BIOLOGICAL NITROGEN FIXATION FOR FOOD PRODUCTION IN THE TROPICS

Contract AID/DSAN-G-0101

ANNUAL REPORT
1980

SUBMITTED TO THE:

U. S. Agency for International Development

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:	Eduardo C. Schroder
CONTRACTOR:	University of Puerto Rico Mayaguez Campus Mayaguez, Puerto Rico
CONTRACT PERIOD:	January 1, 1979 - December 31, 1981
REPORTING PERIOD:	January 1, 1980 - December 31, 1980
TOTAL AID FUNDING:	$360,000.

GENERAL BACKGROUND

In January, 1979, the Agency for International Development (AID) approved a 3-year institution-strengthening grant to the University of Puerto Rico (UPR) to study Biological Nitrogen Fixation (BNF) for Food Production in the Tropics. This was preceded by the BNF component of Grant AI[illegible]857- Classification and Microbiology of Tropical Soils which helped the University of Puerto Rico, Mayaguez Campus to develop facilities for a soil microbiology laboratory.

INTRODUCTION

The actual start of the grant was delayed due to the lack of a Project Leader. On an interim basis, Dr. Luis Cruz-Perez, Head of the Agronomy and Soils Department, assumed the responsibility for the Project. After a long selection process, a decision was made to appoint Dr. Eduardo C. Schroder. He assumed the principal investigator position at the end of March, 1980. In May, Mrs. Doris B. de Rivera filled the position of research assistant but resigned in early October to move to the United States with her husband. Her position was taken by Mrs. Myrna A. de Gaztambide, who has been working for the BNF Project since October, 1980.

RESEARCH ACTIVITIES

1) Project - In coordination with NIFTAL (Hawaii), experiments following the basic design of the International Network of Legume Inoculation Trials (INLIT) were set up.

a) *Cajanus cajan* (Pigeon pea). Two field trials were planted on July 30 and August 7, 1980.

They were located on different soil types; one at the Isabela Experimental Station (Oxisol) and the other at the Fortuna Experimental Station (Tropic fluvaquents). A single strain (TAL 569) seed inoculant was used. Seed germination was reduced at the plots receiving nitrogen (urea) as fertilizer; this effect was more pronounced at Isabela, probably due to a longer time lapse between planting and first irrigation. In October, plants were dug and sampled for nodules. This task was rather difficult because pigeon pea nodules are very fragile. Nodules were counted and stored for strain identification by serological technics. In December 1980, green pods were harvested twice for yield estimates.

b) *Leucaena leucocephala*. A field trial at the Isabela Experimental Station was established on July 30, 1980. The Hawaiian Giant, K-8 variety was used, and the seed inoculated with a mixture of strains TAL 82, TAL 582 and TAL 1145. Seed germination was also affected on the plots receiving nitrogen fertilizer. On October 8, 1980 plants were

sampled for nodules. These were counted and stored for serological strain identification. Growth was slow at establishment, but later growth was very fast. First harvest for forage yield was carried out on October 10, 1980 and a second one 60 days later.

2) Project - Isolation and Selection of *Rhizobium* strains.

Few strains of *Rhizobium* have been isolated from field grown legumes, most from *Cajanus cajan*. These were tested for nodulation with siratro in test tubes. Poor refrigeration facilities were causing problems in the maintenance of the *Rhizobium* strain collection, but a larger refrigerator, recently bought, will help to maintain the *Rhizobium* collection. The collection has been increased with strains (effective for pigeon pea) received from India (ICRISAT) and from the Rothamsted *Rhizobium* collection. A new evaporative cooler was installed in December, in the BNF greenhouse, and it will be possible to test strains for efficiency under greenhouse conditions.

3) Project - Use of Antibiotic Resistant Strains for Ecological Studies.

In an experiment to study the survival of *Rhizobium japonicum* strains under tropical acid soil conditions, being conducted by Dr. W. C. Stearn (INTSOY), a strain resistant to streptomycin (USDA 58) was included. At flowering, soybeans samples were examined for nodulation and nodules tested for strain occupancy. Preliminary data show that a high percentage of nodules was occupied by strain USDA 58 Str.

4) Project - Utilization of *Azolla* for Rice Production in Puerto Rico.

Although the presence of *Azolla portoricensis* in Puerto Rico was reported many years ago, exploration trips to find it have been negative up to date.

STATE OF THE ART (SOTA) DOCUMENTS

Under the first grant (AID/csd-2857), four SOTA manuscripts were prepared by the University of Puerto Rico. Since the Bean SOTA was only at a draft stage and a BEAN-CRSP publication is under way, the publication of this SOTA was cancelled. Progress has been made in editing the Mungbean document for publication by Dr. J. M. Poehlman (Columbia, Missouri). A photo-ready copy is expected to be completed by the end of January, 1981 and arrangements have been made for publication by the University of Puerto Rico.

