

931-11-130-154

211(d) INSTITUTIONAL GRANT PROJECT SUMMARY

24 January 1973

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AAC-598-61
(18p)

A. GRANT SUMMARY

GRANT TITLE: Tropical and Subtropical Soybean Improvement with Emphasis on Developing Disease Resistance and Improved Agronomic Practices

NEW OR EXTENSION: New

PROPOSED GRANTEE: University of Puerto Rico, Mayaguez

GRANTEE'S PROGRAM DIRECTOR: Dr. Salvador Alemany

TOTAL ESTIMATED COSTS: \$500,000

Proposed Budget by Fiscal Years:	FY	\$ 97,600
	FY	98,800
	FY	100,000
	FY	101,200
	FY	102,400

AID LIAISON OFFICER: Dr. Samuel Litzenberger

PROJECT DESCRIPTION:

This proposal is one of two which would enable the recipients to improve their capabilities for assisting in the development of improved soybean production techniques and programs in the tropics and subtropics. The proposed grant would enable the University of Puerto Rico to improve its special capabilities in applied plant pathology for disease control, improved agronomic practices and related disciplines. It will be used to strengthen the University's competence to provide training, special research and technical assistance related to soybean production in tropical and subtropical areas.

The other proposed recipient is the University of Illinois for concentration on plant breeding and production-related disciplines. The grant will be used to assist in developing its capacities to provide assistance in research, training and in developing soybean informational linkages on a worldwide basis.

B. NARRATIVE STATEMENT

1. Rationale for Grant

The world food picture does not present a pleasant prospect for many regions, especially the over-populated areas in the tropical regions of the world, despite great advances like in cereal crop production. A major lag in research and production exists in the tropics for the more extensively grown food legume crops, many of which are excellent sources of cheap high quality vegetable protein.

Soybeans is one of the world's principal legume crops. It may become increasingly important in the tropical and subtropical parts of the world where there is a great need for the improvement of the human diet. Recent research in Puerto Rico and at the University of Illinois, indicates that substantially increased soybean production is feasible in the tropical world. However, further information is needed in order to obtain higher yields through full use of year-round growing weather combined with high yielding adapted cultivars and improved cultural and management practices.

2. Significance to AID/LDC Development Objectives

The major objective of this proposal is to establish at the Mayaguez Campus of the University of Puerto Rico a supporting research and training center to enhance the tropical and subtropical world's capacity to meet goals of increased output and greater efficiency in the production of soybeans. More specifically, the integrated program between Puerto Rico and Illinois would develop a research and training component geared toward the improvement and production-management of soybeans for the tropical and subtropical areas of the world.

The primary focus would be to develop a continuing capacity to do research and training in the tropical and sub-tropical aspects of the breeding and production-management of superior soybean cultivars developed through the joint effort of the two collaborating universities.

Special emphasis would include the strengthening of Puerto Rico's present facilities to do research on the control of limiting tropical diseases and associated insects, the identification of sources of resistance and, in collaboration with the University of Illinois, the incorporation of such improved characters into special populations or lines for the use of developing nations and international institutes. Further, emphasis would also be placed on the determination of management practices that may be recommended under tropical and sub-tropical conditions.

3. Proposed Grantee Profile

The Mayaguez Campus of the University of Puerto Rico offers an exceptional range of resources for international programs, which makes it a valuable site for research in soybeans and for a related resident graduate study program. The various colleges and professional schools of the University present a great variety of courses dealing with Caribbean, Latin American and international studies in general.

The Mayaguez Campus is a Land-Grant Institution and a fully accredited member of the Middle States Association of Colleges and Secondary Schools. The fact that both Spanish and English languages are used by the faculty members and technical personnel especially qualify this University for work with Latin American, Caribbean Area and other Tropical and Subtropical Area countries. The College of Agricultural Sciences, Mayaguez Campus, is in a unique position to provide for education and research of value for these areas. The recent development of graduate programs has expanded the role of the College of Agricultural Sciences as an important training center.

The Mayaguez Campus, College of Agricultural Sciences, performs three basic functions: resident education, research, and extension. It has a well developed, competent and experienced staff for such functions; with more than 100 scientists with a Ph.D. degree. A large number of courses are offered in areas related to this proposal at the College and supporting courses offered by other faculties in the University are an integral part of the work in agriculture. In addition to research on Campus, branch experiment stations located in Isabela, Corozal, Rio Piedras, Gurabo, Adjuntas, Ponce and Lajas provide a wide area of different ecological sites, with more than 2,500 acres available for field work, with adequate laboratories and technical and support personnel well equipped to handle almost any kind of research with soybeans.

