PD-AAQ-792

BIOLOGICAL NITROGEN FIXATION FOR FOOD PRODUCTION IN THE TROPICS

CONTRACT AID/DSAN-G-0101

ANNUAL REPORT

1984

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by the

DEPARTMENT OF AGRONOMY AND SOILS

COLLEGE OF AGRICULTURAL SCIENCES

UNIVERSITY OF PUERTO RICO

MAYAGUEZ CAMPUS

MAYAGUEZ, PUERTO RICO

REPORT SUMMARY

STATISTICAL SUMMARY

TITLE:	Biological Nitrogen Fixation for Food Production in the Tropics (BNF Project)
CONTRACT:	AID/DSAN-G-0101
PRINCIPAL INVESTIGATOR:	Dr. Eduardo C. Schröder
CONTRACTOR:	University of Puerto Rico Mayaguez Campus Mayaguez, Puerto Rico
CONTRACT PERIOD:	January 1, 1979 - December 31, 1985
REPORTING PERIOD:	January 1, 1985 December 31, 1984
TOTAL AID FUNDING:	$360,000.

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SUMMARY ACCOMPLISHMENTS

During 1984, several grant objectives were accomplished. Several research projects concerning inoculation of beans and pigeon peas were completed, and results presented at meetings, and published or in preparation for submittal.

Training activities continued at the undergraduate level with the teaching of the Soil Microbiology course during the first semester of 1984. The graduate course on Biological Nitrogen Fixation, taught on an under experimental basis, was officially approved and will be incorporated permanently in the University catalog. The foreign (Dominican Republic) graduate student sponsored by the BNF Project completed his M.S. degree in December, 1984, in record time. A BNF workshop for the Caribbean was held, with AID-BNF sponsorship, during August, 1984, and the organizational meeting of the Caribbean Rhizobium Group (CRG) elected Dr. Eduardo Schröder as coordinator.

SOTA publications (on mungbeans and pigeon pea) are still being actively asked, and books have been sent to several investigators around the world.

Several proposals were prepared, and the one entitled "Increasing Phaseolus vulgaris yields in the Dominican Republic by optimizing the host/strain (Rhizobium phaseoli) symbiosis", which was submitted to the AID-USDA Limiting Factors Program was approved.

GENERAL BACKGROUND

In 1979, the U.S. Agency for International Development (AID) approved an institutional strengthening grant to the University of Puerto Rico (UPR) to study Biological Nitrogen Fixation (BNF) for Food Production in the Tropics. This contract has helped enormously the College of Agriculture of the University of Puerto Rico (Mayaguez Campus), to develop and improve a Soil Microbiology Laboratory, with emphasis on Biological Nitrogen Fixation. A recent request for an extension without additional funds was approved, and the contract will now end on December 31, 1985.

INTRODUCTION

The objective of the BNF grants from AID to the four universities of the Consortium (Cornell, Hawaii, North Carolina and Puerto Rico), was to improve the institutional response capability in the area of Biological Nitrogen Fixation.

The objectives of the University of Puerto Rico BNF Project can be best considered under the following three types of outputs:

1. Research to exploit BNF for crop production
2. Training of personnel, and
3. Advisory activities

RESEARCH ACTIVITIES

1. Leucaena inoculation trials

The objectives and results of this trial were included in the 1982 annual report, and presented at the XI RELAR (Lima, Perú). The UPR BNF Project sponsored the publication of the Meeting's Proceedings, which was completed in 1984 and distributed during the XII RELAR (Campinas, Brasil).

Further research on Leucaena is being conducted under a Tropical Agriculture (TAD) Grant.

2. Inoculation trials of pigeon peas

Results from the experiments during two years at Isabela Experimental Station have been partially analyzed, and data indicates that efficient strains differ in their competitive ability, but selection for saprophytic and competitive abilities is necessary before a recommendation to inoculate is issued.

3. Evaluation of inoculation methods for pigeon peas (Cajanus cajan)

A valid comparison of inoculation methods was probably prevented by the lack of competitiveness of inoculum strain 176A22, and trials should be postponed until more competitive strains are available. Results of this experiment were presented during at the XII RELAR in Campinas, Brasil in October, 1984, and should appear in the Proceedings.

4. Effect of mulching on Phaseolus vulgaris nitrogen fixation

Statistical analysis of the results has not been completed. It is expected that the work would be completed during 1985.

5. Nodulation survey of local legumes

Funds allocated for 1984 were reduced and, therefore, personnel involved in field survey of local legumes were available only for a limited time. However, table 1 shows the list of plants positively identified to be added to the nodulated legume list.

