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A GRANT TO STRENGTHEN THE CAPABILITIES  
OF THE  
UNIVERSITY OF ILLINOIS  
IN  
IMPROVEMENT OF SOYBEANS FOR TROPICAL AND SUBTROPICAL AREAS

ANNUAL REPORT OF GRANT AID/CM/ta-G-73-49

October 1, 1974 to September 30, 1975

SUBMITTED TO

THE AGENCY FOR INTERNATIONAL DEVELOPMENT  
DEPARTMENT OF STATE  
WASHINGTON, DC

BY

THE UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN  
COLLEGE OF AGRICULTURE  
INTERNATIONAL SOYBEAN PROGRAM (INTSOY)

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Date Due: December 1, 1975

Date Submitted: February 12, 1976

A. Title Page

Grant Title: A Grant to Strengthen the Capabilities of the University  
of Illinois in Improvement of Soybeans for Tropical and  
Subtropical Areas

Grantee: University of Illinois at Urbana-Champaign  
Urbana, Illinois 61801

Grant Program Directors: Dr. William N. Thompson, INTSOY Director  
Dr. Carl N. Hittle, Professor of Plant Breeding

AID Sponsoring Technical Office: TA/AGR

Statistical Summary:

Period of Grant:	October 1, 1973 to September 30, 1978
Amount of Grant:	\$500,000*
Expenditures for Report Year:	\$104,229
Anticipated for Next Year:	\$222,395

## B. Narrative Summary

Special emphasis was placed on providing improved soybean genetic technology for small farmers of the tropics and subtropics. Cooperating with UPR, Mayaguez and other collaborators, research activities included a crossing program, germplasm evaluation, segregation of populations, a preliminary variety trial and an inoculation trial.

Four graduate students contributed to grant objectives during the report period. One did thesis research at the University of Puerto Rico, Mayaguez Campus. Graduate student research involved studies of the effect of daylength on flowering and maturity of various soybean genotypes, on soybean seed vigor and viability, on inheritance of water stress tolerance, and on electrophoretic bands of different soybean genotypes as they might be used in taxonomic classification.

Two short courses were conducted, "Soybean Processing for Human Food" and "Technical and Economic Aspects of Soybean Production" with support from USDA, AID and other donors. Two major international conferences dealing with the production, protection, marketing and use of soybeans as human food were held in Addis Ababa and Urbana-Champaign. Sponsorship included AID, USDA, UIUC and financial support was provided by these and several other sources.

Development of advisory and consultation capability was given significant impetus from non-grant sources. A series of task orders, issued under AID Basic Ordering Agreements, provided opportunity to render advisory assistance in five LDCs, Guyana, Peru, Ecuador, Zaire and Thailand. Problem identification and program planning advisory services were requested. INTSOY teams composed of core staff, UIUC personnel, associated institutions personnel, private organizations and individuals worked in close cooperation with host country and AID mission personnel to accomplish the tasks assigned. The opportunities for establishing new linkages, or strengthening existing ties, was an important aspect of this activity.

Two information systems were improved and expanded. The soybean germplasm data bank capacity was increased and 66 new accessions were added to the Taxonomic Information System (TAXIR). Reference collections of soybean pests, under leadership of the Illinois Natural History Survey, provided literature citations and insect data to soybean researchers in the U.S. and other countries.

Domestic and international linkage formation made excellent progress. The primary domestic linkages with AID, UPR/Mayaguez and USDA/ARS were strengthened through consultation and coordination in program planning activities. Associated U.S. institutions and personnel cooperated in technical assistance activities and in general program planning. Linkages with international centers and LDCs were advanced through a series of Memoranda of Understanding. The International Soybean Variety Experiment Program (ISVEX) links directly to 90 countries with approximately 260 separate locations. The INTSOY Newsletter links the core staff with over 1100 subscribers, more than half of whom are associated with foreign agricultural research, education, and development institutions.

## C. Detailed Report

### 1. General Background and Description of the Problem

Soybeans offer a greater potential for lessening the LDC protein and calorie shortage than any other grain legume. Soybeans, averaging about 40 percent protein with excellent nutritional balance and capable of producing high yields, are the most promising potential source of vegetable protein, and also produce large quantities of useful edible fats. Furthermore, soybeans produce a high yield of protein per unit of energy expended in the production process.

Presently, soybean culture is concentrated in the United States, Brasil, and Mainland China, with significant additional production in Indonesia, Mexico, and the Soviet Union. More than 90 percent of the world's soybeans are grown at latitudes greater than 30°. Recent evidence indicates that soybean cultivation also is practical under small farm conditions in tropical and subtropical areas, including many regions where protein shortage presently is acute. However, to accelerate the rate of expansion more information is needed on the cultural requirements of the crop in these latitudes and varieties are needed which are better adapted to short day-lengths and high temperatures. There is an acute need for a mechanism to disseminate information and seedstocks which will contribute to high production, and for training of technical personnel in modern techniques of growing soybeans in lower latitudes.

The development of an institutional response capability extends beyond plant breeding and associated cultural practices, and the program includes the development of mechanisms to facilitate interdisciplinary advisory and consulting capabilities and the development and maintenance of information systems to serve small farmers through soybean research and extension workers in tropical and subtropical locations.

An analysis of institutional strengths to address the problems inherent in the development of a comprehensive international soybean program readily affirmed the grantee's capacity to undertake the task. The University of Illinois at Urbana-Champaign has played a leading role in soybean research since the 1920s, and has enjoyed international reputation for the excellence of its soybean program since the 1930s. For the past 20 years, Illinois has been heavily involved in institution-building and agricultural advisory activities in several developing countries, and since 1965 has given a particular emphasis to international assistance in soybean development.

The University of Illinois, through its International Soybean Program, INTSOY, has had a significant role in assisting local research personnel to undertake successful soybean trials in a number of tropical and subtropical countries. As a long established center of excellence in soybean research, Illinois is in a unique position to further develop high competence in soybean improvement with special relation to the problems encountered in tropical and subtropical areas. The University of Illinois has outstanding staff,

laboratories, research facilities, library support and the basic infra-structure needed for a major international program in soybean research, development and linkages. In its College of Agriculture virtually all the departments are involved to some extent in research and teaching activities related to soybean.

The USDA/ARS Regional Soybean Laboratory, located on the UIUC campus, is the principal federal activity for research on soybean improvement. Activities of the project are closely coordinated with those of related university departments. All professional staff members of the project have joint university appointments and are available for consultation, cooperation, and supervision of graduate student research.

Outstanding library, laboratory and field facilities are utilized. Computerized information retrieval systems are a special feature of library operations. Recently experience with such facilities has been utilized by INTSOY in cooperation with the Illinois Natural History Survey to organize computerized information storage and retrieval systems for the university soybean insect collection, which is the largest in the world, and the USDA world soybean germplasm collection.

Specialized equipment available at Urbana-Champaign includes Varian Nuclear Magnetic Resonance equipment for rapid, nondestructive analysis for oil content, automatic amino acid analyzers, gas liquid chromatographs, and other apparatus required for the most sophisticated research.

Cooperative arrangements have been developed with the University of Puerto Rico/Mayaquez Campus which will enhance the direct capabilities of the University of Illinois for field work on soybeans in tropical environments. This grant is complementary to a 211(d) grant administered by the University of Puerto Rico/Mayaquez whose focus is protection of the soybean plant.

## 2. Purpose of the Grant

The purpose of the grant, as stated in the original grant document, is to strengthen the competence of the University of Illinois in a collaborative program with the University of Puerto Rico, to provide needed research, training, research and information linkages, technical assistance, and consultation on major problems related to improvement and development of production techniques for soybeans in tropical and subtropical areas. The developed competencies will be used to improve soybean production and utilization to provide protein in diets of low income people throughout the world.

Following the scheduled 18-month review of the grant program in April 1975 the statement of purpose was modified. In the grant redesign, the program purpose is to develop, mobilize and maintain a U.S. institutional response capability in soybean production and use utilizing the competence, leadership and facilities of UIUC and

the University of Puerto Rico, Mayaguez Campus, and focusing on the solution of LDC problems with emphasis on technology applicable to the small farmer and improving nutrition of the urban and rural poor.

Upon completion of the grant program, there will have been developed a core of experienced faculty with supporting knowledge generation, storage, retrieval, and delivery systems providing the capacity to respond to the needs of the LDCs of the tropics and subtropics to improve their capabilities to produce food protein and calories and to market and use soybeans in direct commercial forms acceptable and within the means of the urban and rural poor. As an outgrowth of the grant program, UIUC and its associated U.S. institutions can be expected to become the center of competence in all phases of soybean production, protection, marketing, use, and information systems for the tropical and subtropical regions of the world.

### 3. Objectives of the Grant

#### a. Objectives restated

The original grant objectives focused on the development of soybean genetic technology to assist tropical and subtropical LDCs to increase their supply of protein. Other objectives included research and informational linkages to soybean improvement programs in other countries.

In the program redesign exercise, and with encouragement from AID, the objectives were refined and expanded to reflect a programmatic approach to the problem. The objectives, or program outputs are designed to strengthen the competence of UIUC in selected areas and improve its communications with appropriate institutions in the U.S. and abroad so that an institutional response capability can be achieved in the areas of soybean production, protection, marketing, utilization and development of information systems for tropical and subtropical regions of the world. The primary thrusts in strengthening UIUC capability will be:

- (1) Improvement of educational capabilities at UIUC and associated U.S. universities and research and educational organizations for faculty and students to acquire greater knowledge, and thus greater institutional response capability, of production, protection, marketing, and use of soybeans in tropical and subtropical regions.
- (2) Development of soybean genetic technology for small farmers of the tropics and subtropics. Temperate zone genetic technology provides a base on which to build in developing high-yielding varieties, resistant to crop hazards, and neutral to farm sizes of the less-developed countries. With high yields, soybeans have the potential to out-produce nearly all crops in terms of both high-quality protein and calories per unit of land area. Focus on improved genetic technology to maximize protein and energy production per unit

of input provides a meaningful multidisciplinary, interdisciplinary, problem-solving orientation to which virtually all applied agricultural disciplines can contribute. This approach also capitalizes on the complementarities of the UIUC and UPR-MC.

- (3) Development of mechanisms which facilitate effective interdisciplinary advisory and consulting capabilities relative to the production, and utilization of soybeans in the tropic and subtropic regions.
- (4) Development and maintenance of information systems to serve soybean research workers and educators (formal and nonformal) in tropical and subtropical areas and organizations and individuals in the U.S. and international agricultural development network with interests in soybeans.
- (5) Serve in the leadership role in developing a network of organizations with congruent interests in pursuing the goal of capitalizing on the potentials of soybeans as a low-cost, high-protein and high-energy food for the rural and urban poor of the tropics and subtropics.

To summarize, UIUC will use the grant funds to develop the following capabilities and systems (outputs) all of which will contribute to the attainment of the program purpose. These outputs are: (1) an improved education and training capability; (2) an extended knowledge base and research capability; (3) an increased advisory and consulting capability; (4) an improved and expanded information management capability; and (5) an extended and strengthened set of linkages and networks.

b. Review of objectives

The development of certain technologies, e.g., constructing a superior soybean variety, information systems hardware, and personnel data banks, are important program outputs that will receive considerable attention and resources. However, the key elements in building a U.S. institutional response capability are those associated with the development of human resources. Those outputs stressing human resources development, that is, those outputs dealing with graduate education and professional training, generation of knowledge and development of advisory capacity account for approximately 75 percent of program budget, and are the core of the redesigned program.

c. Review of critical assumptions

The world food picture considered from either an intermediate or long-run view with respect to need for increased protein intake has not changed significantly since the first

year of the grant. In the redesign, several assumptions have been made that are important to the attainment of grant objectives. Should one or more prove to be invalid, grant program success will be adversely affected. These assumptions are as follows:

- (1) That this redesigned 241(d) grant will be supported by AID for three years from October 1, 1975, the effective date of the initiation of the redesigned grant program.
- (2) That AID will support a complementary companion 211(d) grant to the University of Puerto Rico, Mayaguez Campus, with emphasis in developing, mobilizing, and maintaining institutional response capability in soybeans with emphasis in crop protection disciplines.
- (3) That increasing numbers of students from the U.S., Puerto Rico, and the LDCs of the tropics and subtropics will be interested in and supported for graduate study at UIUC in the various aspects of soybean production, marketing and use and that UIUC and other network universities will have the capacity for these students.
- (4) That LDC country personnel participation in short courses, seminars, workshops, conferences, and **special** training programs will be supported by a combination of USDA-AID training programs, USAIDs, foundations, and national and international agencies.
- (5) That AID will support UIUC research on soybean production, marketing, and use for tropical and subtropical areas under separate contractual or other appropriate means.
- (6) That resources will become available for developing cooperating soybean breeding programs located at national and international centers strategically located in the tropics and subtropics.
- (7) That AID will assist in development and maintenance of linkages with the LDCs of the tropics and subtropics, in identifying training needs of institutions and individuals and locations for cooperative activities, and in exchange of information in the soybean network.
- (8) That U.S., international, and LDC institutions will cooperate with UIUC in strengthening of linkages, exchanges, and visits by staff and students, information exchange, and other cooperative activities.
- (9) That AID will encourage and support UIUC and UPR-MC as the leadership institutions in the international soybean network and will assist in developing and supporting cooperative research and outreach work on soybeans in cooperation with international research centers with soybean interests.

#### D. Accomplishments

The accomplishments for the report period are reported in terms of the original grant statement, but cast in the model of the project redesign. These concentrate on (1) improvement of educational capabilities through graduate student education, (2) development of soybean genetic technology for small farmers of the tropics and subtropics, (3) development and maintenance of information systems to serve soybean research workers and educators in LDCs, and (4) development of an international network of organizations and individuals linked in ways to provide means for (a) stimulating cooperation in, (b) ensuring utilization of, and (c) sustaining soybean development programs for the tropics and subtropics.

A major accomplishment of the report period was the development of the redesigned grant program. This cooperative exercise involved not only Agency for International Development and UIUC personnel, but drew upon the considerable knowledge and expertise of several other cooperating institutions and organizations, among which are included the University of Puerto Rico, Mayaguez Campus, several U.S. institutions of higher education having particular interest and competence in food legume production, and international research centers.

The accomplishments of the report period are discussed in the context of the Objectives/Outputs contained in the program redesign.

##### Output 1. Improved Education and Training Capabilities in Soybean Production, Protection and Utilization

The prime objective is to build institutional response capability through strengthening of education and training capabilities at both UIUC and the University of Puerto Rico, Mayaguez Campus. Other U.S. universities, research organization and international research centers in the soybean development network will be stimulated to join in an expanded role in education and training. Graduate studies, on-campus and on-site short courses, and seminars, workshops and conferences are the primary means of addressing this objective.

##### 1. Graduate Studies

Expansion of institutional response capability of the international soybean network oriented toward the needs of the tropics and subtropics is highly dependent on augmenting the reservoir of trained personnel. Support of graduate students, under the guidance of senior soybean workers, is a means of simultaneously broadening and deepening the tropical soybean knowledge base and increasing the numbers of young applied scientists and educators to work on soybeans.

The work of four research assistants was supported by the grant for all or a part of the report period. More detailed progress reports are given in Appendix A.

- a. Curtis R. Nissly has been supported from grant funds since October 1973, the inception of the grant. After completing the major part of his course work he was assigned for field research to the University of Puerto Rico, Mayaguez Campus, from June 1974 to August 1975. He will complete his Ph.D. in 1976.

Mr. Nissly's research involved studies on the effect of daylength on the flowering and maturity of various soybean genotypes. The development of a later maturing soybean genotype with daylength neutrality may permit development of commercial material with a wide range of utilization as is now true of rice and wheat. It may also promote an easier exchange of breeding lines among soybean improvement programs in countries of differing latitudes.

All available genotypes from Maturity Group III were screened for photosensitivity in Urbana, Illinois and Isabela, Puerto Rico. Two crosses from differing maturity groups were also screened at both locations: (1) Clark (Group IV) x P.I. 194-640 (Group 000) and (2) Portage (Group 00) x Coker Hampton 266A (Group VIII). Data from the screening experiment show that there is an extreme variation in daylength sensitivity in Group III germplasm. General maturity is more affected by photoperiod than is flowering. Several genotypes showed a lower degree of sensitivity than the majority. P.I. 317,344B (Kitomi Shiro) showed outstanding neutrality in all experiments. In contrast to the other Group III genotypes tested, this genotype has unique day-neutral characteristics which may be useful in the breeding of soybean lines with wide latitudinal adaptation. Inheritance studies with Kitomi Shiro are continuing.