The College of Agricultural Sciences is involved in a Consortium of Universities with Cornell, North Carolina, Hawaii, and Prairie View, Texas, under the auspices of AID, for enhancing the competence of these institutions for teaching, research, service, and consultation on soils of the tropics and their use for food and fiber production. The research program from this Grant will provide basic soil information required by the proposed project on soybeans. This is a vitally important research area, since many areas of the tropics will remain incapable of achieving their food production potential until adequate soil management practices are developed.

In addition to the above mentioned facilities the College of Agricultural Sciences maintains close contact and cooperation with the U.S.D.A. Federal Experiment Station at Mayaguez. Facilities like USDA laboratories, technical and support personnel and farms in Mayaguez and Isabela, will serve as additional support for this soybean program.

The Puerto Rico Nuclear Center, a research and training institution sponsored by the Atomic Energy Commission, is operated by the University of Puerto Rico. The scientific, technical and Administrative staff in Mayaguez consists of 111 professionals. The Puerto Rico Nuclear Center offers students the opportunity for advanced training in the application of nuclear techniques to problems in tropical agriculture. It is expected to be of possible assistance in the modification of specific inheritance factors by irradiation for improved resistance and yield characters.

The on-going soybean improvement project which is conducted by the University of Illinois, will be closely linked with work carried out under this proposal. However, because of the existing tropical environment of climate and soil, work on the control of diseases and associated insects, cultural practice and management studies will be the main responsibility of the personnel at Puerto Rico. The proposed Grant would quickly strengthen the competencies of both institutions to play a leading role in worldwide tropical and subtropical soybean improvement and production.

Close collaboration will be established with the Federal Experiment Station at Mayaguez and with the University of Puerto Rico Experiment Station if the proposal for the development of multiple resistant cultivars of selected legumes to diseases and insects of the tropics is approved. Very close coordination will exist between the work at Puerto Rico on disease and pest control and that of Illinois plant breeders, so that maximum use will be made of all inputs to attain the desired objectives, i.e. production of superior multiple resistant populations for the developing nations and the development of improved cultural practices for higher yield.

The University of Puerto Rico has long experience with production of food legumes like field beans and pigeon peas -- as well as other food crops -- on tropical soils which will be of great value for the production of soybeans for the tropics.

4. Work Plan

Work under the Grant will be concentrated in the Departments of Agronomy and Plant Pathology. Supporting studies would also include applications of soil sciences, the plant sciences and the food technology sciences or any other science needed to develop the necessary technical skills for efficient and profitable production and utilization of soybeans. Specific fields of endeavor in which 211(d) grant funds will be used to capacitate the University to carry on continuing research programs are: (a) Screening of cultivars for resistance to limiting insects and associated insects, exchangeable aluminum and efficiency in the utilization of minor elements such as zinc, copper and manganese; (b) weed control - pre and post emergence herbicide treatments suitable for the tropics; (c) plant population and date of planting studies which will be of help in designing a soybean idetype for the tropics; (d) soil and water management practices; (e) drought tolerance; (f) fertilizer studies; (g) nitrogen metabolism with emphasis on rhizobium nodulation.

Another function of this grant will be the training of personnel in subject matters which will capacitate them to serve the University of Puerto Rico international legume improvement and development programs. The Universities of Illinois and Puerto Rico already have a group of top ranking scientists with soybean and related legume expertise. In order to increase each university's ability to extend its responsibility in the international field, these men will be called on. They will cooperatively develop and conduct courses on a wide range of topics important in soybean research and by providing this training develop new personnel to work with soybean production in the tropics.

In direct support of this Grant, the University of Puerto Rico will provide:

- (1) Administrative costs, including the time of Department Heads, Directors, Deans and other senior officers of the University.
- (2) Access to needed laboratories, equipment, field research facilities and libraries.
- (3) Office, classroom and auditorium space for faculty, students, and special meetings or symposia related to the program.
- (4) Consulting service of the faculty members in fields related to topics covered by the Grant.

The University of Puerto Rico will administer the Grant through normal administrative channels by normal operating procedures of the institution. The project leader will be responsible for operations and will report to the Directors of the Agronomy Plant Pathology Departments who will in turn report to the Dean of Agricultural Sciences. The funds provided by the Grant will be administered according to established rules and regulations of AID and of the University of Puerto Rico, Mayaguez Campus, as set forth in the agreement.