Table 1: Legumes found nodulated during 1984

Species	Subfamily
Brya ebenus	Papilionoideae
Canavalia nitida	Papilionoideae
Corynella paucifolia	Papilionoideae
Piptadenia flava	Mimosoideae
Vigna ambaensis	Papilionoideae

EDUCATION AND TRAINING ACTIVITIES

a. Undergraduate level

The Soil Microbiology course (AGRO 4007) was taught in 1984 during the regular first semester. With the collaboration of one research assistant (Robert Kluson), an additional laboratory on urea degradation was added to the laboratory section. The Departmental Curriculum Committee discussed and approved the inclusion of Soil Microbiology as a required course in the Soils Curriculum, which will increase the number of students attending the course.

b. Graduate level

Lic. Jorge Peisajovich, a Prof. of Soil Microbiology at the Facultad de Agronomía, Universidad Veracruzana, Xalapa, México, received an internship training scholarship from AID, Mexico, and spent 8 weeks of intensive training during August and September, 1984.

The first graduate student from developing countries (Mr. Yovanny A. Velázquez, from the Dominican Republic), completed his requirements in a very satisfactory way, and graduated with an M.S. degree in December, 1984. Mr. Velázquez returned to the Dominican Republic, where he is the first Soil Microbiologist to earn an M.S. degree, and will be cooperating with the AID-USDA Project recently approved to the University of Puerto Rico.

Ms. Raquel Robledo was unable to complete her thesis, due to family complications, and is expected to graduate during 1985.

A new graduate student, Ms. Jacqueline Lazu, started her M.S. program in Soil Microbiology, and in her thesis, she will evaluate Phaseolus vulgaris cultivars for Biological Nitrogen Fixation.

During 1984, the University Administration approved the inclusion of the new graduate course (CFIT 6645 Advances in Biological Nitrogen Fixation) in the catalog as a permanent course.

The Principal Investigator of the BNF Project was in charge during the first Semester of 1984-85 of the Graduate Seminars (AGRO 6651 & 6652). The general topic of the Seminars was Nitrogen (including BNF, N cycle, N fertilization, etc.).

STATE OF THE ART (SOTA) DOCUMENTS

Approximately 50 copies of the Mungbean and Pigeon pea publications were distributed to scientists in underdeveloped countries and libraries continued during 1984.

AZOLLA WORKSHOP

The photocopy-ready manuscript of the Proceedings of the workshop was sent to the publisher (Martinus Nijhoff/Dr. W. Junk Publishers, Netherlands), and the book was published in November, 1984. Copies of the Proceedings have been ordered for distribution among the workshop attendants and authors.

LINKAGE AND COOPERATIVE ACTIVITIES

The main international activity during 1984, was the organization and sponsoring of the First Regional (Caribbean Seminar on BNF in Agriculture). The event was coordinated by Lic. Elfrida Pimentel, of the Secretaria de Agricultura. The workshop was held at the facilities of INDOTEC (Instituto Dominicano de Tecnología Industrial), where excellent laboratory and classroom space was available. The workshop was a cooperative activity among the FAO Regional Office in Santiago, Chile; the UPR Bean/Cowpea CRISP; the NifTAL Project; and the University of Wisconsin, (Madison).

The workshop was held from August 6 to 10, in Santo Domingo, and the international invited speakers included:

Dr. Rosemary S. Bradley	–	CIAT, Cali, Colombia
Dr. David H. Hubbell	–	University of Florida, Gainesville
Mr. Robert A. Kluson, M.S.	–	University of Puerto Rico, Mayaguez
Dr. Juan C. Rosas	–	University of Wisconsin, Madison
Dr. Joann P. Roskoski	–	NifTAL, University of Hawaii
Dr. Eduardo C. Schröder	–	University of Puerto Rico, Mayaguez

Some of the invited Caribbean scientists were not able to attend, but Haiti and Barbados were represented. Local participants were over 30 in number, representing several research groups and institutions. Therefore, the Caribbean Basin was represented by Barbados, Haiti, Dominican Republic and Puerto Rico.

In order to establish more permanent links among the Caribbean countries with established Rhizobium research groups, a meeting was held with the international delegations. The consensus was that a group should be organized, and that it should be part of the Latin-American Rhizobium Association (ALAR). Dr. Eduardo C. Schröder was named coordinator. The petition was taken to the Brasil ALAR meeting, where it was approved. In order to maintain a linkage, the BNF project is sponsoring the publication of a regional circular, which contains pertinent information and is published both in Spanish and English. Further steps are needed to form a regional network for the exchange of research, training and information. The UPR BNF Laboratory could serve as the regional center for this network. These activities depend on future AID or other international funds.