Both the Clark x P.I. 194,640 population and the Portage x Coker population show considerable variation in photosensitivity and maturity. Lines which are as neutral as the early parent have been isolated but are usually the earlier maturing lines. The correlation between neutrality and earliness seems quite high.

Three evaluation studies were conducted with the screened material: (1) location, (2) planting date, and (3) yield stability under continuous cropping. Preliminary results show that the more neutral genotypes are less affected by change in location and planting date.

A progress report prepared by Mr. Nissly is included in Appendix A, Research Assistant Reports.

- b. Mr. M. D. Tedia has also been supported from grant funds since October 1973. During the period of his support he has completed all course work and most of the research for the Ph.D. Mr. Tedia is an Agricultural Officer with the State Department of Agriculture, Madhya Pradesh, India, and will return to his duties upon completion of the degree in 1976.

Mr. Tedia's research is focused on soybean seed vigor and viability. Studies have been conducted on (1) the effect of high humidity on seed vigor and viability, (2) the effect of moisture content, packaging material and temperature on viability and vigor of soybean seed lots, and (3) the influence of date of

planting, location and environmental factors on field emergence and performance of soybean seed lots. Mr. Tedia's interests crossed departmental lines and he received considerable assistance and cooperation from the Department of Agricultural Engineering as well as his parent department, Agronomy.

Studies on the effect of high humidity on seed vigor and viability were conducted on the UIUC campus in 1974 and 1975. Specially constructed plastic cages with mist fogging capability were used to create high humid preharvest conditions in the field. Mist fogging operations were conducted from September 14-November 5, just over seven weeks. Some soybean seed was harvested each week and observations were recorded for moisture content of harvested seed, germination after 15 days drying, decline in vigor after accelerated ageing tests, and bioassay. The data show that seed vigor and viability declined with delay in harvest; however, the influence of high humid conditions is not the same for all varieties. The fungus Phemopsis/Sojaj is associated with conditions of high humidity and late harvest.

Another set of experiments on the effects of moisture content, packaging material and temperature on viability and vigor of soybean seeds were run in cooperation with the Department of Agricultural Engineering. Seed lots of different moisture contents from northern and southern Illinois were packaged in plastic bags of varying thickness at three different temperatures and certain laboratory tests were done at three successive eight-week periods. Storage temperature had a greater effect on seed viability than initial seed moisture content or packaging material. Seed viability was maintained longer at the lowest temperature, and seeds of higher moisture content deteriorated rapidly when stored in thicker plastic bags at higher temperatures. The optimum moisture content for sealed storage was determined to be around 7 percent. A multiple regression equation was developed to predict viability under constant storage temperature and moisture conditions.

A third study dealt with the influence of planting dates, location and environmental factors on field emergence and performance of 15 selected soybean lots. Three different growing sites were used in northern, central and southern Illinois. Data showed that location and environment had a great influence on seed quality. Dates of planting also indirectly influence the quality of the seed. Weather during the time of seed maturation plays an important role in determining seed quality.

A progress report prepared by Mr. Tedia is included in Appendix A, Research Assistant Reports.

- c. David J. Sammons has been under grant sponsorship since January 1975. Holder of a master's degree in botany with a farm and Peace Corps background, Mr. Sammons concentrated on satisfying course requirements for most of the report period, and in developing an area of research interest, inheritance of water tolerance in selected soybean cultivars.

During the summer semester a technique for screening soybean varieties for tolerance to water stress was developed. The apparatus necessary to conducting the study was assembled. During the fall semester Mr. Sammons is screening 20 varieties of soybeans for the effects of varying levels of soil moisture on the particular parameters outlined on the data-gathering instruments. An additional 8-10 varieties will be screened in early 1976 and a statistical analysis of the data will be made from which material will be selected for field study in the 1976 growing season.

Additionally seedlings will be grown in a large wooden tank filled with wet sandy soil as a gross check on growth chamber data obtained during 1975 and early 1976. The plants will be observed as they pull down soil moisture, and the effect of increasing stress will be measured in terms of plant water status, growth, and soil moisture producing signs of stress in the plant.

Summer field testing will be conducted at the Agricultural Experiment Station field station in Mason County, Illinois, in dry sandy soils. Chamber data will be compared with observations of field water stress on soybean plants. A genetic study of the inheritance of water stress tolerance will commence with the making of hand crosses of selected material to produce  $F_1$  seed. The  $F_1$  seed will be grown under greenhouse conditions in the winter of 1976-77, and the resulting  $F_2$  seed will be studied in the field during the 1977 growing season.

A progress report prepared by Mr. Sammons is included in Appendix A, Research Assistant Reports.

- d. David Orf began graduate study in January 1974 and was supported by the grant from August 1974-August 1975 while studying for an M.S. in agronomy. His research interest focused on the study of electrophoretic bands of different soybean genotypes as they might be used in the taxonomic classification of the genotypes.

Mr. Orf was awarded a University Fellowship in August 1975 reducing the needs for financial support from the grant. He will complete his M.S. degree in the spring of 1976 and plans to continue work toward a Ph.D.

## 2. On-campus short courses

Two experimental nondegree short courses were planned and conducted in the spring and summer of 1975. Both courses were funded from a combination of sources including AID contract CSD 3179 (a basic ordering agreement for participant training at UIUC), FAO, the Ford Foundation, and government and private institutions in Ghana and Iran. Some grant staff participated as instructors or resource persons.

Although the courses were nongrant funded, they fit in the overall International Soybean Program and such training efforts are an important

component of the grant redesign. Therefore, they are included in this report.

The first course offered was entitled "Soybean Processing for Food Uses." Thirteen participants from 10 countries spent approximately five weeks of March/April in laboratory training and observation. The general development objectives of the course were (1) to provide opportunity to learn the principles and processes involved in the use of soybeans and soybean products for human food, (2) to teach the concepts and procedures for processing of whole soybeans, and (3) to apply the knowledge gained in (1) and (2) to country and individual development objectives in use of soybeans as an improved source of food.

Countries represented include Brasil, Colombia, Costa Rica, Ghana, Kenya, Korea, Nicaragua, Philippines, Sri Lanka, and Thailand. Leaders of the course were Professors A. I. Nelson and L. K. Ferrier of the Department of Food Science. The experimental offering was a success and the course will be repeated in the spring of 1976.

The second course was entitled "Technical and Economic Aspects of Soybean Production." This 17-week course commenced in mid-May with 16 participants from 15 different countries. The general development objectives were (1) to learn the technical and economic principles and practices of soybean production, (2) to study the research, educational and regulatory functions supportive of a soybean industry, (3) to become better aware of the use of soybeans to alleviate protein-calorie deficiency problems, and (4) to increase firsthand knowledge, experience and understanding of agronomic and technological practices involved in the production and utilization of soybeans.

Countries represented included Burma, Chile, Costa Rica, El Salvador, Ghana, Iran, Jamaica, Korea, Lesotho, Liberia, Nicaragua, Philippines, Sri Lanka, Uruguay, and Zambia. Leader for the course was Professor J. B. Sinclair, Department of Plant Pathology, aided by M. T. Wall, graduate assistant. This experimental offering also exceeded all expectations and the course will be repeated in the summer of 1976.

### 3. International conferences

During the report year, two major international conferences relating to soybean production, protection, marketing and utilization were held. Neither conference was sponsored from grant funds although grant staff served as speakers, section leaders, and resource persons. Each conference afforded the grant staff unparalleled opportunity to interact with colleagues within and across academic discipline and to link to international centers, LDC institutions, and to workers in developed countries where interest in soybeans is increasing.

In October 1974 the Second Regional Soybean Conference for Scientists of Africa, the Middle East and South Asia was held in Addis Ababa, Ethiopia. Sponsored by the Ethiopian Institute of Agricultural Research and the International Soybean Program (INTSOY),

the conference was supported by the Agency for International Development under provisions of Research Contract AID/CM/ta-c-73-19 and Grant AID/CM/ta-q-1151. The conference attracted 97 participants from 27 countries. Except for those persons giving invited papers, travel and other costs were paid by a sponsoring government, university, research institution or by the individuals. Proceedings of the conference were published as Number 6 in the INTSOY Publication Series. A Third Regional Soybean Conference for Scientists of Asia and Oceania will be held at Chiang Mai, Thailand in February 1976 under sponsorship of the Royal Thai Government, the Asian Vegetable Research and Development Center (AVRDC), and INTSOY.

In August 1975 a World Soybean Research Conference was held at the University of Illinois at Urbana-Champaign with the U.S. Agency for International Development and U.S. Department of Agriculture as joint sponsors. Financial support was provided by the American Soybean Association, the National Soybean Crop Improvement Council, the Illinois Crop Improvement Association, Illinois Foundation Seeds, Inc., and the Illinois Soybean Program Operating Board. Registrants numbered 662 including 149 participants from 48 foreign countries. More than 230 speakers participated. Proceedings of the conference will be available in early 1976.

#### Output II. Extended Knowledge Base and Research Capability

Special emphasis is placed on improving the response capability of UIUC and UPR-MC and associated institutions in providing improved soybean genetic technology for small farmers of the tropics and subtropics. The experience of international research centers shows that this program focus holds promise of high returns from relatively small inputs.

Work under this output centers on activities conducted at the University of Puerto Rico, Mayaguez Campus, in cooperation with that institution and other collaborators. Research activities included a soybean crossing program, germplasm evaluation, segregation of populations, a preliminary variety trial and an inoculation trial. Work in each of these areas is discussed below.

##### 1. Crossing Program

In June, 1975 a crossing program was initiated in Puerto Rico. Parents were chosen on the basis of their performance in the INTSOY Variety Evaluation Experiment (ISVEX) and their possession of desirable characteristics for a high-yielding, high-quality soybean variety for tropical and subtropical environments. The ISVEX trials were conducted at 60 sites in 27 different countries in 1973-1974. Varieties chosen from ISVEX exhibited adaptation over a wide range of environmental conditions. Late maturing, tropical types are also used in the hybridization program to impart characteristics such as adaptation to short daylengths, resistance to disease

and insect pests, and retention of seed quality under adverse tropical conditions of high temperatures and high relative humidity.

A number of crosses have also been made involving PI 317.334B, a plant introduction of Maturity Group III which exhibited a high degree of photoperiod insensitivity in evaluations conducted in Illinois and Puerto Rico, and a maturity range of sensitive cultivars. The purpose of these crosses is to study the inheritance of the insensitivity and determine the relationship between photoperiod insensitivity and early maturity.

F<sub>1</sub> seeds were harvested from the following crosses:

Williams X Hill  
" X Santa Rosa  
" X HLS  
" X PI 382.181  
" X Improved Pelican  
" X Jupiter  
Jupiter X Hill  
" X SJ-1  
" X Calland  
" X Santa Rosa  
" X SJ-2  
" X Improved Pelican  
" X PI 317.334B  
" X UFV-1  
" X Hardee  
" X Lee 68  
" X Bossier  
" X Bonus  
Improved Pelican X Santa Rosa  
" X SJ-1  
" X Calland  
" X Chung Hsing #3  
" X HLS  
" X Hill  
" X Bonus  
" X Bossier  
" X PI 317.334B  
" X Hardee  
G-103 X Hardee  
" X Bonus  
" X Calland  
PI 382.181 X Santa Rosa  
" X Hardee  
" X Lee 68  
" X Bonus  
" X Calland  
" X Hill  
PI 317.334B X Hardee  
" X HLS

Santa Rosa	X Hardee
"	X Hill
"	X Lee 68
Chung Hsing #3	X HLS
"	X Hardee
Hardee	X SJ-1
HLS	X Bossier

Most of the populations generated by these crosses will be advanced to homozygosity by the single seed descent method in which each plant in a given generation is advanced to the subsequent generation by a single seed. This method maintains the genetic variability of hybrid populations while minimizing the amount of note taking and other time consuming operations in early generations. Preliminary strain evaluations will be conducted in Puerto Rico and advanced strains will be tested in selected environments in conjunction with Soybean Preliminary Observation Trial (SPOT) cooperators in various countries.

## 2. Germlasm Evaluation

Accessions from the USDA germplasm collection at Stoneville, Mississippi are being evaluated in Puerto Rico. Group VIII (211 lines) and Group IX (48 lines) were planted in June 1975 at the Isabela Substation of the Agricultural Experiment Station of UPR/Mayaguez. Group X (135 lines) was planted in August 1975 at Isabela. The last plots from the Group VIII and IX test were harvested in November; Group X lines are to be harvested in December and early January 1976. The following data are being taken from 3 meter long plots of each accession: date of flowering, flower color, date of maturity, height at maturity, lodging score, stem termination (growth habit), color and type of pubescence, pod color, shattering score, seed size, seed color, hilum color, and seed quality score. Observations are also recorded on reactions to disease and insect pests.

The tropical germplasm is also being screened for resistance to seed-borne bacterial and fungal pathogens which cause loss of seed quality and vigor, especially in tropical and subtropical environments. Samples of 100 seeds from each line are plated on potato dextrose agar (PDA) in petri plates and incubated at 30°C for 5-7 days. At the end of the incubation period, data are recorded on germination percentage and number and kind of organisms present. After this preliminary screening a more detailed evaluation will be conducted in which the better lines from the initial screening will be studied in a replicated test. This test will include delayed harvest techniques to determine which lines resist field weathering.

Other sources of germplasm are also being exploited. Material received for evaluation and increase in Puerto Rico include the following:

<u>Designation</u>	<u>Origin</u>
M-79	Nigeria
M-90	"
M-98	"
M-216	"
M-281	"
Chung Hsing #3	Taiwan
SJ-1	Thailand
SJ-2	"
Oribi	Rhodesia
Buffalo	"
Rhosa	"
Acc. #84	AVRDC (Taiwan)
Acc. #107	"
Acc. #242	"
Acc. #1612	"
Acc. # 1340	"
Acc. #BM8	"
Acc. #BM10	"
Acc. #BM11	"
PRNC-1	Puerto Rico Nuclear Center
PRNC-2	"
PRNC-5	"
PRNC-6	"
PRNC-8	"
UFV-1	Brasil
Mineira	"
Santa Rosa	"
PI 229.321	USDA-Stoneville
PI 171.451	"
PI 229.358	"

### 3. Segregating Populations

Although the hybridization-selection program was just begun in 1975 in Puerto Rico, several segregating populations were evaluated and plant selections made. The following populations or lines were planted at Isabela in June 1975 for observation and selection:

<u>Designation</u>	<u>Origin</u>
UFV-1 (BP) (Bulk F <sub>3</sub> )	Natural outcross, Puerto Rico
Calland X SJ-2 (Bulk F <sub>3</sub> )	USDA, Illinois
L72U-640 X SJ-2 (Bulk F <sub>3</sub> )	"
L72U-761 X SJ-2 "	"
L72U-758 X SJ-2 "	"
L70U-35-4 X SJ-2 "	"
Amsoy 71 X SJ-2 "	"
Williams X SJ-2 "	"
Beeson X SJ-2 "	"
Clark X PI 317.334B (45 F <sub>3</sub> derived F <sub>4</sub> rows)	Puerto Rico

In August 1975 the following F<sub>4</sub> and F<sub>5</sub> lines from the USDA soybean breeding project at Gainesville, Florida were planted for evaluation and individual plant selection:

<u>Designation</u>	<u>No. of lines</u>
Jupiter X F65-170	24
Jupiter X F66-1534	13
D66-12394 X (Bragg X PI 274.454)	1
Hardee X (Bragg X PI 274.454)	10
Hardee X (Hill X PI 274.454)	3
Hill X PI 274.454	1
Hardee X PI 274.454	3
Hill (2) X PI 274.454	2

The following F<sub>2</sub> populations were also received from the USDA Florida program and evaluated in August plantings at Isabela:

F66-1534 X F72-5514  
 F66-1534 X UFV-1  
 F67-1533 X UFV-1  
 UFV-1 X F72-5509  
 F72-5532 X (Jupiter X F65-170)  
 F72-5532 X (Jupiter X F66-1534)  
 F72-5509 X (Jupiter X F65-170)  
 F72-5511 X (Jupiter X F65-170)  
 F72-5509 X (Jupiter X F66-1534)  
 F72-5514 X (Jupiter X F66-1534)  
 F72-5514 X (Jupiter X F67-1533)  
 F72-5509 X (Jupiter X F67-1533)  
 F72-5511 X (Jupiter X F67-1533)  
 UFV-1 X (Jupiter X F66-1534)

The following bulk F<sub>3</sub> and F<sub>4</sub> populations were received from AVRDC and will be increased and observed in winter plantings in Puerto Rico:

S. P. Soybean X Palmetto  
 PI 200.492 X Huang-Pau-Tsu  
 CH #3 X PI 297.550  
 Wayne X 1340  
 PI 180.530 X TK #5  
 PI 232.901 X TN #4  
 PI 79.703 X Ch #3  
 PI 80.844-2.209 X CH #1  
 CH #1 X Shih shih  
 CH #3 X PI 230.973  
 R-10 X Lee  
 TN #4 X Yagil  
 S. P. Soybean X TN #4  
 CH #1 X PI 227.159  
 66-G-3 X (Jupiter X F67-1533)

#### 4. Preliminary Variety Trial

A variety trial including "tropical" cultivars and check varieties from the ISVEX trials was planted at Isabela in June 1975. Four-row plots and four replications were utilized. Data were recorded on yield and other agronomic characters. Although analyses are not complete, yields of the 12 varieties were as follows:

<u>Variety</u>	<u>Yield (kg/ha)</u>
Hardee	2766
HLS	2729
UFV-1	2439
Buffalo	2275
Chung Hsing #3	2060
Jupiter	1991
SJ-2	1982
SJ-1	1732
Santa Rosa	1689
Oribi	1632
Rhosa	1545
Williams	1166

LSD(5%) = 230 kg/ha

#### 5. Inoculation Trial

Tests were initiated in June 1975 at the Isabela and Lajas Stations to evaluate forms of commercial inocula in soils with a history of previous soybean crops and in virgin soils. Unfortunately the Lajas trials were lost during the floods accompanying tropical storm Eloise. Cultivars Williams and Improved Pelican and inoculation treatments normal peat, granular, and no inoculation were used in the test. The following data were recorded from the two Isabela sites and are being analyzed: nodule number and dry weight at peak bloom, flowering date, height, lodging, maturity date, yield, seed quality, and protein and oil percentage.