OPERATIONAL PLAN

a. Professional Staff:

The Grant will provide salaries for two full time senior staff members. Their principal activities will be to establish strong programs of teaching, research, training, and informational linkage in soybean improvement and production-management, with special emphasis on diseases and associated insects as well as improved cultural practices for specific environments.

b. Visiting Lecturers:

The Grant will provide a means of bringing to Puerto Rico special expertise lacking on the University of Puerto Rico Campus to further enhance its special knowledge and leadership in the area of soybean pathology, entomology, breeding, and production-management. The visiting lecturers will provide leadership to awaken students and staff to the importance of their particular fields of science in agricultural production of soybeans in the tropics. They may also help to plan research programs in their respective areas of specialty.

c. Technical Assistants:

Services of two qualified field and laboratory technicians are essential if the University is to be effective in the development of a research program. Such support with Grant funds is considered essential until such time as their salaries can be assumed by the University. These technicians will assist in laboratory and field plot work, data recording and filing, and the preparation of reports.

d. On-Campus Academic Training

In order to develop an additional source of trained experts who may be drawn on by the University of Puerto Rico 6 assistantships will be made available to qualified graduate students who have a career commitment to tropical crop production and management, specifically legumes like soybeans. Three of these will be accepted as candidates for advanced degrees. Three will be accepted as exchange students from the University of Illinois. Other students will be accepted in the program as candidates for advanced degrees under resources which may be made available from such additional sources as Private Foundations, USAID Missions, FAO, International Agencies and National Governments.

The exchange students will select course work from crop science or supporting fields chosen specifically to complement their training at the University of Illinois. They will take advantage of the tropical environment available at Puerto Rico to develop their theses;

e. Training and Research in the Tropics:

The Grant will enable the candidates for advanced degrees from the University of Illinois to do their thesis research, or to solve professional problems in a tropical environment.

The work will be done in collaboration with Puerto Rico on problems mutually acceptable to the major advisor. Preferably, the problems will be parts of priority research programs being carried on or contemplated, and will be of sufficient importance to the participating institution so that it would be willing to commit some of its available resources and staff time. Visits of the University of Illinois faculty for direction of the student's project and consultation with the onsite supervisor will be made as deemed mutually appropriate. The day-to-day operations will be supervised by a designated competent University of Puerto Rico staff member.

f. Training Through Exchange of Students:

The Grant will make it possible for Puerto Rican students to study at the University of Illinois for the purpose of working and training in areas where Puerto Rico has not developed strength. It should be noted that when a resident student goes to the University of Illinois as an exchange student, his stipend will be available for an additional student in residence.

g. Training Schools, Short Courses, and Individual Training:

Although not specifically financed under the Grant, the additional resources will provide an opportunity to formally respond to requests for special training of groups or individuals financed by outside sources.

Individuals supported by AID country missions, Private Foundations, FAO, etc. can benefit from the strengthened program at Puerto Rico equally with those supported by the Grant, whether or not they are enrolled in degree programs. With outside support, they could also participate in an exchange program with the same advantages as others. Similarly, groups of students having outside support may be accommodated more adequately for short courses and training schools with appropriate supplementary financing for commitments beyond the regular course offerings of the program.

h. Research and Technical Assistance:

In as much as the University of Illinois is far removed from the tropical environment, its collaboration with a tropical institution such as the University of Puerto Rico will be essential. The areas of research selected by students should be in accord with Puerto Rico's areas of specialization, e.g. Pathology, Entomology, Crop Improvement, and Production Management under tropical environments.

i. Library Teaching and Training Materials:

The availability of teaching and training materials on soybean production, management and utilization in the tropics is rather limited. The Grant would provide support for some of the aspects of this activity and also for informational services as needed. Professors from the University of Puerto Rico involved in this project have had an ample and continuous tropical experience in tropical crop production and on problems of the tropics which would be very valuable for the soybean program. The Grant provides capabilities for developing teaching and training materials, and informational services.

5. BudgetESTIMATED BUDGET - FIVE CALENDAR YEARS

	<u>1st Year</u>	<u>2nd Year</u>	<u>3rd Year</u>	<u>4th Year</u>	<u>5th Year</u>
Senior Professor (Agronomist)	\$18,000	\$18,600	\$19,200	\$19,800	\$20,400
Senior Professor (Plant Pathologist)	18,000	18,600	19,200	19,800	20,400
Visiting Lecturer (Short time asgmt.)	2,000	2,000	2,000	2,000	2,000
Technician in Agronomy	5,400	5,700	6,000	6,300	6,600
Technician in Plant Pathology	5,400	5,700	6,000	6,300	6,600
3 Exchange Graduate Assistants	10,800	10,800	10,800	10,800	10,800
3 Resident Graduate Assistants	10,800	10,800	10,800	10,800	10,800
1 Stenographer	5,100	5,400	5,700	6,000	6,300
Employees Benefits	2,000	2,000	2,000	2,000	2,000
Travel and Subsistence*	7,000	7,000	6,100	5,200	4,300
Supplies and Materials	2,600	1,700	1,700	1,700	1,700
Student Support	8,000	8,000	8,000	8,000	8,000
Departmental Support	2,500	2,500	2,500	2,500	2,500
TOTAL	\$97,600	\$98,800	\$100,000	\$101,200	\$102,400

* Travel will be increasingly paid for by University of Illinois budget--
see Illinois 211(d) Soybean Proposal.

