971) is developing a soybean breeding program for Northeast Arkansas State University, Jonesboro, Arkansas.

D. DEVELOPMENT OF COMPETENCE FOR CONSULTATION AND SERVICES

The 211(d) grant is making it possible for the International Professor and other members of the Department of Agronomy staff to actively participate in a wide range of consulting and service activities with International dimensions. Some examples will be cited:

Professor Poehlman was one of five Land Grant College Professors to be invited by the Romanian Ministry of Agriculture and the U.S. Department of Agriculture to visit the State Farm System of Romania and consult with Ministry officials during August of 1971. Professor and Mrs. Poehlman traveled as guests of the Romanian government and Professor Poehlman gave eight lectures on wheat and soybean improvement.

Mr. Yohe was invited to give seminars at Kasetsart University and at the Orissa University of Agriculture and Technology on his mungbean research.

Unsolicited requests of seed of superior mungbean strains have been received during the past year from nine research workers in seven countries and four continents. All of these requests have been filled.

A request was received for a list of mungbean research papers from an experiment station where library facilities on this crop were inadequate. The bibliography is in the process of preparation.

E. UNDERGIRDING OF OTHER INDIAN PROGRAMS OF CUSURDI UNIVERSITIES

Developing cross linkages among the separate 211(d) programs of the six CUSURDI universities has been difficult for several reasons:

- (a) Each university was given a separate discipline in which to focus their activities.
- (b) Although cooperation among the disciplines would be useful in certain instances, the separation of the concentration area in different universities, each of which has a different focus for its activities, makes close cooperation difficult.
- (c) The 211(d) students have gone to different institutions in India so that no overseas tie is obtained.
- (d) The size of the grant to each institution has made it necessary to make very specific and direct approaches to the problems under study and has not permitted attacking the problems on the broad interfaces which requires the interdisciplinary approach.

Many examples of the desirability of linkages may be cited for our work. For example, the need for cooperation with pathologists in regard to mungbean diseases, or the need for assistance from food and nutrition specialists on the improvement of nutritive value of the mungbean. But due to the difficulties cited above we have sought help from other specialists (both intra- and interdepartmental) in our own institution rather than from other CUSURDI institutions. This has certain advantages for it does result in a wider involvement within our own institution.

F. INVOLVEMENT OF OTHER UNIVERSITY RESOURCES IN THE 211(d) PROGRAM

The purpose of the 211(d) grant was to make it possible to initiate teaching and research in plant breeding with an international dimension at UMC and to utilize these activities to develop competency for carrying out such activities on a larger scale. A program of this nature is usually difficult to initiate and finance in a state-supported institution, but once established it will often develop into an ongoing program. The purpose here is to illustrate ways in which the University of Missouri, Columbia, and its College of Agriculture are giving support to the activities of this project. A few examples will serve as illustrations.

- (a) The University in 1971-72, for the second year, assumed one-half of the salary of the International Professor.
- (b) The College of Agriculture is funding a project on "Breeding Agricultural Crops of India" which supplements the research of the grant project.
- (c) The Agricultural Experiment Station has developed and presented to USAID a proposal for "Developing an International Mungbean Project."

(d) The services of the Agricultural Experiment Station Laboratories have been utilized to analyze protein and lysine on 126 strains of mungbeans and 17 amino acids on 53 strains.

(e) Computer service has been supplied for processing mungbean data without cost to the project.

(f) The excellent facilities of the University of Missouri Library has been utilized to develop a bibliography of mungbean literature. New books on international agronomy and plant breeding are being added by the library upon request.

(g) Facilities for field and greenhouse research and utilities and laboratory facilities for growth chamber studies are provided.

(h) Staff members of other departments as well as Agronomy Departmental staff have given freely of time and assistance for consultation on matters pertaining to diseases, nutrition, genetics, and fertilization of the mungbean.