This study is designed to provide needed information on the necessity of inoculation with each soybean planting and on efficacy of inoculant forms.

Much has been accomplished in the area of facility development and acquisition of equipment. A seed laboratory including cold storage facilities for soybean seed was refurbished for use of the INTSOY program at the Isabela Station. Needed repairs and electrical installations were completed for a work/storage area, and drying facilities constructed. Two vehicles were purchased for project use in Puerto Rico. Plot equipment such as threshers, planters and mowers were acquired. Scales, balances, a moisture meter, and other equipment for the seed laboratory were also acquired. Most of the equipment and the two vehicles were purchased with funds provided by a Rockefeller Foundation grant.

A full-time field technician employed by UPR/Mayaguez, with costs reimbursed from grant funds, was added to the breeding project.

During the reporting period the following linkages were initiated:

- A. Asian Vegetable Research and Development Center (Taiwan) - germplasm exchange.
- B. International Institute of Tropical Agriculture (Nigeria) - germplasm exchange and a visit to Puerto Rico by Mr. D. Nangju, IITA agronomist.
- C. Instituto Interamericana de Ciencias Agricolas (Costa Rica) - germplasm provided for IICA program in the Dominican Republic.
- D. Instituto de Investigaciones Agropecuarias (Ecuador) - germplasm and information exchange, cooperative research through evaluation of tropical germplasm and breeding lines in Ecuador.
- E. Benchmark Soils Project (UPR/Mayaguez) - cooperative research and exchange of results related to soybean production.
- F. Instituto Nacional da Pesquisa da Amazona (Brasil) - germplasm exchange.
- G. Puerto Rico Nuclear Center (UPR/Mayaguez) - testing of lines from PRNC's induced mutation studies.
- H. USDA/ARS (Florida) - evaluation and selection of tropical lines in Puerto Rico in cooperation with Dr. Kuell Hinson.
- I. Division of Tropical Research, Tela Railroad Company (Honduras) - exchange of data and information.
- J. Facultad de Agronomia, Universidad de Panama - exchange of data and information.

Development of linkages to other institutions, programs and scientists is a natural function of this output sector. Although a more comprehensive description of the way in which the program promotes and pursues linkage and network development is contained under Output V, it may be mentioned here that the breeding program initiated linkage contacts with two international centers, three national institutes, three universities, and the U.S. Department of Agriculture during the report period.

### Output III. Expanded Advisory and Consultation Capability

The objective of this output is to develop and expand competence among core staff and others to respond to a variety of requests for expert advice or assistance in a number of problem areas including problem identification and analysis, project design and operation and program evaluation.

Progress toward this output goal was made from non-grant sources. The primary source was two AID funded Basic Ordering Agreements through which several task orders to provide specific services to country missions were issued. They were:

1. BOA-73-30 & Task Order #1 Guyana (completed)

The objective was to assist the Government of Guyana to diversify its agriculture, specifically soybean development, by 1) developing a comprehensive time-phased plan for a soybean development program emphasizing research, material exchange, production management and training and 2) evaluating manpower and training needs for an integrated research-production-marketing-utilization soybean program involving related farmer, agri-business, industry and government institutions working cooperatively under national policy guidelines developed by the Guyana Ministry of Agriculture. INTSOY scientists were joined by personnel from USDA and private industry in staffing this project which commenced September 1973 and was completed in August 1975.

2. BOA-1109 Task Order #2 Peru (ongoing)

The objective is to assist the Government of Peru to improve the management of human and financial resources for more effective performance in a program of soybean research, marketing and utilization. This project uses core staff, county-based extension staff and private industry scientists as members of the team. The project commenced January 1975 and extends through December 1976.

3. BOA-1109 Task Order #3 Ecuador (under negotiation)

The objective will be to give research and educational assistance to the Government of Ecuador in developing an improved soybean program by designing a package of practices appropriate to the farmers' environment. A four man team, all fluent in Spanish, has been recruited and is comprised of core staff from UIUC, the University of Puerto Rico, Mayaguez Campus and the Potash Institute, Atlanta, Ga. The first contingent of the team will travel to Ecuador in October/November 1975 and the project will be completed by December 1976.

4. BOA 1109 Task Order #4 Zaire (negotiated)

The objective is to assist in determining the feasibility of a soybean industry for the Republic of Zaire, recommend an appropriate research system to develop its production and name and make recommendations for the development of other leguminous crops. INTSOY provided one team member from an associated institution to a three man team comprised of an AID officer, a 211(d) professor from the Tropical Soils Consortium and the INTSOY representative. The study is to be conducted in November 1975.

5. BOA 1109 Task Order #5 Thailand (under negotiation)

The objective is to conduct a feasibility study dealing with the inoculant component of a comprehensive seed development project. INTSOY will provide a two-man team recruited from an associated university to conduct the study which will take place in the first half of calendar 1976.

A central feature of INTSOY participation in Task Order activities has been the ability to assemble teams of highly qualified personnel from among the developing network of international soybean scientists. Our capability to respond to requests to advisory services has been enhanced by this mechanism. On the five projects listed above INTSOY core staff served with colleagues from AID/W, USDA/ARS, University of Puerto Rico, Mayaguez Campus, University of Illinois and U.S.D.A. Cooperative Extension Service, Iowa State University, Cornell University, Texas A&M University, Mississippi State University, The Potash Institute, Agricultural Laboratories, Inc., and Research Seeds, Inc. as well as with a retired vice president of Swift Edible Oils, to provide a wide array of experience to specific problems. This pattern of operation, which has worked well to date, will continue to provide an expanding manpower base from which INTSOY teams can be assembled.

Output IV. Improve and Expand Information Management Capability

This output goal seeks to develop and expand the knowledge base and increase capability to provide advisory and consulting services by the orderly and systematic collection, analysis and distribution of information, data and materials relative to soybean development and use. Eventually four systems will be developed:

- A. Soybean germplasm data bank;
- B. Reference Collections of soybean pests;
- C. INTSOY publications series; and
- D. Soybean literature compilation, retrieval and delivery

Progress was made on items A, B, and C above although grant funds were used in partial support of A and B only.

A. Soybean germplasm data bank

The soybean germplasm data bank is maintained through the Taxonomic Information Retrieval System (TAXIR), a system for coding germplasm information on punch cards for quick retrieval. Information which is entered concerns five sources of soybean germplasm: 1) named soybean varieties; 2) type collection lines; 3) species collections; 4) plant introduction; and 5) forage collections.

During the report period, work centered on refining material already stored in the data bank, entering of new accessions, and adding new information to the system. Sixty-six new accessions were added during

the report period, bringing the total number of entries as of October 1975 to 3732. The new accessions include recently released soybean varieties, plant introductions and wild species closely related to the cultivated soybean.

The number of possible characters recorded for each entry was increased from 145 to 172. Most of these have been devoted to disease responses as results of screening tests for several diseases not previously assayed became available. Information from a screening survey conducted in Taiwan for rust resistance of 3000 soybean varieties and plant introductions was added to the appropriate entries and stored in the bank for ready reference. Work was nearly completed on a publication on morphological descriptions and responses to foliar, stem, and root diseases of U.S. and Canadian soybean cultivars that will be published in early 1976 in the INTSOY publication series.

#### B. Reference collections of soybean pests

A comprehensive and accessible soybean information system is vitally important to the improvement and development of plant protection techniques for increasing the production of soybeans in tropical and subtropical areas. The response capability and success of any research program, in great part, can be measured by its available resource information, the organization of the information, and the utilization of the information by its research and outreach staff in association with other entities in the international soybean network.

The Illinois Soybean Entomology Research Team at UIUC and the Illinois Natural History Survey has taken the international leadership in developing and mobilizing two separate, but complementary, information systems for soybean protection research. They are the Soybean Insect Research Information Center (SIRIC) and the International Reference Collection of Soybean Arthropods (IRCSA). Grant and research contract funds have been used to partially support both systems.

#### Soybean Insect Research Information Center (SIRIC)

SIRIC operates an information storage and retrieval system for all literature of arthropods associated with soybeans. The objectives of SIRIC are to:

1. Compile the literature on soybean arthropods.
2. Respond to researchers in the form of computer searches for the specific topics and by furnishing copies of documents on file.
3. Compile and publish comprehensive bibliographies on key species.
4. Establish a data bank for bibliographic research leading to the production of review articles and monographs covering major areas of soybean entomology.

Currently, the holdings of SIRIC approach 12,000 documents. Copies of these documents are kept on file, and bibliographic references to

these documents are stored in a computerized file using Fortran IV language for later retrieval on an IBM 360/75 computer. These references are gathered and selected in various ways: 1) routine checking of the standard abstracting and indexing aids; 2) methodic scanning of current issues of specialized journals; and 3) careful checking of every document that is added to the system for additional citations and references.

Criteria for the inclusion of publications in the SIRIC system are two basic words: soybean and arthropod, including certain, lower taxonomic categories of the latter. Part of the merit of the system lies in the fact that each reference is carefully verified for accuracy and relevance to the established criteria. Great effort is made to obtain copies of all titles listed in the system. These are filed and made available upon request to user of SIRIC.

SIRIC aims to serve the immediate and long-range needs of soybean scientists working in other USA and foreign institutions. Personalized service is provided to any interested researcher. Searches are formulated within particular subject parameters. To this end, a hierarchical code-word description thesaurus (HCD) has been prepared.

Bibliographies have been published on the Mexican bean beetle, Epilachna varivestis; southern green stink bug, Nezara viridula; bean leaf beetles, Cerotoma trifurcata and C. ruficornis; and velvetbean caterpillar, Anticarsia gemmatilis.

Within the last six months, SIRIC has carefully reassessed its internal operating priorities. Previously, the primary emphasis was on the compilation and publication of bibliographies of major soybean pests, and secondly, on updating the system. Due to the complexity of the bibliographies, the updating lagged. Equal emphasis now is being placed on updating. Following the established goals of the Center, the literature on all arthropods associated with soybeans is collected. However, the species listed below were selected for in-depth searches due to their importance. Searches for references on these species are based on the species' names. References on all other arthropod species are searched using "soybean + arthropod species" as the key words.

List of species for in-depth bibliographical searches:

Soybean pests

Acrosternum hilare  
Anticarsia gemmatilis  
Bemisia tabaci  
Cerotoma (all species)  
Colaspis brunnea  
Colias eurytheme  
Diabrotica longicornis  
Diabrotica undecimpunctata howardi  
Diabrotica virgifera  
Elasmopalpus lignosellus  
Empoasca fabae  
Epilachna varivestis  
Heliothis virescens

Heliothis zea  
Lygus lineolaris  
Nezara viridula  
Plathypena scabra  
Pseudoplusia includens  
Sericothrips variabilis  
Tetranychus urticae

Natural enemies

Geocoris (all species)  
Nabis (all species)  
Orius (all species)  
Podisus maculiventris

Research Interest profiles were compiled for all soybean entomology team members of University of Illinois, Urbana-Champaign, and the Illinois Natural History Survey. These profiles will facilitate the development of a current awareness service within the scope of SIRIC.

Several procedures have been reorganized and the thesaurus is undergoing a major revision. Accession numbers for the reprints had been assigned by genus using a code of 2 letters and 4 numbers, but are being changed to straight numerical codes. The taxonomic section of the thesaurus is being edited. Of the 4,000 species listed, 5 percent contained spelling errors, 96 species were misplaced from the proper order and family, and many synonyms were treated as valid species. For these corrections, the SIRIC librarians worked closely with Dr. George L. Godfrey and Mr. John K. Bouseman from the International Reference Collection of Soybean Arthropods (IRCSA). As a consequence of the efforts to update the system, an influx of foreign literature was noted, mainly from Brazil. This literature provided over 200 species not yet recorded in SIRIC's taxonomic lists. The geographical section of the thesaurus has undergone a complete revision and updating. Many countries and the states/provinces of the major soybean producing countries were added. This totaled some 300 new entries. The general descriptors section of the thesaurus will be the object of a major revision in the near future. Discussion of possible revisions of the computer programs are underway.

Currently there are 11,517 records on tape. Input has slowed during the reorganization period, but will soon pick up including work on a Heliothis zea bibliography. An associated project of the Illinois Natural History Survey provides SIRIC with many articles and citations through the bibliographies on which it is currently working.

A descriptive brochure of SIRIC was prepared in July 1975 and distributed at the First World Soybean Research Conference held at the University of Illinois at Urbana-Champaign in August 1975. The brochure has greatly increased the awareness of soybean researchers of the mission of SIRIC.

SIRIC only recently moved into new facilities within the Natural Resources Building at the University of Illinois, Urbana-Champaign campus.

#### International Reference Collection of Soybean Arthropods (IRCSA)

The second soybean information system is the International Reference Collection of Soybean Arthropods. As stated earlier these collections complement each other. The collection functions as a depository for soybean field and insect data which is being gathered through a cooperative international survey of arthropods associated with soybeans. The collection's main objective is to enhance the response capability of the soybean entomologists at UIUC and the Illinois Natural History Survey by compiling baseline data useful in the analysis of the soybean

fauna and in the development of soybean insect pest management programs. This includes an arthropod identification service for soybean researchers and producers.

The specialists associated with the International Reference Collection of Soybean Arthropods presently have examined approximately 100,000 specimens representing 1,900 species since the collection was established in 1970. The material has been received from 26 countries and 22 states in the U.S.A.

The focus of the collection's activities for the past 12 months has been in Latin America. During this period numerous shipments of soybean insects have been received either as part of the Illinois Soybean Entomology Team's cooperative international survey or as part of specific identification requests. For instance, in recent months, samples from Brasil (47), Puerto Rico (26), Argentina (17), Bolivia (5), Nicaragua (4), and Peru (2) were received through efforts of persons involved in the survey. In addition, 242 species of Brazilian soybean insects were submitted for identification or identity verification by E. A. Heinrichs of Projeta Nacional da Soja - DNPEA/USAID. Specimens routinely are identified for INTSOY staff members at UIUC and at the University of Puerto Rico, Mayaguez.

To provide accurate and reasonably fast identifications for some soybean insects, outside specialists, who are more familiar with particular insect groups from specific neographical areas, need to be consulted. The International Reference Collection of Soybean Arthropods maintains an extensive data file on the available specialists. This data bank plus the identification network which has been developed is a tremendous asset to the collection's services. For example, during the past six months 1,500 identified specimens were received through this network and another 2,000 specimens have been sent to collaborators for determination. Ninety-one outside specialists cooperate in this identification network, and about half of these are associated with foreign institutions.

Experience with this identification network has revealed that certain insect groups are extremely difficult to identify. Either there are no specialists currently working with these groups or the demand for the services of the specialists is so great that they cannot commit themselves to another project. Future plans for the International Reference Collection of Soybean Arthropods should include provisions for providing one-year postdoctoral positions to systematists for the purpose of identifying and curating certain insect groups for the collection. Part of the responsibilities would be to investigate and revise the systematics of the designated insect groups.