EXPLANATION OF BUDGET:Professional Staff

The Grant will provide for two senior professors to devote full time to teaching, research and technical assistance. They will be appointed immediately on implementation of the Grant to supervise the program. The expected full-time starting salary levels are \$18,000 per year.

Technical Assistants

The Grant provides for two full time technicians at a starting salary of approximately \$5,400 per year. It also provides for 1 stenographer.

Puerto Rico will provide routine funds necessary for servicing the operation and will be responsible for teaching aids, assembly of teaching materials, laboratory supplies, greenhouse supplies and facilities, photographic and copying services and materials, reference materials and related services under the direction of the agronomist and plant pathologist. This will be an important factor in the development of teaching and training material discussed under item 9 of the operational plan.

Graduate Assistantshipsa. Exchange Assistantships

The Grant will provide stipends and normal support for three (3) graduate assistantships which will be held, on priority basis, for students of the University of Illinois. Such students would come to Puerto Rico to reinforce their programs from special competences of Puerto Rico, to take

advantage of the tropical environment in rounding up their training. These would normally be awarded for a period of one semester or one year, but could be extended by mutual agreement to as much as two years. In the event that no exchange student applies, the assistantships would be available for support of Puerto Rico students in the program.

b. Puerto Rico Resident Assistantships

The Grant will provide for three graduate assistantships to be held for students regularly enrolled in the program at Puerto Rico. The three assistantships under this Grant would be limited to students in the program and would carry duties associated with the program. These three assistantships may be used for support of exchange students under appropriate circumstances. Graduate students upon the termination of their studies will, at the respective universities' options, become available for employment to increase the University of Puerto Rico and the University of Illinois staff facilities for research and teaching.

Staff Support

The Grant provides for travel and subsistence of project personnel, including that of the Dean or his representative, that of visiting lecturers to and from Puerto Rico, and that of the professors and other staff on business of the project. Such business would include travel to supervise students under training at Illinois and travel for workshops, conferences or research directly concerned with the project.

The allocation for staff support also provides for expenses of the professors and visiting professors of the project for supplies and services specific to their activities for the project. The items included would be different from general departmental supplies and services common to all

projects. In view of the close collaboration between the two universities, funds for travel in any one year may be shared as deemed advantageous to the total effort. This is particularly the case as the University of Illinois has budgeted extensive obligations for travel while those for Puerto Rico have been maintained at a minimum.

Student Support

The Grant provides for travel of Puerto Rico graduate students for complementary training at the University of Illinois and for cost of their programs which are not covered by the host institution. It also provides for normal departmental support of both resident and exchange students at Puerto Rico. It includes tuition and fees, travel to one scientific meeting, local travel for the program, and miscellaneous supplies as associated with program operations. It does not include books, personal supplies and other personal costs incidental to their graduate studies.

Departmental Support

The Grant provides for those costs over and above normal operating costs which the department will incur for this program: This includes communications, data processing, copying services, analytical services, typewriter rental, laboratory supplies and office supplies and services in support of the professors of crops, visiting lecturers and students. It includes costs associated with special seminars and training schools, but the primary costs of training schools and major conferences will be derived from other sources.

6. Internal/External Review

This proposal, prior to implementation will have been internally reviewed by technical specialists in the various Regional Bureaus of AID, RIGC, and other concerned offices.

TA/AGR will provide a Liaison Officer to maintain close contact with the Grantee to provide administrative and technical backstopping, guidance and reporting functions. If technical services are to be performed under this Grant by means of a Basic Ordering Agreement to be determined at a later date, the Liaison Officer will serve as the principal AID contact to coordinate such services.