Institutions other than the University have facilitated our program also. They include the USDA Plant Introduction section that has supplied seed of strains from the USDA collection and has identified strains that we are growing; the USDA Plant Quarantine office by facilitating the importation of seeds from other countries, the State Board of Agriculture for issuing Phytosanitary Certificates for seed being exported, and the Nitragin Company, Milwaukee, Wisconsin, for supplying root nodule inoculation without cost.

An exact dollar value on the University contribution would be difficult to calculate due to the various costs pertaining to administration and physical facilities, however, it can be safely assessed as being double that expended directly from the 211(d) grant fund.

IV. INTERNATIONAL PROGRAMS OF THE UNIVERSITY

The University of Missouri, Columbia, is developing as a strong resource for international expertise and information. Examples of activities will be cited here to demonstrate commitment in this area of education:

(1) While the International Professor was serving as Chairman of a campus-wide committee on International Programs and Studies, an "Office of International Programs" was established and a Director to coordinate the campus-wide activities employed.

(2) An Assistant Dean for International Programs has been employed recently in the College of Agriculture.

(3) The College of Agriculture has had an "Agricultural University Development Program" in India since 1956 and "Agricultural Production Promotion Projects" in Orissa and Bihar states of India. Forty-five UMC staff members have served on these projects and 140 Indian participants have received training on this campus.

(4) A strong international resource is developing in the Department of Agricultural Economics. These include:

Two courses in International Agricultural Development

One staff member recently conducted an agricultural policy seminar at Washington, D.C. for agricultural leaders in developing countries.

One staff member is currently on leave developing a book on institution building. During the past year he also participated in an Asian Agricultural university seminar in Indonesia and the North Carolina Team Leader's Handbook Seminar in Peru.

One staff member spent four months as consultant to the Nepal Government on farm management.

One staff member has just returned after serving as project specialist for the Ford Foundation in Brazil.

(5) Examples of other College of Agriculture staff who have been active in international agricultural activities during the current year include:

A forestry staff member at a world conference on forestry education in Stockholm.

A forestry staff member who served with FAO surveying forestry resources in Surinam.

An agricultural engineering staff member who consulted on agricultural engineering education at a university in Greece.

(6) UMC has long maintained a strong South Asian studies program. This is an interdisciplinary program with courses in Indian language, political science, literature, anthropology, history, and geography. An Indian national serves as resource librarian developing the South Asian collection of books for the University Library.

(7) A partial listing of other programs include:

A program to train medical technicians in South Viet Nam.

A college of education exchange program with the University of Reading, England.

A visiting professor exchange program in history with University of Saarbrücken in Germany. The first exchange of staff will be in 1972-73.

A veterinary science exchange program with Yugoslavia.

A journalism exchange program with Belgium.

V. EXPENDITURES

The original budget, actual expenditures for 1968-69, 1969-70, 1970-71, and 1971-72, and projected expenditures for 1972-73 are given below:

	<u>Original budget</u>	<u>1968-69</u>	<u>1969-70</u>	<u>1970-71</u>	<u>1971-72^a</u>	<u>1972-73^b</u>	<u>Totals</u>
Salaries	114,000	24,209 ^c	25,445	16,593	15,603	19,000	100,849 ^d
Stipends	52,000		4,229	7,300	7,223	12,000	30,758 ²
Travel	21,000	986	1,217	1,367	8,860	10,920	23,350 12,902
Equipment, supplies, misc.	13,000	9	236	11,825	3,068 ^d	6,000	21,136 ⁸
SUBTOTALS	200,000	25,204	31,127	37,085	34,754	47,920	176,090
International tickets purchased but not charged to account (estimated)							4,843
TOTALS	200,000						180,933
Estimated balance at end of May 31, 1973							19,067

^a The expenditures for 1971-72 are for the 11-month period July 1, 1971 through May 31, 1972 to conform with the new reporting period requested in letter of May 5, 1972 from Wm. H. Naylor, Jr.