The data being compiled by the International Reference Collection of Soybean Arthropods are stored using Fortran IV language for later retrieval on an IBM 360/75 computer. The programs that handle these data presently are separate from the programs used by SIRIC. The practicality and feasibility of integrating the two sets of programs is being investigated.

The facilities, programs, and personnel of SIRIC and the International Reference Collection of Soybean Arthropods were used and participated in the on-campus short course TC 120-6 "Technical and Economic Aspects of Soybean Productions", sponsored by AID/USDA and INTSOY. SIRIC's assistance was in the form of the distribution of key literature and a computerized bibliography of the genus Spodoptera (Lepidoptera: Noctuidae). The personnel of the Collection presented materials on the recognition of major insect pests and assisted in the entomology field trips to recognize and assess feeding damage by soybean insects. Insect specimens from the Collection were used in the lecture demonstrations.

C. INTSOY publication series

The INTSOY publications series that was initiated through support of UIUC, soybean research contract AID/CM/ta-C-73-19, and some AID General Technical Services funds has added to the joint UIUC and UPR-MC soybean response capability as well as provide a means of making research results readily available to those interested in tropical and subtropical production and use of soybeans. Nine publications have either been issued or are in final stages of production. They include:

- Godfrey, G. L. (ed.), Selected Literature of Soybean Entomology, University of Illinois International Agriculture Publications, INTSOY Series No. 1. 221 + xxi pp. April 1974.
- Proceedings of the Workshop on Soybeans for Tropical and Subtropical Conditions. University of Puerto Rico, Mayaguez Campus. INTSOY Series No. 2. 184 pp. May 1974.
- Williams, S. W., and Rathod, K. L., A Case Study of Expeller Production of Soybean Flour in India. College of Agriculture, University of Illinois at Urbana-Champaign. INTSOY Series No. 3. 12 + iii pp. April 1974.
- von Oppen, M. K., Soybean Processing in India: A Location Study on an Industry to Come. College of Agriculture, University of Illinois at Urbana-Champaign. INTSOY Series No. 4. 35 pp. July 1974.
- Williams, S. W., Hendrix, W. E., and von Oppen, M. K., Potential Production of Soybeans in North Central India. College of Agriculture, University of Illinois at Urbana-Champaign. INTSOY Series No. 5. 21 + iv pp.
- Whigham, D. K. (ed.), Soybean Production, Protection and Utilization- Proceedings of a Conference for Scientists of Africa, the Middle East, and South Asia. College of Agriculture, University of Illinois at Urbana-Champaign. INTSOY Series No. 6. 266 pp. March, 1975.
- Sinclair, J. B., and Dhingra, O. D., An Annotated Bibliography of Soybean Diseases. College of Agriculture, University of Illinois at Urbana-Champaign. INTSOY Series No. 7. 280 pp. December 1975.

Whigham, D. K., International Soybean Variety Experiment, First Report of Results. College of Agriculture, University of Illinois at Urbana-Champaign. INTSOY Series No. 3. 161 pp. October 1975.

Hymowitz, T., Carmer, S. G., and Newell, C. A., Soybean Cultivars Released in the United States and Canada: Morphological Descriptions and Responses to Selected Foliar Stem and Root Diseases. College of Agriculture, University of Illinois at Urbana-Champaign. INTSOY Series No. 9 (to be released in early 1976).

None of these publications have been reproduced from grant funds although personnel supported from grant funds made significant contributions to Nos. 1, 2, 6, 8 and 9. The interest in and demand for the series publications has demonstrated the important place of the series in meeting informational needs of soybean workers. With the expected expansion of grant program operations in 1975/76 editing, production and distribution functions will receive greater attention and support.

The further development of the three information management and delivery capabilities reported above, plus the integration of a system for the compilation retrieval and delivery of soybean literature, will combine to make an effective means of dissemination of valuable information to soybean workers worldwide.

#### Output V. Expanded and Strengthened Linkages and Activities

The objective of this output goal is to develop UIUC, with the University of Puerto Rico, Mayaguez Campus, to serve in an intensive leadership role in mobilizing U.S. resources as the hub of an international network of organizations and individuals linked in ways to provide means for stimulating cooperative efforts, insure effective utilization of program outputs and contribute to sustaining future soybean development programs for the tropics and subtropics.

Development of linkage mechanisms has gone forward at an astonishing rate with relatively little grant support. UIUC, with the associated USDA-ARS Northern Soybean Laboratory (Urbana) and the Northern Regional Research Laboratory (Peoria), has well developed U.S. research, educational and private sector linkages. The following types of linkages form the elements of the soybean development and utilization network.

Domestic linkages. The principal linkage for program development and administration is between UIUC and AID. The program works closely with the Office of Agriculture of the Bureau for Technical Assistance. Similar close working relations are being developed with the AID Regional Bureaus and with AID missions in cooperating countries for identification of soybean development opportunities and problems, establishment of relationships with country organizations and individuals and for evaluation of development projects and activities in the tropics and subtropical LDCs.

The second principal linkage for program development and outreach activities is with the University of Puerto Rico, Mayaguez Campus,

providing the opportunity to add major subtropical environment dimension, increasing response capability in the soybean protection areas, and with special language and geographical advantages for serving the Caribbean area, Central and South America.

A third principal linkage is maintained with the Agricultural Research Service, U.S. Department of Agriculture primarily at the Urbana, Illinois and Stoneville, Mississippi Regional Soybean Laboratories, the Mayaguez Institute of Tropical Agriculture, and the Northern Regional Research Laboratory, Peoria, and also through personnel and facilities in Washington, D. C., Beltsville, Maryland and the ARS scientists at Illinois, Puerto Rico, and other U.S. universities.

The already well-established relationship with soybean research and education personnel at U.S. universities is being strengthened and focused in a network oriented toward soybean production and use in the tropics and subtropics. Universities in the leading soybean producing states have a special place in the U.S. part of the network. Several other universities have roles to play through special interests and competencies. Special relationships are being developed with individual and consortia of universities with special problem international interests that interface with soybeans.

Domestic linkages are not limited to government agencies and universities. Private foundations and private sector interests in soybean production, marketing, and use are also included as a vital part of the soybean network where there is the interest and capacity to contribute to soybean development in tropical and subtropical areas.

International linkages. Primary international linkages have been or are being established with the international research centers that include soybeans as a part of their research and outreach programs and with other centers that have an interest in soybeans through their multiple cropping and cropping systems programs.

LDC linkages. Linkages with the institutions and professional personnel of the less-developed countries of the tropics, either directly or through regional and international organizations, are of prime importance. In the final analysis, national organizations must be effective for small farmers to increase production of food and for the rural and urban poor to have improved protein and energy sources. INTSOY has established relationships with more than 90 countries through the INTSOY Soybean Variety Experiment (ISVEX) program, AID basic ordering agreement task orders, USDA-AID soybean processing and production training courses and soybean projects supported by national and international organizations.

The INTSOY Newsletter. A one-sheet quarterly issued publication, the INTSOY Newsletter was first issued on an experimental basis in August 1974 with support from UIUC and the soybean research contract. The first mailing went to approximately 500 individuals and institutions.

Experience has shown this to be an effective device for providing information to soybean workers of the tropics and subtropics and their institutions. It also has assisted in communication and building linkages with U.S. institutions and international organizations interested in providing technical assistance in soybean production and use. Requests by individuals or institutions to be added to the free subscription list have brought the number of receivers to just over 1100. While grant funds have not been used in the publication of the INTSOY Newsletter, program activities have been publicized.

Formalizing linkages with national and international organizations. INTSOY has demonstrated that administrative mechanisms can be developed for cooperation with national and international organizations. One effective means is the general Memorandum of Understanding with Letters of Agreement to provide for specific projects and activities. The flexibility of this mechanism should be noted. Memoranda of Understanding have been completed with the following organizations:

1. University of Puerto Rico, Mayaguez Campus. This is the primary relationship in INTSOY providing for joining of the temperate and tropical based universities.
2. International Institute of Tropical Agriculture (IITA), Nigeria. This provides a means for INTSOY to work with and through an international center with soybeans as part of their mandate. It is anticipated that an INTSOY research and outreach team, fully integrated with the IITA Grain Legume Improvement Program staff, will be based at IITA. However, separate funds to implement work under this Memorandum have not yet been identified.
3. Asian Vegetable Research and Development Center (AVRDC), Taiwan. General objectives are similar to IITA but there are funding and other questions associated with AVRDC's role as an "international center" that are constraints to joint program development.
4. Fundacao Instituto Agronomico do Parana (IAPAR), Brasil. This provides the opportunity to join with the second most important soybean producing country to expand the use of soybeans for human food, both there and in low-income countries of the tropics and subtropics. The recent location of the National Soybean Center at IAPAR provides expanded opportunities for cooperative efforts in serving the needs of tropical and subtropical countries, particularly in South America.
5. Office of Rural Development, Ministry of Agriculture and Fisheries, Korea. Korea has had significant experience in soybean production and has an aggressive crop development program that includes soybeans. Cooperation here is planned as a technological bridge between the temperate and tropical areas of the Orient and Asia.

6. College of Agriculture, University of Tehran, Karaj, Iran and College of Agriculture and Animal Husbandry, Rezaiyeh, Tehran. Memoranda of Understanding have been completed with these two colleges of agriculture and discussions are well advanced with other Iran organizations. The objective is to develop cooperative research, education, and development work on expanded use of soybeans and production under irrigated conditions typical of Middle East and other similar conditions.

Discussions are underway with personnel of other organizations including additional international centers with interests in soybeans because of the crop being part of their mandate, relations between soybeans and other legumes, or farming systems in which soybeans have a place.

Other INTSOY Linkages. INTSOY has a host of relations with organizations and individuals demonstrating that a basic organizational concept of cooperation with all who have interest congruent with our mission "to expand the use of soybeans for human food."

The following is a list of these organizations.

1. Organizations in 90 countries through International Soybean Variety Experiment (ISVEX).
2. Southeast Asia Regional Center for Graduate Study and Research In Agriculture (SEARCA), Philippines (ISVEX).
3. International Rice Research Institute (IRRI), Philippines (ISVEX).
4. Food and Agriculture organization of the United Nations (FAO), Rome (ISVEX, Sri Lanka).
5. Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres (IRAT), Paris (ISVEX, IITA, individual country programs).
6. Nitrogen Fixation by Tropical Agricultural Legumes (NIFTAL), University of Hawaii/AID (microbiology, rhizobium japonicum, etc.).
7. USDA Regional Soybean Laboratories at Urbana and Stoneville, Mayaguez Institute for Tropical Agriculture, other USDA personnel.
8. Kansas State University, Food and Feed Grain Institute.
9. Mississippi State University, Seed Technology Laboratory.
10. University Consortium on Soils of the Tropics (Cornell University, University of Hawaii, North Carolina State University, Prairie View A & M College, University of Puerto Rico).
11. North Carolina State University--NCSU/AID root-knot nematode project.

12. U.S. university personnel on Task Orders and other projects-- Iowa State University, Purdue University, Texas A & M University, University of Florida, Cornell University, and Mississippi State University.
13. Private sector employers on Task Orders and other projects-- Swift and Company, Potash Institute of North America, Agricultural Laboratories, Inc., and Soy Pro, International.

Regional conferences and training courses. Two major conferences have been held for soybean scientists and a third is scheduled for early 1976. They are:

1. Mayaguez, Puerto Rico (for the Caribbean, Central and South America)--February 4-6, 1974. 71 participants from 12 countries.
2. Addis Ababa, Ethiopia (for Africa, the Middle East, and South Asia)-- October 14-17, 1974. 97 participants from 27 countries.
3. Chiang Mai, Thailand (for Asia and Oceania)--February 23-27, 1976. (AVRDC and Royal Thai Government - joint sponsors.)

These conferences have been very effective as a means of encouraging exchange of ideas and information among soybean workers across national lines. The proceedings (INTSOY Series 2 and 6) are constantly being requested.

Two nondegree training courses were established in 1975 under the USDA/AID training program format.

1. Soybean Processing for Food Uses--five-week course with 13 trainees from 10 countries.
2. Technical and Economic Aspects of Soybean Production--18-week course with 16 participants from 15 countries.

These courses were well received and have resulted in soybean workers with whom we are now cooperating in country programs. The courses will be repeated in 1976. Plans are underway for offering more specialized courses on a regional or national basis.

These courses are supplementary to degree work available at the University of Illinois and University of Puerto Rico and many other universities with soybean expertise.

Grant support of these two useful linkage-building activities were limited to salary of grant personnel who participated by reporting on grant activities, or as instructors or resource persons.

There is little INTSOY activity that does not result in building or strengthening linkages in the soybean network.

#### E. Impact of Grant Supported Activity in Achieving Grant Purposes

Grant funding has had a significant impact in developing UIUC response capability in soybean production and use. The primary thrust of the grant program, before the re-design exercise, was the improvement of soybean genetic technology and graduate education, with the development of information systems a subsidiary goal.

The introduction of grant supported activities has had a desirable major ripple effect in the total INTSOY program. The INTSOY core staff was increased by adding a highly qualified, internationally experienced soybean breeder who was posted at the University of Puerto Rico, Mayaguez Campus. In addition to the program of soybean genetic improvement reported in Objective 1, he has served as on-site liaison with the soybean coordinator for UPR Mayaguez and INTSOY headquarters. Coordination of program activities with the complementary 211(d) grant to the University of Puerto Rico (AID/CM/ta-6-73-50) in the area of plant protection has been facilitated. The Puerto Rico based soybean breeder, with the grant program directors and ISVEX leader, have been constantly active in establishing contacts with scientists working in international research centers and in national soybean development programs. The breeder and INTSOY Puerto Rico Associate Director have been highly effective in the Central and South American region.

Graduate education opportunities have been expanded due to grant program inputs. Support has been made available to four students who are interested in a professional career in soybean development, one of whom is from an LDC with considerable potential for expanded soybean production and use. Grant funds have made possible off-campus thesis research of one student who spent 15 months in Puerto Rico. As a spin-off from that training experience and from the close coordination of interests in plant disease control under the companion 211(d) grant to UPR, a second graduate student is engaged in thesis research at Mayaguez supported from other than grant funds. A third student is tentatively scheduled to study in Puerto Rico in the coming year.

Nor is the graduate education activity one way flow. Three students from UPR Mayaguez are pursuing graduate programs at UIUC at this time in the area of crop protection. Grant funds are not used in their support.

With the expansion of the grant program in 1975/76 as a result of the re-design exercise, the influence of grant activities on the INTSOY program will be even more pronounced. Staff additions, language training, talent banking, state of the arts information, and improved special training opportunities can be expected to significantly increase UIUC response capability over the next three years of grant operations.

#### F. Other Resources for Grant Related Activity

INTSOY is conceived as a programmatic approach to international soybean development. As such all elements of the program are supportive of a common goal, that of cooperating with international and national

organizations to expand the use of soybeans for human food.

Grant related activities have been supported from a number of sources, state, federal, private and international. UIUC provides administrative costs, access to laboratories, equipment, computers, research facilities and libraries, office and classroom space and consulting service of faculty in fields related to grant activities.

The Agency for International Development, through a number of instruments, assists in grant-related activities associated with the five outputs discussed in Section D. Complementary activities of research contract AID/CM/ta-C-73-19 contribute to all five outputs. Task orders performed under basic ordering agreement AID/TA/BOA-1109 strengthen objectives II, III and V particularly. General technical services grants in support of on-campus short courses contribute to objectives I and IV and complement objectives III and V.

Private contributions, chiefly a one-time grant from the Rockefeller Foundation, provided needed equipment in support of objective II, provided some graduate stipends complementary to objective I and partially supported some information system development in objective IV. It further provided impetus to new work in seed storage and seed quality maintenance at UIUC and UPR, Mayaguez that will be incorporated in the extended research contract.

Participation by international organizations in outreach activities is encouraged by INTSOY. The United Nations Development Program and Food and Agricultural Organization of the United Nations are supporting INTSOY assistance to the Government of Sri Lanka in a comprehensive program of soybean development from production through utilization in the diets of the rural poor. Information from this project will be especially useful in the development of soybean genetic technology (objective II). Training will feature special opportunities for Sri Lanka nationals at the G. B. Pant University of Agriculture and Technology, India, and will assist in the development of UIUC competence to plan and conduct regional training in cooperation with collaborating institutions (objective I). Service in Sri Lanka by INTSOY core staff and associated personnel will materially increase UIUC competence to advise and consult on national development programs (objective III). Linkages with organizations within the United Nations family and with other donor agencies and governments are being fostered (objective V). Information on a wide spectrum of germplasm improvement and disease and insect susceptibility or resistance will augment the data stored in information systems and will be made available to interested scientists (objective IV).