MEETINGS AND TRIPS

In 1984, the principal investigator attended the following meetings:

1. First Caribbean BNF Workshop. August 6 to 10, Santo Domingo, Dominican Republic.

2. SOPCA (Puerto Rican Society of Agricultural Sciences) Annual Technical Meeting. October 11, Mayaguez, Puerto Rico.

3. BNF Biotechnology Meeting (Latinamerica). First Workshop (UNDP, UNESCO, UNIDO). October 18, 19, 20. Campinas, Brasil.

4. XII RELAR (Reunión Latino-Americana de Rhizobium). October 21-26, Campinas, Brasil.

OTHER ACTIVITIES AND ACHIEVEMENTS

From December 3 to 7, a group of Caribbean scientists working with pigeon pea visited the University of Puerto Rico, to get acquainted with all research aspects related to pigeon pea. Dr. J. Fenel (Haiti), who was among the visitors, is in charge of a research project on Rhizobium, and several discussions on cooperative research were held.

In order to maintain the research funding for the BNF Laboratory, the following proposals were prepared and submitted during 1984:

TITLE	SUBMITTED TO	STATUS
Occurrence and Effectiveness of Lysogenic strains of *Rhizobium japonicum*	USDA/SEA, CRGP	Not approved
Increasing *Phaseolus vulgaris* yields in the Dominican Republic by optimizing the host/strain (*R. phaseoli*) symbiosis	USDA/AID	Approved
Selection of V.A. Mycorrhiza Fungi for Enhanced Nitrogen Fixation in Soybeans	USDA/Special Res.	Not approved

As a staff member of the Department of Agronomy and Soils of the UPR, the principal investigator participated in regular Departmental Faculty and Committee meetings, and served as graduate studies representative in M.S. oral exams. A new spectrophotometer (B&L 20) was received, and a needed pH meter is on order.

FUTURE PLANS

The Biological Nitrogen Fixation Laboratory of the University of Puerto Rico has excellent research facilities and secured adequate funds for its operation for the next couple of years. However, long term support is still needed for such activities as maintenance of Rhizobium strains collection, legume seed germplasm, contracts for equipment service, education and training of foreign students.

PUBLICATIONS

Schroder, E. C. 1984. La Fijación Biológica del Nitrógeno y el Proyecto BNF del Departamento de Agronomía y Suelos (RUM). Segunda parte. Rev. Col. Agr. Puerto Rico, p. 7 (S)

Schroder, E. C. 1984. Delonix regia. Confirmation of its non-nodulating character. In: Advances in Nitrogen Fixation Research. Veeger, C., and Newton, W. E. (Eds.) M. Nijhoff/Dr. W. Junk, (PUDOC), The Hague. p. 359.

Silver, W. S. and Schroder, E. C. (Eds). 1984. Practical Applications of Azolla for Rice Production. Martinus Nijhoff/Dr. W. Junk Publ., The Hague, Netherlands.

Gaztambide, M. A. de, and Schroder, E. C. 1984. Effect of toxic substances of Leucaena seed on Rhizobium. Ann. Proc. SOPCA 1984 p. 4 (Abstr.) (S).

Schroder, E. C. 1984. The role of microcomputers in rhizobiology laboratories. Proceedings of the XII RELAR (Reunión Latino Americana sobre Rhizobium) Campinas, Brasil. (S, e).

Schroder, E. C. and Gaztambide, M. A. de 1984. Evaluation of inoculation methods for Cajanus cajan in Puerto Rico. Proceedings of the XII RELAR (Reunión Latino Americana sobre Rhizobium). Campinas, Brasil. (S, e).

(S = Spanish text; e = english summary)

APPENDIX

BNF LABORATORY PERSONNEL

Staff	Position	Months Served
Myrna A. de Gaztambide	Research Assistant	1-84 to 12-84
Robert A. Kluson	Research Assistant	1-84 to 12-84
María A. Pagán	Secretary	1-84 to 12-84
Miguel Rivera	Laboratory Aide (50%)	1-84 to 12-84
Eduardo C. Schroder	Project Leader/ Microbiologist	1-84 to 12-84

GRADUATE STUDENTS

Jacqueline Lazu (new)
Raquel Robledo
Yovanny A. Velázquez (Dominican Republic; M.S., 1984)

LIST OF VISITORS TO THE BNF LABORATORY DURING 1984

Rep. Douglas Bereuter (D-Nebraska)	U.S. Congress, Foreign Affairs Committee
Dr. M. W. Michaud	College of the Virgin Islands, St. Croix
Ing. Maritza Rosario	SEA, Dominican Republic
Ing. M. Olivero de Sánchez	SEA, Dominican Republic
Dr. R. J. Baker	Ministry of Agriculture, Jamaica
Dr. J. Fenel Felix	Faculty of Agronomy, Haiti
Dr. Philippe Mathieu	Damien, Port au Prince, Haiti
Dr. Jean Springer	Bahamas Agricultural Research Center
Dr. Hernderson Williams	Ministry of Agriculture, Barbados