^b Estimated for period June 1, 1972, through May 31, 1973.

^c Stipends paid in 1968-69 are included in this item.

^d Equipment, supplies and miscellaneous:

(1) Equipment purchased in 1971-72 with cost in excess of \$100: None

(2) This item includes cost of chemical analyses of mungbean samples which was \$2,198.

VI. WORK PLAN AND BUDGET FOR 1972-73, 1973-74

1. Plans for 1972-73

Recent events in India make it necessary to change our original plans for sending students to India to conduct thesis research. Mr. Earl Watt had requested admission to QUAT and it was planned that he spend the period September, 1972 through May, 1973, in India. The International Professor plans to travel to Thailand, the Philippines, and other Southeastern Asia countries conducting research on mungbeans in August and September to develop arrangements for Mr. Watt to conduct research on his thesis problem. Our preference would be for him to go to Thailand and we believe suitable arrangements may be made through the Rice Department, Ministry of Agriculture, or through Kasetsart University in Bangkok.

Mr. John Yohe will continue his thesis research on plant type in mungbeans at Columbia, Missouri, during the summer of 1972 with probable completion date of his Ph.D. program in May, 1973.

Mr. Mohèb Bashandi will continue his M.S. thesis on the photoperiod sensitivity in mungbeans with probable completion date of January, 1973.

Mr. Richard Swindell will conduct thesis research on yield components in mungbeans during the summer of 1972 with probable completion date of May, 1973.

We will continue the cooperative nursery program on evaluation of mungbean strains with Thailand, Philippines, Korea, Canada, Colombia, Nigeria, and Ethiopia and on basic studies to learn more about the characteristics of the mungbean plant that affects its adaptation and production in different areas of the world. This research will be used as the vehicle for involvement in a plant breeding program with international dimensions.

2. Plans for 1973-74

A request has been made to AID for permission to move forward the date for termination of the grant from May 31, 1973 to May 31, 1974. This change is being requested because the sudden termination of the work in India is causing us to make adjustments in the program. While we are expecting that plans may be completed for Mr. Watt to go to Thailand during 1972-73 to conduct the research that had been planned for India, these plans have not been completed at this time. Should we be unable to get these completed for Mr. Watt to grow his thesis materials in Thailand during the months optimal for his experiment, it might be necessary for him to wait until 1973-74.

Also, we would like to send Mr. Richard Swindell to Thailand or the Philippines for conducting research during 1973-74. The 1972-73 budget as planned would leave about \$19,000 unspent which could be utilized for his expenses during 1973-74.

The proposed budget for 1973-74 is as follows:

	<u>1973-74</u>
Salaries	5,800
Stipends	4,200
Travel	7,000
Equipment, supplies and miscellaneous	2,067
TOTAL	<u>19,067</u>

Table I

Distribution of 211(d) Grant Funds and Contributions From Other Sources of Funding*
 Review Period July 1, 1971 to June 30, 1972

Grant related	211(d) Expenditures				Non 211(d) Funding amount
	Period Under Review	Cumulative Total	Projected Next Year	Projected to end of Grant	
Research	14,754	63,013	20,920	20,920	
Teaching	24,000	70,000	27,000	27,000	
Total					

* These figures are our best estimates

Table II

Expenditure Report

(Actual and Projected)

Under Institutional Grant #AID/csd - 1921

Review Period July 1, 1971 to June 30, 1972

(Line Items to Conform to Budget in Grant Document)	Expenditures to Date		Projected expenditures Year 5	Total
	Period Under Review	Cumulative Total		
Salaries	15,603	81,850	19,000	100,850
Stipends	7,223	18,752	12,000	30,752
Travel	8,860	17,273	10,920	28,193
Equipment, supplies and miscellaneous	3,068	15,138	6,000	21,138
			Total	180,933
Estimated Balance at end of May 31, 1973				19,067
			Total	200,000