In turn, the grant program re-design will, if the design is approved and the additional resources are made available on a timely basis to implement the expanded program, effectively increase the capacity of UIUC to respond to the types of activities described in this section.

#### G. Utilization of Institutional Response Capabilities in Development Programs

A tabular resume of requests for assistance is provided in Table III-A. Only major project requests are reported, thus the table does not fully reflect the constant flow of requests to the INTSOY directorate and staff for publications, seed samples, data on varietal performance, disease and insect identification, information on types and preparation of soy food products and general information.

Programmatic assistance was provided to all requesting organizations, however, this could be done only by drawing on the reservoir of expertise at UIUC and among USDA-ARS personnel, many of whom have not been supported with grant or other funds intended to be used for development of the LDCs of the tropics and subtropics.

Included in the more than 1500 graduate students from over 90 foreign countries studying at UIUC were approximately 890 male and 280 female graduate students. Agricultural programs were the choice of many of these students. A listing of graduate students by country for the Fall 74 and Spring 75 semesters is attached as Appendix B.

#### H. Next Year's Plan of Work and Anticipated Expenditures

Since the inception of this grant, the first priority has been given to generate hybrid populations leading to the development of soybean varieties adapted to tropical and subtropical conditions. Sustained priority in this area is warranted. Through the aegis of the global variety experiments, and a second-generation program of evaluation trials, parent lines for breeding stock are being selected. Of increasing priority interest is the protection of soybean plants from diseases and pests, work that is characterized by extremely close coordination and cooperation between UIUC and UPR-MC. The work will be increasingly closely coordinated with other collaborators in USDA, other U.S. universities, international centers and LDCs.

Among other priorities are the following: state of the arts studies in soybean production in the LDCs of the tropics and subtropics and of low level mechanization needs under small farm conditions; increased numbers of graduate students supporting faculty members on release time; increasing capability for on-campus and on-site training; international soybean personnel talent banking; language training for UIUC-INTSOY staff; soybean information collection retrieval and delivery; and service in a leadership role in developing an international network of organizations and individuals oriented toward production and use of soybeans by rural and urban poor of the tropical and subtropical LDCs.

To achieve progress toward these objectives will require that the program re-design be approved by AID, and the budgetary resources necessary to address the expanded program goals be made available at the beginning of the third year of the program. Delays in either action will adversely affect program effectiveness.

Individual work plans by objective and activity are attached as Appendix C. A summary work plan by objective, activity and cost is presented below:

	<u>Activity</u>	<u>Objective</u>
<u>Objective I -</u> <u>Education and Training</u>		\$ 24,820
A-1 Graduate students supporting staff to develop soybean expertise and knowledge response capability.	\$ 10,410	
A-2 Determining needs for on-campus short courses and planning specialized courses	7,700	
A-3 Planning for on-site short courses for trainees of LDCs.	5,200	
A-4 Evaluate experience of 3 regional conferences & determine needs for & plan integrated program of seminars, workshops & conferences	1,500	
A-5 Special individual training	---	
 <u>Objective II -</u> <u>Extended Knowledge Base and Research</u>		 105,030
A-1 Development of soybean genetic technology.	44,520	
A-2 Technical & economic aspects of soybeans in cropping systems	34,430	
A-3 Low level mechanization	26,080	
 <u>Objective III -</u> <u>Advisory Capacity</u>		 44,650
A-1 Talent bank of international soybean personnel	8,440	
A-2 Language training of UIUC-INTSOY personnel	5,120	
A-3 Salary support for staff release time to increase staff availability for responding to LDC requests	31,090	
 <u>Objective IV -</u> <u>Information Capability</u>		 34,540
A-1 Soybean germplasm data bank (TAXIR)	12,500	
A-2 Soybean literature compilation, retrieval and delivery capacity	9,090	
A-3 Reference collections of soybean pests (SIRIC & IRCSA)	10,630	
A-4 INTSOY publications series to provide information on soybean production and use.	2,320	

	<u>Activity</u>	<u>Objective</u>
Objective V - <u>Linkages and Networks</u>		\$ 13,355
A-1 Liaison with USDA-ARS germplasm bank of NRSL and communication with other U.S. organizations	\$ 5,045	
A-2 Linkages with international research centers and other international organizations	3,000	
A-3 Linkages to national agricultural research, education, training and development organizations in LDCs.	---	
A-4 Improve production and distribution of INTSOY Newsletter	5,310	
		222,395

I. Involvement of Minority Personnel and Women

The grant has employed on its professional staff an American Indian of the Potawatomi tribe of Oklahoma, Dr. George Godfrey. Grant expansion will provide opportunities for employment of women under Objective IV, Information Management Capability working with the soybean germplasm bank (TAXIR) and the reference collections of soybean pests (SIRIC and IRCSA). Women will also be utilized in a professional capacity in Objective V, Linkages and Networks, in the improvement of production and distribution of the INTSOY Newsletter.

The University of Illinois has, on each of its three campuses, an affirmative action program to assure opportunities for employment of minority personnel and compliance with Title IX. Each program is supervised by a campus level officer with coordination by a general officer of the University. The program is on file with a number of departments of the United States Government.

Table I  
Distribution of 211(d) Grant Funds and Contributions From Other Sources of Funding

Reporting Period 01 Oct 74 to 30 Sept 75

Grant Objectives/Outputs	Period Under Review	211(d) Expenditures			Non 211(d) Funding** Amount
		Cumulative Total	Projected Next Year	Projected to End of Grant	
I Education & Training	\$ 17,755	\$ 28,551	\$ 24,820	\$ 77,850	Impossible to assess with any degree of accuracy due to multi-purpose nature of non-grant funded activities. See Narrative Section D and Table III for examples and magnitudes of non-grant funding.
II Extended Knowledge Base	52,639	91,721	105,030	131,370	
III Advisory Capacity	11,151	11,151	44,640	89,430	
IV Information Capability	9,313	9,313	34,540	73,080	
V Linkages & Networks	13,371	13,371	13,355	27,680	

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TOTAL

\* These figures are your best estimates

\*\* Include other AID projects if relevant

Table II - A

211(d) Expenditure Report

Actual and Projected Summary

Under Institutional Grant #AID/esd- CM/ta-G-73-49

Reporting Period 01 Oct 74 to 30 Sept 75

	Expenditures to Date		Projected Expenditures				Total
	Reporting Period	Cumulative Total	Y E A R				
			2	3	4	5	
Personnel (including stipends)	\$ 67,420	\$102,468	---	\$154,985	\$152,940	\$134,925	\$545,318
Fringe	4,678	7,443	---	23,160	21,735	18,810	71,148
Travel	8,883	16,319	---	21,500	14,500	9,500	61,819
Research Support	23,248	27,877	---	22,750	25,000	22,000	97,627
	\$ 104,229	\$154,107		\$222,395	\$214,175	\$185,235	\$ 775,912

TABLE II - B

211(d) Expenditure Report

Reporting Year Detail

Under Institutional Grant #AID CM/ta-G-73-49

Reporting Period 01 Oct 74 to 30 Sept 75

I. Salaries				\$ 67,420
A. Academic				
Thompson	.25	none		
Hittle	.75	\$ 19,295		
Godfrey	.50	8,058		
Whigham	.25	4,691		
Paschal	1.00	17,621		
B. Stipends				
Nissly	USA	8,995		
Tedia	India	4,527		
Orf	USA	3,850		
Sammons	USA	383		
II. Fringe				4,678
III. Travel				8,883
A. Domestic (Includes P.R.)		4,068		
B. International		4,815		
IV. Research Support				23,247
A. Hourly Help		5,577		
B. Materials & Supplies		17,670		
				<hr/>
				\$ 104,228

Table III - A

Requests For Assistance Received During Reporting Period 01 Oct 74 to 30 Sept 1975

## A. Requests Attended

Description of Request for Assistance	Whom did you Assist?	Who Requested Assistance	Who Funded Assistance	Size of Effort		Results of Assistance
				Dollars	Man Days*	
1. Technical Assistance- Program planning to improve management resources for effective performance in a soybean development program.	Ministry of Agriculture Govt. of Peru	Govt. of Peru through USAID	AID	\$99,440	22m.m.	1. Development planning team assembled and first trip made 2. Issued first report and recommendations to USAID 3. Planning follow up activities
2. Technical Assistance- Guidance and recommendations toward improvement of soybean production	Ministry of Agriculture Govt. of Ecuador	Govt. of Ecuador through USAID	AID		4.5m.m.	1. Assembled four man team fluent in Spanish 2. Made preparations for 1st visit of breeder/agronomist and extension agronomist in early Nov. 75.
3. Technical Assistance- Feasibility study for establishment of soybean industry	Government of Zaire	USAID Mission to Zaire	AID	\$ 6,442	21m.d.	1. Recruited one extension agronomist as requested 2. Made preparations for his visit in mid-Nov. 75.
4. Technical Assistance- Feasibility study dealing with inoculant production as a part of a national seed development project	Ministry of Agriculture Govt. of Thailand	Govt. of Thailand through USOM	AID	\$20,540	90 m.d.	1. Assembled two man team from associated university 2. Assisted planning for inventory phase of project 3. Prepared for feasibility phase to be conducted Dec. 75.
5. Technical Assistance- Preliminary study of economic and material resources required for soybean development	Ministry of Agriculture Govt. of Ivory Coast	Ministry of Agriculture Govt. of Ivory Coast (through AID/W)	Govt. of Ivory Coast UIUC	\$10,000	60 m.d.	1. Visits by two separate teams 2. Reports submitted to Govt. of Ivory Coast 3. Up to 5 students expected to enroll UIUC Jan. 76 in preparation for graduate study.

\* md = man days

mm = man months

Table III - A

Requests For Assistance Received During Reporting Period 01 Oct 74 to 30 Sept 75

## A. Requests Attended

Description of Request for Assistance	Whom did you Assist?	Who Requested Assistance	Who Funded Assistance	Size of Effort		Results of Assistance
				Dollars	Man Days	
6. Technical Assistance- Preliminary study of soybean potential	Ministry of Agriculture, Govt. of Saudi Arabia	Ministry of Agriculture, Govt. of Saudi Arabia	Govt. of Saudi Arabia	\$ 3,000	14	1. Visits to research centers and potentials assessed. 2. Recommendations to Govt. of Saudi Arabia.
7. Technical Assistance- Modification of plan for soybean development program to include food uses component	Grain Development Board, Min. of Agriculture, Govt. of Ghana	Ministry of Agriculture through USAID	AID	\$ 6,000	1 m.m	1. Ghanaian team visited INTSOY. 2. Request for further assistance prepared and submitted by team. 3. Preparations underway to send INTSOY team to Ghana when funds available.
8. General Education Development- Interinstitutional collaboration in education, research and related activities	Univ. of Puerto Rico Mayaguez Campus	AID and UPR/Mayaguez	AID, Rockefeller Found UIUC and UPR/Mayaguez	\$ 80,000	-	1. Two project agreements implemented. 2. General support services provided. 3. Improved coordination of soybean research in areas of breeding, protection, and storage. 4. Interchange of scientific workers and students.
9. General Education Development- Inter-institutional collaboration in education, research and related activities	Faculty of Agriculture, Univ. of Tehran	Faculty of Agriculture, Univ. of Tehran	Planning costs met by Univ. of Tehran and UIUC	\$ 1,000	7 m.d.	1. General planning for three programs: A. Production and utilization of irrigated soybeans-B. Staff exchange C. Student exchange 2. Cooperative search for funds to implement programs underway.

Table III - A

Requests For Assistance Received During Reporting Period 01 Oct 74 to 30 Sept 75

## A. Requests Attended

Description of Request for Assistance	Whom did you Assist?	Who Requested Assistance	Who Funded Assistance	Size of Effort		Results of Assistance
				Dollars	Man Days	
10. General Education Development- Inter-institutional collaboration in education, research and related activities	Rezaiyeh Coll. of Agri. & An. Husb.-Iran	Rezaiyeh Coll. of Agri. & An. Husb.-Iran	Planning costs met by Rezaiyeh and UIUC	\$ 1,000	7 m.d.	1. General plan for research in soybean development submitted. 2. Rezaiyeh staff member deputed to short course USDA-TC-120-6 "Technical and Economic Production of Soybeans" in summer 75.
11. International Research Center- Collaboration on research, service and related activities	International Institute for Tropical Agriculture, Nigeria	IITA	IITA and AID	\$ 3,000	10	1. General program of collaboration established. 2. Follow-up visit to IITA by INTSOY staff planned. 3. Search underway for funds to support INTSOY outreach team at IITA.
12. International Research Center- Collaboration on research, service and related activities	Asian Vegetable Research & Development Center, Taiwan	AVRDC	AVRDC and AID	\$ 2,000	6	1. Project developed for joint research on soybean rust. 2. Co-sponsorship of Third Regional Soybean Conference scheduled for 76. 3. Exchange of soybean germplasm.
13. National Development Programs Advice and assistance on multidisciplinary soybean development program	Crop Improvement Research Center, Ofc. Rural Dev., Govt. of Korea	CIRC	CIRC/AID	\$ 2,000	6	1. UIUC plant pathologist to spend 2 mos. at CIRC in early 76. 2. UIUC team in soybean production and protection to visit CIRC Feb. 76. 3. CIRC staff member to spend year at UIUC as post-doctoral fellow.

Table III - A

Requests For Assistance Received During Reporting Period 01 Oct 74 to 30 Sept 75

## A. Requests Attended

Description of Request for Assistance	Whom did you Assist?	Who Requested Assistance	Who Funded Assistance	Size of Effort		Results of Assistance
				Dollars	Man Days	
14. National Development Programs Advice and assistance on multidisciplinary soybean development program	Fundacao Instituto Agronomico do Parana, Brasil	IAPAR	IAPAR, UIUC and MUCIA	\$ 16,100	3.75mm	1.Preliminary study on comparison of soybean production systems of Brasil and U.S. completed. 2.Consultations on soybean pathology conducted. 3.UIUC staff member to be assigned to work on general soybean entomology work Dec. 75-Feb. 76.
15. International Organization-Assistance to country program in area of soybean development	Central Agricultural Research Institute, Ministry of Agriculture, Govt. of Sri Lanka	Ministry of Agriculture, Govt. of Sri Lanka	UNDP/FAO	\$680,000	142 mm	1.Program implemented and staff assigned. 2.Recommendations for research on production and and utilization presented. 3.Regional training program conducted in India. 4.Comparative advantage study underway. 5.Recruitment of long term staff in process. 6.Participation by CARI staff in two USDA short courses: 120-7 "Soybean Processing for Food Uses" and 120-6 "Technical and Economic Aspects of Soybean Production."

APPENDIX A

Research Assistants Reports

APPENDIX A

RESEARCH ASSISTANTS REPORTS

Curtis Nissly -- Supervisors -- Dr. Carl N. Hittle, Dr. R. L. Bernard,  
Dr. E. H. Paschal II

Research Area: Studies on the effect of daylength on the flowering and maturity of various soybean genotypes.

Introduction

Because of the photoperiodic (daylength) response of soybeans, there is a large variation in flowering and maturation dependent on geographical location. This limits the adaptation of a given soybean variety to rather narrow belts of latitude and therefore is a serious limitation on the interchange of germplasm from north to south.

Lack of sensitivity to photoperiod should be a valuable addition for soybean breeders and may permit the development of commercial material with a wide range of utilization as is now true of rice and wheat. It would promote an easier exchange of lines among programs of improvement in different countries.

Recently, photoinensitive types were identified in the early maturing Groups 00 and 0 genotypes. The search for insensitive genotypes in later maturing soybeans should be a priority in current research. Also information relating the expression of the day-neutrality characteristics to various environments and latitudes is needed. Studies concerning inheritance patterns will be necessary in order for breeders to effectively incorporate day-neutrality into agronomic superior varieties. The following described research is focused on these needs.

Major objectives of this research

- (1) To screen and evaluate selected soybean germplasm for photosensitivity.
- (2) To determine whether photoinensitivity is genetically transferable to later maturing genotypes.
- (3) To determine effect of location and date of planting on yield and development patterns.

The measure of sensitivity is taken by growing homozygous soybean genotypes in two plots at the same location. One plot receives extended low intensity illumination (5-15 ft.-c) during the night (dark period) while the other receives only the shorter natural daylength. The number of days which flowering and/or maturity are delayed is the measure of photosensitivity.