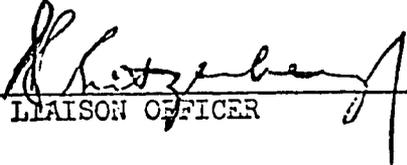
7. Proposing Office's Evaluation

TA/AGR places high priority on this activity based on the rationale described in paragraph B.1. above. While it is difficult to determine at this time, the actual benefits that can be derived from an investment in such an activity are obvious. Benefits would be expressed in higher production of soybeans in the LDCs, improved diets, increased farmer incomes, reduced costs of production, greater employment, promotion of related agribusiness and in general an improvement of the well being and living standards of countless peoples in LDCs.

The soybean is unquestionably the world's principal food legume crop. It is not only the most extensively grown legume crop in the world and the cheapest source of plant protein, but it ranks first in economical production of high quality protein (Tables 1 and 2). The relatively high oil content of the soybean (18 to 22 percent) also gives it a potentially unique multi-purpose role in human nutrition, animal feeding and industrial utilization. As a food it very satisfactorily complements cereals.

Most interested agencies, including AID, believe soybeans can and should become increasingly important in the tropical and subtropical parts of the world where there is great need for improvement of the human diet. Recent limited research by the USDA in Puerto Rico and by the University of Illinois in Ecuador, Colombia, Brazil, Nigeria, Sierra Leone, India, Thailand and Indonesia, indicate that greatly expanded soybean production is readily feasible in the tropical world. However, further specific information is needed to obtain higher yields through the full use of year-round growing weather, combined with high-yielding adapted cultivars and intensive cultural and management practices.

Because soybeans offer perhaps the best source of additional substantial amounts of relatively cheap plant protein to enrich protein-deficient diets of populations of many developing countries, TAB considers this project to be of highest priority. This is also the view of the FAO.


LIAISON OFFICER


AGRICULTURAL OFFICE DIRECTOR

Table 1. COST OF MAJOR PROTEIN SOURCES IN HUMAN DIETS

(Source: Dimler R. J. Soybean Protein Foods. Soybean Protein Foods 1966, AGRI. RES. SERVICE, USDA 71 -35 May 1967)

<u>Food Source</u>	<u>US \$ lb.</u>	<u>% Protein</u>	<u>US \$1-lb. protein</u>
Beef	\$0.70	15.2	\$4.60
Pork	0.50	11.6	4.30
Poultry	0.30	20.0	1.50
Nonfat dry milk solids	0.145	35.6	0.41
Dry Beans	0.08	23.1	0.35
Soybeans	0.05	34.9	0.14
Oats	0.023	13.0	0.18
Wheat	0.028	12.2	0.23
Corn	0.026	9.5	0.27
Potatoes	0.05	2.0	2.50

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Table 2. RELATIVE EFFICIENCY OF WORLDWIDE PROTEIN PRODUCTION OF SELECTED FOOD CROPS

Sources: 1969 Production Yearbook (FAO Vol. 23) and 1970 Amino Acid Content of Foods and Biological Data on Protein (FAO Vol. 24)

Crop	Total World Production (1,000 MT)	Grain Yields (Kilos/ha)	Protein Content of Seed (%)	Nutritional Value (% egg protein)	Protein Content Nutritional Coefficient (%)	Yield Protein Nutrition (Kilos/ha)
<u>Legume Food Crops</u>						
Soybean	43,613	1,300	38	62	23.6	306.8
Dry beans	8,676	799	22.1	47	10.4	83.1
Dry peas	10,115	1,150	22.5	50	11.3	130.0
Chickpeas	7,445	690	20.1	53	10.7	73.8
Groundnuts	15,034	850	25.6	69	17.7	150.5
Broadbeans	4,636	990	23.4	41	9.6	95.0
Pigeon peas	1,829	630	20.9	39	8.2	51.7
Cowpeas	1,083	390	23.4	57	13.3	51.9
Lentils	996	620	24.2	41	9.9	61.4
Mungbeans	1,969	259	23.9	32	7.6	19.7
<u>Cereal Grain Crops</u>						
Wheat	332,500	1,460	12.2	68	8.3	121.2
Rice (Paddy)	284,200	2,150	7.5	76	5.7	122.6
Maize	251,100	2,370	9.5	55	5.2	123.2
Sorghum/Millet	85,100	770*	10.1*	41*	4.1*	31.6*
Barley	130,700	1,740	11.0	78	8.6	149.6
Oats	54,200	1,680	13.0	79	10.3	173.0
Sunflowers	9,944	1,270	12.6	93	11.7	148.6
Potatoes (Irish)	315,500	13,800	2.0	53	1.1	151.8
Cassava	85,625	8,700	1.6	85	1.4	121.8
Plantain	12,724	15,000	1.1	71	0.8	120.0

* Analyses are for sorghum. For pearl millet respective values would be 9.7 and 67% with a protein content coefficient of 6.5%.