Current Research

- I. Germplasm screened and evaluated for photoinensitivity
  - A. Group III U.S.D.A. collection

All available genotypes (~515) were screened for photosensitivity in Urbana, Illinois (40°N latitude) during the period May through November 1973 and again in Isabela, Puerto Rico (18°N latitude) during the period July 1974 through February 1975.

B. Clark (Group IV) x P.I. 194.640 (Group 000) population (original cross by R. L. Bernard).

191 lines from the  $F_6$  generation of this cross were grown and screened in Urbana in 1973. The same lines were screened in Puerto Rico during 1974-75 using  $F_6$  seed.

C. Portage (Group 00) x Coker Hampton 266A (Group VIII) population (original cross by J. J. Stanton).

Object: To determine: (a) the variation in flowering and maturity for such a wide cross and (b) if photoinsensitivity of early parent is genetically transferable.

- a)  $F_2$  generation grown in Urbana 1973 as spaced plants.
- b)  $F_3$ ,  $F_4$ ,  $F_5$  generations grown in Puerto Rico during 1974-75.
- c)  $F_6$  generation was screened and evaluated for photosensitivity in Puerto Rico spring and summer of 1975.

. Evaluating screened material

A. Location study

Object: To determine effect of location (latitude). Seven selected genotypes were grown at the following locations, planted June 1 in 1974 and 1975:

Florida - Gainesville  
Illinois - Dekalb, Urbana, Belleville, Eldorado  
Iowa - Ames  
Minnesota - St. Paul  
Mississippi - Stoneville  
Missouri - Portageville  
Puerto Rico - Isabela, Lajas  
South Carolina - Hartsville

B. Planting date study

Object: To determine effect of planting date. Selected genotypes from Group III, P.I. 194.640 x Clark cross, Clark and Harosoy isolines were grown at three dates in Urbana, Illinois 1974 and 1975.

C. Yield stability under continuous cropping. P.R. 1974-1975.

Object: To determine the correlation of yield stability and development with degree of sensitivity over seasons.

Ten soybean genotypes were grown under irrigation (as needed) at Isabela, Puerto Rico during period June 1974 through November 1975. Plantings

were made every six weeks (approximately every 34 minutes change in daylength) throughout one year at two plant densities.

### III. Additional research

A study of the inheritance of two qualitative characters. These are chlorophyll deficient characters and are found in genetic type strains; T 134 found in 'Illiini' x 'Peking' in 1937 and T 162 found in 'Mandarin' in 1940.

F<sub>2</sub> populations were grown and evaluated. F<sub>3</sub> progeny rows were grown and evaluated. T 162 and T 134 were crossed to a number of other chlorophyll deficient types to establish confirmation of an independent locus.

Results from the F<sub>2</sub> and F<sub>3</sub> show that the chlorophyll deficiency of T 134 and T 162 are due to the effect of a single recessive gene. Evaluation of the F<sub>1</sub> generation from crosses among the chlorophyll deficient lines is in progress. Plans are to report this research in the Soybean Genetics Newsletter Vol. 3 (April 1976).

### Results

#### A. Group III screen

Data from the Urbana 1974 and Puerto Rico 1975 screening experiment shows that there is an extreme amount of variation in daylength sensitivity in Group III germplasm. It appears that in general maturity is more affected by photoperiod than is flowering. Continuous light used in Puerto Rico to extend the natural daylength caused greater delays in flowering and maturity than the 20 hour daylength used in Urbana.

Several genotypes were found having a lower degree of sensitivity than the majority. One genotype P.I. 317.334B (Japanese name Kitami Shiro) showed outstanding neutrality in all experiments. It flowered and matured in approximately the same number of days in both natural and extended daylength treatments. In contrast to the other group III genotypes tested, it is clear that this variety has unique day-neutral characteristics which may be useful in the breeding of soybean lines with wide latitudinal adaptation. Inheritance studies with Kitami Shiro are in progress.

#### B. Populations from crosses of diverse maturity groups

Both the Clark x P.I. 194.640 population and the Portage x Coker population show large variation in photosensitivity and maturity. Lines which are as neutral as the early parent have been isolated but are usually the earlier maturing lines. The correlation between neutrality and earliness seems quite large.

#### C. Evaluation Trials

Preliminary results from these experiments show that the more neutral genotypes are less affected by change in location and planting date.

Activities for Interval January 1974 to December 1975

Spring Semester 1974 - University of Illinois. Course work and research

½ time research assistant: INTSOY

June 1, 1974 through August 1, 1975 - stationed at University of Puerto Rico,  
Isabela Substation, Agricultural  
Experiment Station.

full-time research assistant.

Engaged in dissertation research and  
seed increase work for INTSOY.

Fall Semester 1975 - University of Illinois. Course work and research

½ time research assistant: INTSOY

M. D. Tedia -- Supervisors -- Dr. Carl N. Hittle, Dr. Errol D. Rodda

Research Area: The Inference of Various Preharvest Environmental Factors and Subsequent Storage Conditions on Seed Vigor and Viability of Different Soybean Seed Lots.

Introduction:

In many tropical countries soybean crop production is expected to play a vital role in solving the malnutrition problem and alleviating protein deficiency. One of the main problems in the extension of soybean hectareage, particularly in tropical countries, is obtaining adequate stands. Much of the variation in field emergence is the direct or indirect influence of unfavorable weather during maturation and at harvest time. Soybean seed is inherently short lived. Various storage conditions also influence the viability and vigor of soybean seed.

This study is aimed to investigate the influence of various preharvest environmental factors and subsequent storage conditions on seed vigor and viability of different soybean seed lots.

The major specific objectives of research were:

- (1) To study the effect of high humidity prevailing during seed maturation on seed vigor and viability of several soybean varieties.
- (2) To determine the influence of moisture content of seed, storage temperature and packaging material on vigor and viability of different soybean seed lots.
- (3) To determine the influence of dates of planting, location of seed production and local environmental factors on field emergence and performance of different soybean seed lots.

Three different experiments were conducted to investigate the various factors as outlined in above objectives affecting seed vigor and viability. These experiments will be described separately.

Experiment # 1 - Effect of high humidity on seed vigor and viability.

The specific objectives of the experiment were:

- (1) To determine the stage of seed development at which the seed of different soybean varieties are most vigorous and viable.
- (2) To measure the rate of deterioration, if any, of soybean seed of different varieties from seed development stage to date of harvest under different humidities and prevailing temperatures.
- (3) To study the effect of high humidity on wetting and drying of soybean seed during maturation and its effect on change in viability and vigor.

The following variables were included:

1974 Studies

- (1) Three varieties (Clark 63, Williams and Wells)

- (2) a) High humid conditions - frequent spraying of water on soybeans enclosed in plastic cages
- b) Soybeans grown without plastic cage under natural conditions

#### 1975 Studies

- (1) Three varieties (Wayne, Williams and Woodworth)
- (2) a) High humid conditions - frequent spraying of water (2" in 8 hours) on soybeans enclosed in plastic cages
- b) Soybeans enclosed in plastic cage under natural conditions
- c) Soybeans grown without plastic cage under natural conditions

Replications: four - Design - split plot - (randomized complete block)

The study was conducted at the University of Illinois Urbana Agronomy South Farm. For creating high humid conditions in the field, plastic cages were erected and a mist (fogging) treatment was employed. Plants were exposed to fogging for three days out of the week, from 10 A.M. until 6 P.M., and for one out of every six minutes. A hygro-thermograph was used to record variations in humidity inside and outside the plastic cage. The mist fogging was started on September 14 and continued until November 5. The soybean seed was harvested every week and the following observations were recorded:

- (1) Moisture percent of fresh harvested seed
- (2) Germination percent after drying the seed for 15 days
- (3) Accelerated ageing test to determine the decline in vigor
- (4) Bioassay - this was done in 1975 only

Total harvests were eight.

#### Results

The statistical analysis of the data is in progress. From the overall perusal of the data it can be said that seed vigor and viability declined with delay in harvest. The influence of high humid conditions does not seem to be the same for all varieties. There seems to be more association of fungus Phomopsis/Sojae under high humid conditions at the time of final harvest.

#### Experiment # 2 - Effect of moisture content, packaging material and temperature on viability and vigor of soybean seed lots.

The specific objectives of the experiment were:

- (1) To study the rate of deterioration in different soybean seed lots under different temperature and moisture conditions similar to those frequently followed for soybean seed storage in tropical countries.

- (2) To evaluate the change in vigor and viability as influenced by different storage containers.
- (3) To determine the changes in moisture content of seed in containers stored at different temperatures.
- (4) To determine the gas composition in sealed containers (percent of  $O_2$  and  $CO_2$ ) and its effect on viability and vigor.

The experiment involved the following treatments in factorial combination in completely randomized design.

#### 1974 Studies

Seed lots	(North and South Illinois)
Storage temp.	(35°, 25°, and 3° c)
Initial moisture	(7%, 10%, and 13%)
Packaging material	(plastic bags - 8 mil, 5 mil, and 1 mil. thick)

#### 1975 Studies

Storage temp.	(35°, 25°, and 3° c)
Initial moisture	(7%, 10%, and 13%)
Packaging material	(plastic bags - 8 mil, 5 mil, and 1 mil) and sealed tin containers

This experiment was conducted at Urbana using the facilities of the Agricultural Engineering laboratory.

The initial germination and moisture percent of seed was determined.

Seed lots were conditioned to 7, 10, and 13 percent moisture (moisture percent expressed as wet basis) using Aminco in which constant temperature of 61°F. and relative humidity of 85 percent was maintained for a definite period. The seed lots were packaged in different containers (8 mil, 5 mil, and 1 mil thickness). The containers were heat sealed and subsequently stored at constant temperatures of 35°, 25° and 3°c.

The following laboratory tests were done after 8, 16 and 24 weeks of storage: (1) standard germination test; (2) accelerated ageing; (3) moisture; and (4) bioassay

#### Results

(1) Progressive deterioration was greater for a southern Illinois seed lot than for a seed lot produced in northern Illinois.

(2) Seed viability was maintained for longer periods of time at 3° than at 25° and 35°c. The effect of initial seed moisture and packaging material was not important at this storage temperature.

(3) Seeds of higher moisture content (13%) deteriorated rapidly in 8 and 5 mil containers at 35° and 25°c.

(4) The optimum moisture content for sealed storage was found to be around 7%. Seeds of 7 and 10% moisture maintained viability at 3° or 25°c but not at 35°c.

(5) There was a significant difference in the association and type of mycoflora depending upon the location of seed produced.

(6) The effect of the thickness of container was insignificant if seeds of low moisture content (7 or 10%) were stored at 3<sup>o</sup>c or 25<sup>o</sup>c.

(7) Multiple regression equation  $y = a + b_1x_1 + b_2x_1^2 + b_3x_2^2 + b_4x_2^2 + b_5x_1x_2$  was found to be best suited for predicting viability under constant storage temperature and moisture conditions ( $x_1$  = temperature,  $x_2$  = moisture).

### Experiment #3

The objective of this experiment was to determine the influence of dates of planting, location of seed production and environmental factors on field emergence and performance of 15 soybean seed lots.

Fifteen soybean seed lots of 5 varieties (Wayne, Williams, Wells, Beeson and Amroy 71) were procured in January 1974 from soybean seed growers (North, South and Central Illinois). The data on environmental conditions (temperature, rainfall) where the soybeans were grown in 1973 were collected. The initial germination percentage was determined before storing them in cold room (controlled temperature of 38<sup>o</sup>F. and relative humidity of 40-45%). The weight of 100 seeds and the moisture content were also determined. The seeds were then visually rated for various characteristics, e.g., normal, wrinkled, growth cracks, damaged and diseased. 1000 seeds of each lot were made available to the pathologists for bioassay.

The germination percentage of the 15 seed lots was again determined after which time they were used in a trial conducted at the UIUC Agronomy South Farm in 1974. The following variables were included in the experiment:

- |                       |   |
|-----------------------|---|
| (1) Dates of planting | 3 |
| (2) Varieties         | 5 |
| (3) Location          | 3 |

Design: Split plot (randomized complete block arrangement)  
Replications: four

This experiment was also conducted in 1975 at the South Farm, Urbana, using the same 5 varieties of seeds which were grown at three different experiment stations (Dekalb, Dixon Springs and Urbana) in 1974.

### Results

From the preliminary perusal of data it seems that location of seed production and environmental factors have great influence on soybean seed quality. In 1975, a higher percentage of seeds grown in southern Illinois had the fungus Phomopsis Sojae than for seeds grown in northern Illinois. The dates of planting also indirectly influence the quality of seed. The weather during the time of seed maturation plays an important role in determining the quality of seed.

David J. Sammons -- Supervisors -- Dr. Theodore Hymowitz,  
Dr. Doyle B. Peters

Research Area: Inheritance of Water Stress Tolerance In Selected Soybean Cultivars

Introduction

Since entering the University of Illinois in January 1975 as a graduate student supported by INTSOY, I have concentrated most of my time in two areas: course work and dissertation planning and research. Both will be discussed chronologically with an emphasis on dissertation work.

Spring Semester 1975 (January - May)

Much of the spring semester was devoted to course work aimed at broadening my background in international agriculture and basic agronomic sciences. I arrived here with an A.M. in botany and several years of practical experience on a small farm in Ohio, and as a Peace Corps volunteer in the Philippines. During the spring semester, I did course work in plant pathology, international crops, physiology, international agriculture, soils and field crop science. Course work continues this Fall in crop production, plant breeding, and statistics.

About half way through the semester (spring), my advisor, Dr. Theodore Hymowitz, returned from a sabbatical leave, and together we began work on selection of a dissertation topic. This proved to be a difficult and frustrating task, although rewarding in the end. We spent much time tossing ideas back and forth, and then I began an odyssey through the Department of Agronomy consulting with people in physiology, breeding, production, international agriculture and genetics.

From the outset, it was clear to me that I wanted to tackle problems that:

- a) dealt with food legumes (soybeans);
- b) involved much field work;
- c) focused on breeding and production problems;
- d) had practical significance in the context of world agriculture;
- e) would be acceptable to INTSOY and the Department of Agronomy by contributing to 211d grant program objectives.

As a result of this search, I selected a topic which I have tentatively titled "The Inheritance of Water Stress Tolerance in Selected Soybean Cultivars." I chose this topic because it fulfills my specific desires as noted above. Water, in the view of many agriculturalists, is the single most limiting resource in terms of improving world agricultural output. Obvious solutions to the water resource problem include:

- a) changed production practices to improve water use efficiency;
- b) development of an inexpensive mechanized water delivery system of some sort;

- c) choice of crops that tolerate conditions in which water availability may be suboptimal;
- d) looking for genetic variability in crop species for water stress tolerance, and use of tolerant varieties and derivatives to expand species' range.

Points a and b involve changing or fitting the environment to the needs of the plant, and may be prohibitively expensive and/or ecologically dangerous (especially in the case of b). Points c and d involve fitting the plant to the environment, a more workable choice it seems to me. With these thoughts in mind, I began my research.

#### Summer 1975

I spent nearly the entire summer working out a technique for screening soybean varieties for tolerance to water stress, and building the needed apparatus. At the suggestion of my faculty committee, I decided to begin my study with artificially stressed soybean seedlings grown in pots of soil pre-moistened to set soil water potentials. I worked out a soil desorption curve for a Flanagan Silt Loam which was available for my use. Based on this curve, quantities of soil are wetted by misting water into a slowly turning cement mixer. Seedlings started in wet sand in the greenhouse are then transplanted into sealed pots of this soil and allowed to grow to about the second trifoliolate stage. The potted seedlings are kept in a large growth chamber under controlled light, temperature, photoperiod and humidity. Three soil moisture tensions are used (2/3 ATM, 3 ATM, 9 ATM), and equal numbers of seedlings of each variety are grown at each soil moisture level.

A diverse assortment of varieties is being screened currently. At the proper stage (three weeks after planting, one week after potting), the seedlings are tested. A data-gathering instrument is attached. Leaf and root water potentials are measured using a pressure bomb. Leaf surface areas are determined by use of an area meter. The photosynthesis data are measured using an infrared gas analyzer that samples gas drawn from a small sealed chamber into which six potted seedlings can fit at any given time. A digital voltmeter reads the infrared gas analyzer, and a small, programmable calculator computes the rate of photosynthesis directly.

By the end of the semester I will have completed screening 20 varieties of soybeans for the effects of varying levels of soil moisture on the particular parameters outlined on the data-gathering instruments. (See attached list for soybean varieties.) No thorough data analysis has been conducted at this point. However it appears certain that there are differences among soybean cultivars tested in terms of effect of water stress on plant water potentials, growth, and rates of photosynthesis.  $CO_2$  compensation point appears to be unaffected by moisture stress in the range of this study.

#### Planned Activities (1976)

I plan to test about 8 - 10 more varieties in early 1976 by the procedure outlined above (see attached list). I also plan a complete statistical analysis of data from which I will select material for further study in the field.

Additionally, I will perform a gross check on my chamber data by

growing seedlings of tested varieties in a large wooden tank filled with wet sandy soil. The plants will be observed as they pull down the soil moisture, and the effect of increasing stress will be measured in terms of plant water status, growth, and soil moisture producing the signs of stress in the plant.

During the summer of 1976, I will field test my selected varieties in the dry, sandy soil of the University of Illinois' field station in Mason County. By observing the effects of field water stress on my materials, I hope to confirm my chamber data. I also intend to begin my genetic study of the inheritance of water stress tolerance by making hand crosses of selected material to produce  $F_1$  seed. The  $F_1$ 's will be grown in the greenhouse next winter to produce  $F_2$  seed. The segregating  $F_2$  material will then be studied during the summer of 1977 in the field.

Attachment -- Test Varieties of Soybeans

Material tested in 1975

A-100	Dunfield
Adelphia	Earlyana
Amsoy	Grant
Black Eyebrow	Lindarin
Blackhawk	Magna
Cayuga	Manchu
Chief	Manitoba Brown
Chippewa 64	Mukden
Clark 63	Pagoda
Disoy	Seneca

Material to be tested in  
Spring 1976

Kent
Miller 67
S. J. #1
S. J. #2
Calland
Aoda
Beeson
Corsoy
Hahto
Hawkeye

from Thailand

APPENDIX B

University of Illinois at Urbana-Champaign  
Distribution of International  
Students by Home Country  
1974/75 Academic Year

AFRICA

	GRAD		UGRAD		<u>TOTAL</u>
	M	F	M	F	
Algeria	0	0	4	0	4
Cameroon	2	0	0	0	2
Congo Kinshasa	1	1	0	0	2
Dahomey	1	0	0	0	1
Ethiopia	8	1	0	0	9
Gambia	2	0	0	0	2
Ghana	4	0	1	0	5
Ivory Coast	1	0	0	0	1
Kenya	4	0	1	0	5
Liberia	1	0	1	0	2
Libya	8	0	0	0	8
Malawi	0	0	0	0	0
Nigeria	19	1	3	1	24
Rhodesia	3	0	0	0	3
Somalia	1	0	0	0	1
Sierra Leone	6	1	0	0	7
South Africa	2	1	0	0	3
Southwest Africa	1	0	0	0	1
Sudan	3	0	0	0	3
Tanzania	5	1	0	0	6
Tunisia	1	0	0	0	1
Uganda	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
SUB TOTAL	74	6	10	1	91

ASIA (Far East)

	GRAD		UGRAD		<u>TOTAL</u>
	M	F	M	F	
Bangladesh	2	0	0	0	2
Ceylon	4	0	0	0	4
China	98	42	4	9	153
Hong Kong	47	5	42	10	104
India	84	23	1	0	108
Indonesia	18	0	2	0	20
Japan	56	18	3	1	78
Korea (Republic of)	36	8	1	0	45
Malaysia	9	1	0	0	10
Pakistan	10	1	4	0	15
Philippines	8	2	0	0	10
Singapore	0	0	0	0	0
Thailand	22	21	1	3	47
Vietnam (Republic of)	<u>3</u>	<u>1</u>	<u>2</u>	<u>0</u>	<u>6</u>
SUB TOTAL	397	122	60	23	602

ASIA (Near & Middle East)

	<u>GRAD</u>		<u>UGRAD</u>		<u>TOTAL</u>
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	
Afghanistan	1	0	0	0	1
Iran	3	11	33	7	84
Iraq	2	0	0	0	2
Israel	18	10	1	1	30
Jordan	7	1	2	0	10
Kuwait	1	0	2	0	3
Lebanon	8	3	4	1	16
Saudi Arabia	5	0	0	0	5
Syria	1	0	0	0	1
Turkey	16	2	0	0	18
United Arab Republic	2	0	0	0	2
	<u>94</u>	<u>27</u>	<u>42</u>	<u>9</u>	<u>172</u>
SUB TOTAL					

EUROPE

	<u>GRAD</u>		<u>UGRAD</u>		<u>TOTAL</u>
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	
Austria	2	4	0	0	6
Belgium	1	0	0	1	2
Czechoslovakia	0	0	0	0	0
Denmark	0	1	0	0	1
Finland	1	0	1	0	2
France	8	1	5	1	15
Germany (Federal Republic)	4	4	2	0	10
Greece	8	0	3	1	12
Hungary	0	0	0	0	0
Iceland	3	0	0	0	3
Ireland	6	0	0	0	6
Italy	3	1	0	0	4
Netherlands	3	0	0	0	3
Norway	2	1	0	0	3
Portugal	1	0	0	0	1
Romania	2	0	0	0	2
Spain	4	3	0	0	7
Sweden	2	1	0	0	3
Switzerland	1	0	0	0	1
United Kingdom	33	6	11	6	56
Yugoslavia	6	1	0	0	7
	<u>90</u>	<u>23</u>	<u>22</u>	<u>9</u>	<u>144</u>
SUB TOTAL					

NORTH AMERICA, CENTRAL  
AMERICA, WEST INDIES

	GRAD		UGRAD		<u>TOTAL</u>
	M	F	M	F	
Canada	34	24	0	1	59
Costa Rica	1	3	0	0	4
Cuba	0	1	0	0	1
El Salvador	2	0	1	0	3
Guatemala	1	0	0	1	2
Haiti	0	0	0	0	0
Honduras	1	0	0	0	1
Jamaica, W.I.	4	2	0	0	6
Mexico	16	2	0	0	18
Trinidad & Tobago	0	1	0	0	1
	<u>59</u>	<u>33</u>	<u>1</u>	<u>2</u>	<u>95</u>
SUB TOTAL	59	33	1	2	95

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OCEANIA

	GRAD		UGRAD		<u>TOTAL</u>
	M	F	M	F	
Australia	13	2	0	1	16
New Zealand	4	2	1	0	7
	<u>17</u>	<u>4</u>	<u>1</u>	<u>1</u>	<u>23</u>
SUB TOTAL	17	4	1	1	23

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SOUTH AMERICA

	GRAD		UGRAD		<u>TOTAL</u>
	M	F	M	F	
Argentina	3	0	0	0	3
Bolivia	1	0	0	0	1
Brazil	9	4	1	0	14
Chile	7	2	0	0	9
Colombia	17	1	1	0	19
Ecuador	3	1	0	0	4
Guyana	3	0	2	0	5
Nicaragua	2	0	0	0	2
Panama	1	0	1	0	2
Paraguay	1	0	0	0	1
Peru	3	1	0	0	4
Uruguay	1	0	0	0	1
Venezuela	8	2	1	0	11
	<u>59</u>	<u>11</u>	<u>6</u>	<u>0</u>	<u>76</u>
SUB TOTAL	59	11	6	0	76

TOTAL STUDENTS

	GRAD		UGRAD		<u>TOTAL</u>
	M	F	M	F	
FOREIGN	789	226	142	45	1202
IMMIGRANTS	<u>67</u>	<u>47</u>	<u>123</u>	<u>70</u>	<u>307</u>
	856	273	265	115	1509

AFRICA

	GRAD		UGRAD		TOTAL
	M	F	M	F	
Algeria	0	0	4	0	4
Cameroon	2	0	0	0	2
Congo Kinshasa	2	0	0	0	2
Dahomey	1	0	0	0	1
Ethiopia	8	1	0	0	9
Gambia	2	0	0	0	2
Ghana	6	0	0	0	6
Ivory Coast	1	0	0	0	1
Kenya	5	0	0	0	5
Liberia	0	0	1	0	1
Libya	7	0	0	0	7
Madagascar	1	0	0	0	1
Malawi	0	0	0	0	0
Nigeria	20	0	4	2	26
Rhodesia	4	0	0	0	4
Senegal	1	0	0	0	1
Somalia	1	0	0	0	1
Sierra Leone	6	1	0	0	7
South Africa	1	1	1	1	4
Southwest Africa	1	0	0	0	1
Sudan	3	0	0	0	3
Tanzania	6	1	0	0	7
Tunisia	2	0	0	0	2
Uganda	2	0	0	0	2
<b>SUB TOTAL</b>	<b>82</b>	<b>4</b>	<b>10</b>	<b>3</b>	<b>99</b>

ASIA (FAR EAST)

	GRAD		UGRAD		TOTAL
	M	F	M	F	
Bangladesh	2	0	0	0	1
Burma	1	0	0	0	2
Ceylon	4	0	0	0	4
China	93	42	8	7	150
Hong Kong	59	10	46	17	132
India	85	20	1	0	106
Indonesia	16	0	2	0	18
Japan	54	13	1	1	69
Korea (Rep. of)	38	9	0	0	47
Malaysia	8	1	0	0	9
Pakistan	12	0	3	0	15
Philippines	11	3	0	1	15
Singapore	0	0	0	0	0
Thailand	20	23	1	3	47
Vietnam (Rep. of)	3	1	1	0	5
<b>SUB TOTAL</b>	<b>406</b>	<b>122</b>	<b>63</b>	<b>29</b>	<b>620</b>

ASIA (NEAR & MIDDLE EAST)

	GRAD		UGRAD		TOTAL
	M	F	M	F	
Afghanistan	1	0	0	0	1
Iran	40	9	32	6	87
Iraq	2	0	0	1	3
Israel	19	11	1	0	31
Jordan	7	1	2	0	10
Kuwait	1	0	2	0	3
Lebanon	9	3	4	1	17
Saudi Arabia	6	0	0	0	6
Syria	1	0	0	0	1
Turkey	16	1	0	0	17
United Arab Republic	2	1	0	0	3
<b>SUB TOTAL</b>	<b>104</b>	<b>26</b>	<b>41</b>	<b>8</b>	<b>179</b>

EUROPE

	GRAD		UGRAD		TOTAL
	M	F	M	F	
Austria	2	4	0	0	6
Belgium	2	0	0	1	3
Czechoslovakia	0	0	0	0	0
Denmark	0	1	0	0	1
Finland	1	0	0	0	1
France	7	2	6	3	18
Germany (Fed. Rep)	6	3	2	0	11
Greece	9	1	3	1	14
Hungary	0	0	0	0	0
Iceland	3	0	0	1	4
Ireland	6	0	0	0	6
Italy	4	1	0	0	5
Netherlands	4	0	1	0	5
Norway	3	1	0	1	5
Portugal	0	0	0	0	0
Romania	2	0	0	0	2
Spain	3	3	0	0	6
Sweden	1	1	0	0	2
Switzerland	0	2	0	0	2
United Kingdom	19	3	1	3	26
Yugoslavia	8	1	0	0	9
<b>SUB TOTAL</b>	<b>80</b>	<b>23</b>	<b>13</b>	<b>10</b>	<b>126</b>

NORTH AMERICA, CENTRAL AMERICA, WEST INDIES

	GRAD		UGRAD		TOTAL
	M	F	M	F	
Canada	37	25	0	1	63
Costa Rica	1	3	0	0	4
Cuba	0	1	0	1	2
El Salvador	1	0	1	0	2
Guatemala	1	0	0	1	2
Haiti	1	0	0	0	1
Honduras	1	0	0	0	1
Jamaica, W.I.	6	2	0	0	8
Mexico	14	2	0	0	16
Trinidad & Tobago	1	1	0	0	2
St. Kitts	1	0	0	0	1
<b>SUB TOTAL</b>	<b>64</b>	<b>34</b>	<b>1</b>	<b>3</b>	<b>102</b>

OCEANIA

	GRAD		UGRAD		TOTAL
	M	F	M	F	
Australia	11	2	0	0	13
New Zealand	6	2	0	0	8
<b>SUB TOTAL</b>	<b>17</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>21</b>

SOUTH AMERICA

	GRAD		UGRAD		TOTAL
	M	F	M	F	
Argentina	2	1	0	0	3
Bolivia	0	0	0	0	0
Brazil	13	2	0	0	15
Chile	7	2	0	1	10
Colombia	21	0	2	1	24
Ecuador	5	1	0	0	6
Guyana	4	0	2	1	7
Honduras	2	0	0	0	2
Panama	1	0	1	0	2
Paraguay	1	0	0	0	1
Peru	4	1	0	0	5
Uruguay	1	0	0	0	1
Venezuela	6	4	2	0	12
<b>SUB TOTAL</b>	<b>67</b>	<b>11</b>	<b>7</b>	<b>3</b>	<b>88</b>

TOTAL STUDENTS ENROLLED

	<u>GRAD</u>		<u>UGRAD</u>		<u>TOTAL</u>
	M	F	M	F	
FOREIGN	820	224	135	56	1235
IMMIGRANTS	71	54	113	67	305
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	891	278	248	123	1540

APPENDIX C

Work Plans for Next Year

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. I Education and training capability

Program subcategory No. 1 Activity Graduate students supporting staff to develop soybean expertise and knowledge response capability.

Staff to be involved Faculty members in areas where tropical-subtropical soybean expertise development is most needed; department graduate committees and staff involved in course and curriculum modification.

Scheduled events/targets Two graduate students added beginning January 1976; two additional by August 1976; staff identification for expertise development.

Expected results Increased staff with tropical-subtropical soybean expertise; publications on soybean production and use under tropical conditions; M.S. and Ph.D. students completing adding to tropical soybean personnel pool. Selected students at international research centers in support of soybean network programs.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$9,170</u>	<u>\$19,270</u>
Equipment, materials, supplies	<u>1,000</u>	<u>2,000</u>
Travel	<u>          </u>	<u>          </u>
Computer time	<u>250</u>	<u>500</u>
Subcategory total	<u>\$10,420</u>	<u>\$21,770</u>
Man months	<u>12</u>	<u>24</u>

Work summary--years 3 through 5 Continuing graduate studies in support of program, and to add to tropical soybean personnel pool.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. 1 Education and training capability

Program subcategory No. 2 Activity On-campus short courses for trainees from tropical and subtropical countries

Staff to be involved Training officer (.25); UIUC-INTSOY staff; other UIUC staff

Scheduled events/targets Soybean food processing training course--March-April 1976; production training course--May-August 1976; (these courses to be repeated annually).

Evaluation of two-year course experience. Determining needs for and planning for more specialized courses.

Expected results Fifteen trainees in processing and 18 in production short course completed annually; courses evaluated and revised for 1977 offering; specialized course needs , determined and two planned for 1977.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$5,200</u>	<u>\$5,165</u>
Equipment, materials, supplies	<u>1,500</u>	<u>1,500</u>
Travel	<u>500</u>	<u>500</u>
<u>Publications, reports</u>	<u>500</u>	<u>500</u>
Subcategory total	<u>\$7,700</u>	<u>\$7,965</u>
Man months	<u>3</u>	<u>3</u>

Work summary--years 3 through 5 Continuation of general short courses if evaluation and LDC country demands warrant; offering of more specialized short courses as needs develop.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. 1 Education and training capability

Program subcategory No. 3 Activity On-site short courses for trainees from tropical and subtropical countries.

Staff to be involved Training officer (.25); UIUC staff with expertise and experience in short course subject-matter areas.

Scheduled events/targets Determine needs for regional or national soybean short courses in cooperation with USDA and AID regional bureaus and USAIDs during 1976; offer minimum of two courses in 1977.

Expected results Short course priority needs established; courses planned in 1976 for 1977 offerings; 1977 course offerings; increased numbers of tropical country personnel trained in soybean production, marketing, processing and use.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 5,200</u>	<u>\$ 5,465</u>
Equipment, materials, supplies	<u>          </u>	<u>          </u>
Travel	<u>    --</u>	<u>  1,000</u>
Subcategory total	<u>\$ 5,200</u>	<u>\$ 5,465</u>
Man months	<u>    3</u>	<u>    3</u>

Work summary--years 3 through 5 Expanded offerings of regional and national courses as demand grows with increasing soybean production and use.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. I Education and training capability

Program subcategory No. 4 Activity Seminars, workshops, conferences

Staff to be involved Training officer (see 12 and 13); UIUC and UPR-MC staff participating in regional workshops.

Scheduled events/targets Evaluate experience of three regional workshops sponsored from February 1974 to February 1976 under AID Research Contract CM/ta-c-73-19; determine needs for and plan for integrated program of seminars, workshops and conferences from 1977 to 1980.

Expected results Evaluation of regional workshops completed; program of seminars, workshops, and conferences planned; specific activities for 1976 and 1977 conducted and evaluated; improved tropical country personnel training; added support from nongrant sources.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel (Included in 12 and 13)	\$ _____	\$ _____
Equipment, materials, supplies	<u>1,000</u>	<u>1,000</u>
Travel	_____	_____
<u>Publications</u>	<u>500</u>	<u>500</u>
Subcategory total	<u>\$ 1,500</u>	<u>\$ 1,500</u>
Man months	_____	_____

Work summary--years 3 through 5 Offering of integrated program of seminars, workshops, and conferences utilizing increasing institutional response capability; increasing involvement of international soybean network organizations and individuals.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. 1 Education and training capability

Program subcategory No. 5 Activity Special training for individuals from tropical and subtropical areas.

Staff to be involved Training offered and specific UIUC staff members to meet needs of individuals.

Scheduled events/targets Individual tropical-subtropical country representatives to receive special training by individual or small groups of UIUC staff members.

Expected results Selected key individuals with specialized training in priority areas.

Costs and man months:	Budget included in other I subcategories.	Year 1	Year 2
Personnel		\$ _____	\$ _____
Equipment, materials, supplies		_____	_____
Travel		_____	_____
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Subcategory total		\$ _____	\$ _____
Man months		_____	_____

Work summary--years 3 through 5 It is anticipated that there will be decreasing need for special training with expanded training nationally and on a regional basis.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. II Extended knowledge base and research capability

Program subcategory No. 1 Activity Development of soybean genetic technology for the tropical and subtropical environments of the LDCs.

Staff to be involved Soybean breeder located in Puerto Rico (1.0); breeder technician (1.0); UIUC and UPR-MC staff in production and protection areas.

Scheduled events/targets Continuous breeding program to generate hybrid populations adapted to tropical and subtropical conditions; increasing cooperation with soybean breeders at selected international centers and national research centers leading to high yielding and more nutritious varieties for the tropics.

Expected results Improved soybean germplasm for tropical-subtropical environments; interchange of germplasm among soybean breeders; progress in developing network of tropical soybean breeders.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$33,520</u>	<u>\$35,720</u>
Equipment, materials, supplies	<u>8,000</u>	<u>8,000</u>
Travel	<u>3,000</u>	<u>3,000</u>
<u>Subcategory total</u>	<u>\$44,520</u>	<u>\$46,720</u>
Man months	<u>24</u>	<u>24</u>

Work summary--years 3 through 5 This highest priority work will continue with increasing linkages with breeding programs at regional and national locations; continuing emphasis on breeding for resistance to yield and nutritional quality depressing factors.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. II Extended knowledge base and research capability

Program subcategory No. 2 Activity State of the arts study of technical and economic aspects of soybeans in cropping systems of small farmers of the tropics and subtropics.

Staff to be involved Multidisciplinary team (12 man months year 1; 6 man months year 2); many UIUC staff with experience in tropical areas.

Scheduled events/targets Year 1--plan and initiate study of role of soybeans in cropping systems of selected high potential areas of tropics assessing opportunities and constraints to adoption of the crop; literature review; visits to countries for data collection and on-site studies. Year 2--complete country visits, analyze data, complete report on state of the arts.

Expected results Completed state of arts study including recommendations of opportunities and problems research and education needs to encourage adoption of soybeans under conditions where they have comparative advantage.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 25,430</u>	<u>\$ 13,350</u>
Equipment, materials, supplies	<u>1,000</u>	<u>500</u>
Travel	<u>8,000</u>	<u>4,000</u>
Publication, report	<u>--</u>	<u>1,000</u>
Subcategory total	<u>\$ 34,430</u>	<u>\$ 18,850</u>
Man months	<u>12</u>	<u>6</u>

Work summary--years 3 through 5 This program subcategory activity is expected to be completed in year 2.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. II Extended knowledge base and research capability

Program subcategory No. 3 Activity State of the arts study of low level mechanization needs for soybeans to be produced and harvested under small farm conditions of the LDCs.

Staff to be involved Agricultural engineer and agricultural economist (9 man months, Year 1, 6 man months, Year 2.)

Scheduled events/targets Year 1--Plan and initiate study of low cost mechanization for small farms with low cost and abundant labor supplies; literature review; visits to international and national centers to identify technologies adapted to special requirements of soybeans. Year 2--Complete country visits, analyze data, prepare report.

Expected results Completed study in Year 2 containing assessment of state of the arts, needs for mechanical technology development and adaptation, research, education, and training needs.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	\$ <u>19,080</u>	\$ <u>13,350</u>
Equipment, materials, supplies	<u>1,000</u>	<u>500</u>
Travel	<u>6,000</u>	<u>3,000</u>
<u>Publications/Reports</u>		<u>1,000</u>
Subcategory total	\$ <u>26,080</u>	\$ <u>17,850</u>
Man months	<u>9</u>	<u>6</u>

Work summary--years 3 through 5 It is anticipated that this activity will be completed in Year 2.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. III Advisory capacity

Program subcategory No. 1 Activity Develop and maintain an up-to-date talent bank of institutional and individual capacity and expertise in soybean research, education, and development. Ability to mobilize resources to be improved.

Staff to be involved Clerk-typist (.5); computer programmer (3 months in Year 1 and 1 month in Year 2).

Scheduled events/targets Year 1--Develop system for continuing registry of soybean workers on international scale including study of relevant talent banking experiences and development of computer program; begin collection of information on soybean workers. Year 2--complete system and test for completeness and effectiveness.

Expected results Soybean talent banking system completed in Year 2 and operating on basis desirable for continuation; information being supplied throughout soybean network.

Costs and man months:

	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 6,940</u>	<u>\$ 4,860</u>
Equipment, materials, supplies	<u>1,000</u>	<u>1,000</u>
Travel	<u>--</u>	<u>--</u>
<u>Computer time</u>	<u>500</u>	<u>500</u>
Subcategory total	<u>\$ 8,440</u>	<u>\$ 6,360</u>
Man months	<u>9</u>	<u>7</u>

Work summary--years 3 through 5 Talent bank activity will continue and be maintained with increasing completeness of coverage of soybean professional personnel on international scale.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. III Advisory capacity

Program subcategory No. 2 Activity Language training of soybean network personnel

Staff to be involved Staff from UIUC language departments as needed basis; UIUC soybean administrative and core staff and advanced graduate students.

Scheduled events/targets Group Spanish instruction, for core staff, Years 1 and 2; individual French instruction, Year 1, Group French instruction for core staff, Year 2; individual instruction other languages as needed.

Expected results Improved foreign language competency adding to individual and institutional response capability to assist LDCs in soybean research, education, and developmental programs.

Costs and man months:

	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 4,620</u>	<u>\$ 4,620</u>
Equipment, materials, supplies	<u>500</u>	<u>500</u>
Travel	<u>_____</u>	<u>_____</u>
Subcategory total	<u>\$ 5,120</u>	<u>\$ 5,120</u>
Man months	<u>4</u>	<u>4</u>

Work summary--years 3 through 5 Continuing need for language training; however, it is anticipated that needs for group training will decline with increasing emphasis on building language capability on individual basis from nongrant funds.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. III Advisory capacity

Program subcategory No. 3 Activity Salary support for UIUC faculty on release time to increase staff availability for responding to needs of LDCs in development of soybean production, marketing, processing, and use.

Staff to be involved Grant program codirectors (.5); secretary (.25) 6 months faculty release time annually. Some of graduate students in Output I.1. will support faculty members involved.

Scheduled events/targets Identification of UIUC staff members with potential for support of LDC soybean development programs; assignment on release time basis. Overall grant direction will be done under this program subcategory.

Expected results Soybean development response capability in more disciplines with orientation toward needs of LDCs of tropics and subtropics in balanced multi-disciplinary approach; reports and publications from tropical soybean projects completed on release time.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	\$ <u>31,090</u>	\$ <u>33,205</u>
Equipment, materials, supplies	_____	_____
Travel	_____	_____
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Subcategory total	\$ <u>31,090</u>	\$ <u>33,205</u>
Man months	_____ <u>15</u>	_____ <u>15</u>

Work summary--years 3 through 5 This program activity will continue in years 3 through 5 with emphasis on mechanisms for increasing availability of personnel in early to mid-career.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. IV Information capability  
Program subcategory No. 1 Activity Tropical soybean germplasm data bank (TAXIR)  
development and maintenance and information delivery system; tropical and  
subtropical soybean germplasm collection.

Staff to be involved Technician (1.0) supporting UIUC staff member in charge of  
data bank; soybean geneticists and breeders conducting plant explorations and  
collection in high-priority areas.

Scheduled events/targets Addition of tropical soybean germplasm information to  
data bank; delivery of information to soybean breeders in tropic and subtropical  
LDCs; providing information for Output II, Subcategory 1. Two soybean germplasm  
explorations in years 1 and 2 with germplasm added to collection and information  
added to data bank (dependent on funding from nongrant sources).

Expected results More complete tropical soybean germplasm data system, information  
delivery to tropical soybean breeders upon individual request and through published  
reports; widened soybean genetic base for breeding varieties for tropical and sub-  
tropical conditions.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	\$ <u>12,000</u>	\$ <u>12,000</u>
Equipment, materials, supplies	_____	_____
Travel	_____	_____
<u>Computer time</u>	<u>500</u>	<u>500</u>
Subcategory total	\$ <u>12,500</u>	\$ <u>12,500</u>
Man months	<u>12</u>	<u>12</u>

Work summary--years 3 through 5 The germplasm data bank will become increasingly  
important with increased tropical soybean breeding and will be continued; soybean  
germplasm explorations anticipated completed in Year 3.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. IV Information capability

Program subcategory No. 2 Activity Soybean literature compilation, retrieval and delivery capacity to meet the needs of soybean workers under tropical and subtropical conditions.

Staff to be involved Library technical assistant (1.0). Staff to be integrated with UIUC library personnel and be under supervision and guidance of UIUC Agriculture Librarian.

Scheduled events/targets Develop system for tropical literature compilation, retrieval, and delivery; add to tropical journals; conduct literature searches in response to requests and delivery relevant literature; coordinate with UPR-MC library and other international and national libraries with soybean literature for tropical and subtropical conditions.

Expected results Improved system for compiling, retrieving, and delivery of tropical soybean literature; more complete literature on soybeans for tropics and subtropics to serve soybean network personnel and add to institutional response capability. Supplementary funding in addition to grant funds essential for fully effective system.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 8,090</u>	<u>\$ 8,500</u>
Equipment, materials, supplies	<u>1,000</u>	<u>1,000</u>
Travel	<u>_____</u>	<u>_____</u>
<u>Subcategory total</u>	<u>\$ 9,090</u>	<u>\$ 9,500</u>
Man months	<u>12</u>	<u>12</u>

Work summary--years 3 through 5 There will be a continuing and expanding need for tropical and subtropical soybean literature compilation, retrieval, and delivery with increasing soybean development in tropical-subtropical environments.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. IV Information capability

Program subcategory No. 3 Activity Reference collection of soybean pests

(insects, nematodes, diseases, weeds) to serve the needs of soybean workers of  
tropical and subtropical areas and UIUC INTSOY core staff.

Staff to be involved Soybean faunal analyst (.5) UIUC staff in crop production  
disciplines in cooperation with UPR-MC staff.

Scheduled events/targets Development of reference collections as needed in several  
crop protection disciplines to meet tropical and subtropical LDC needs; provide  
identification and information sources to LDCs; integration of system and service  
with Output IV, subcategory 2.

Expected results Increased response capability to assist in identifying problems  
of hazards to tropical soybean production and backup for recommending economical  
means of managing problems.

Costs and man months:

	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 9,130</u>	<u>\$ 9,600</u>
Equipment, materials, supplies	<u>1,000</u>	<u>1,000</u>
Travel	<u>_____</u>	<u>_____</u>
Computer time	<u>500</u>	<u>500</u>
Subcategory total	<u>\$10,630</u>	<u>\$11,100</u>
Man months	<u>6</u>	<u>6</u>

Work summary--years 3 through 5 The reference collection will be gradually  
expanded and maintained; increasing requests for identification and assistance  
with problems are to be anticipated.



WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. V Linkages and networks

Program subcategory No. 1 Activity Development of a network of U.S. institutions with interests and capabilities in development of soybeans for LDCs of tropics and subtropics.

Staff to be involved Grant co-directors; UIUC-INTSOY core staff in cooperation with ARS-USDA soybean personnel; support staff linking UIUC and ARS-USDA Northern Regional Soybean Laboratory.

Scheduled events/targets Technician (6 months annually) providing liaison with USDA-ARS germplasm bank of Northern Regional Soybean Laboratory; travel and other communication with other organizations in U.S. network.

Expected results Development of cohesive network of U.S. organizations and individuals oriented to building response capability to assist LDC of the tropics and subtropics in expanded soybean production and use; identification of needs and determine program activities and mechanisms to facilitate continuing cooperation.

Costs and man months:

	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 4,045</u>	<u>\$ 4,250</u>
Equipment, materials, supplies	_____	_____
Travel	<u>1,000</u>	<u>1,000</u>
<u>Subcategory total</u>	<u>\$ 5,045</u>	<u>\$ 5,250</u>
Man months	<u>6</u>	<u>6</u>

Work summary--years 3 through 5 Formalized activity in this subcategory will decline as result of Year 1-2 activities and increasing involvement of many organizations in the U.S. portion of the network through programs supported by nongrant funds.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. 5 Linkages and networks

Program subcategory No. 2 Activity Development of linkages to international research centers and other international organizations.

Staff to be involved Grant co-directors; UIUC-INTSOY core staff.

Scheduled events/targets Development of memoranda of understanding with appropriate international research centers and other international organizations; cooperative program planning and letters of agreement for specific activities; faculty exchanges and development of joint research and outreach capability; advanced graduate student assignments in support of projects.

Expected results Cooperative soybean research and development programs to serve regional and national needs; increased support from national and international/in support of programs; research and training programs, progress toward international soybean network to serve tropics and subtropics.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	\$ _____	\$ _____
Equipment, materials, supplies	_____	_____
Travel	<u>3,000</u>	<u>3,000</u>
<u>Subcategory total</u>	<u>\$ 3,000</u>	<u>\$ 3,000</u>
Man months	_____	_____

Work summary--years 3 through 5 Work will expand with increasing cooperative programs with international organizations to meet regional and national needs.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. v linkages and networks

Program subcategory No. 3 Activity LDC linkages to national agricultural research, education, training, and development organizations interested in expanded soybean production and use.

Staff to be involved UIUC-INTSOY core staff in cooperation with national organizations and personnel.

Scheduled events/targets Cooperative projects on soybean production and use research, training building on ISVEX, training program and regional workshop developed relations; program planning, technical assistance, and project evaluations supported through task order and technical service agreements.

Expected results Use of institutional response capability of UIUC and soybean network by increasing numbers of LDCs; more effective national programs of soybean development for small farm conditions.

Costs and man months:

		<u>Year 1</u>	<u>Year 2</u>
Personnel	Budget included in other grant categories and by funds from other sources.	\$ _____	\$ _____
Equipment, materials, supplies		_____	_____
Travel		_____	_____
<u>Subcategory total</u>		\$ _____	\$ _____
Man months		_____	_____

Work summary--years 3 through 5 Work will continue but with increasing proportions of support from nongrant funds.

WORK PLANS FOR UNIVERSITY OF ILLINOIS 211(d) GRANT--  
DEVELOPING RESPONSE CAPABILITY IN SOYBEANS FOR LDCs OF TROPICS AND SUBTROPICS

OUTPUT No. y Linkages and network

Program subcategory No. 4 Activity INTSOY Newsletters to provide for communication within the soybean network and the international research, education and development system.

Staff to be involved Communication specialist and editor (see IV,4); UIUC staff in agricultural communications; UIUC soybean personnel.

Scheduled events/targets Analysis of early experience with Newsletter; determine means to make Newsletter more effective; expand distribution to soybean workers in tropical and subtropical areas.

Expected results Improved communication and information transfer within the international soybean network.

Costs and man months:	<u>Year 1</u>	<u>Year 2</u>
Personnel	<u>\$ 2,310</u>	<u>\$ 2,430</u>
Equipment, materials, supplies	<u>1,000</u>	<u>1,000</u>
Travel	<u>          </u>	<u>          </u>
<u>Publication costs</u>	<u>2,000</u>	<u>2,000</u>
Subcategory total	<u>\$ 5,310</u>	<u>\$ 5,430</u>
Man months	<u>2</u>	<u>2</u>

Work summary--years 3 through 5 The Newsletters will serve expanding linkage and communication function in the international soybean network; changing format, size, and increasing circulation are to be anticipated.