The pigeon pea SOTA is being edited by Dr. M. Lugo-López (UPR) and a corrected draft is expected to be ready shortly.

An editor for the improvement of cowpea SOTA is still being sought.

LINKAGES AND COOPERATIVE ACTIVITIES

The establishment of International linkages was affected by the lack of travel documents by the Principal Investigator. A preliminary linkage has been established with Dr. Lillián Frioni (UNRC) from Argentina and a pre-proposal for research in peanuts rhizobia was prepared and sent to USDA/SEA-AID.

Through the members of the Consortium, names and addresses of scientists working in the Dominican Republic were obtained, and letters expressing interest in cooperative work were recently sent, but no

responses have been received yet.

In cooperation with Dr. A. G. Wollum, pigeon pea strains will be tested for high temperature growth and resistance.

A very fruitful cooperative work is being held with the Soil Microbiologist of the INTSOY Project (Dr. W. C. Stearn), located at the same facilities as the BNF Project at the Mayaguez Campus of the UPR. A pre-proposal to work on the improvement of inoculants has been sent to the USDA/SEA-AID.

The principal investigator of the BNF Project participated in the elaboration of a CRSP proposal to work with legumes in the acid soils of the Llanos Orientales region of Colombia. The UPR was recently selected to work in the Soil Management CRSP in this region.

TRAINING

With the cooperation of Dr. A. G. Wollum (NCSU) and Dr. W. C. Stearn (INTSOY) a small training workshop to identify *Rhizobium* strains using microaglutination technics was held in October, 1980. Ms. Peggy Musselwhite (Department of Soils, NCSU) conducted the workshop. As a result, the research assistants of both projects (INTSOY and BNF) and one graduate student were trained to perform serological identifications.

Currently, three UPR graduate students (M.S. degree) have chosen Dr. Eduardo C. Schroder as their major advisor. One of them, Mr. Ismael Matos, has started experiments to test strains to be used in the inoculation of pigeon peas. He was initially funded by the project but presently he receives an assistantship from the School of Agricultural Sciences.

A Nitrogen Fixation Journal Club has been established, and the group meets once a week to discuss current research papers. Approximate 7 scientists participate regularly.

In June, 1980, Mr. Rodulio Caudales, who holds an instructor position at the Department of Agronomy and Soils (UPR), was assigned by the University to work 50% of his time in the B.N.F. Project. He will be working in the project that focuses on the utilization of *Azolla* for rice production in Puerto Rico.

The University of Puerto Rico has been developing and improving facilities for a planned course in Soil Microbiology (AGRO 407) during the second semester of 1980-81 calendar year. This course will be taught by the principal investigator.

MEETINGS

During 1980, the principal investigator attending the following meetings:

1) P. I. SEA/CR-AID Nitrogen Fixation Program. April 10-11, Kansas City.
2) ASM 1980 Annual Meeting. May 11-16 Miami Beach, Florida.
3) AID and BNF Consortium Representatives Meeting. June 24-27, Washington, D. C. and Ithaca, N.Y. Dr. Luis Cruz Perez, Director of the Agronomy Department, also attended.
4) BNF Consortium Representatives Meeting

November 10-11, Raleigh, North Carolina.

5) First Conference Fertility Transfer.

December 9-11, Mayaguez, P.R.

APPENDIX

PROJECT PERSONNEL

Staff	Position	Months Served
Rodulio Caudales	Instructor*	7/80 - 12/80
Myrna A. de Gaztambide	Research Assistant	10/80 - 12/80
Susan Padilla	Secretary	1/80 - 9/80
Doris B. de Rivera	Research Assistant	5/80 - 9/80
Miguel Rivera	Laboratory Aid	1/80 - 12/80
E. C. Schroder	Project Leader Microbiologist	3/80 - 12/80

* Paid with University of Puerto Rico (Mayaguez Campus) funds.

LIST OF VISITORS TO THE BNF PROJECT DURING 1980

NAME	INSTITUTIONS
J. M. Poehlman	University of Missouri
A. G. Wollum	North Carolina State University
D. J. Sammons	University of Maryland
L. Frederick	DSB/AGR, AID, Washington, D. C.
P. Musselwhite	North Carolina State University
B. L. Smith	Ohio State University
F. T. Davis, Jr.	Texas A & M University

-11-

SUMMARY REPORT

1980

211-d Grant: AID/DSAN-G-0101-University of Puerto Rico
P.I. E. Schroder

STATE OF THE ART:

1. THE MUNGBEAN - Morton, J. F., Smith, R. E. and Poehlman, J. M. (in preparation).

2. THE PIGEON PEA - Morton, J. F., Smith, R. E. and Lugo-López, M. A. (in preparation).

3. THE COWPEA - Morton, J. F., and Smith, R. E. - (An editor is still being sought).

GRADUATE STUDENTS:

Matos-Torres, I.
Lugo-Vargas, S.
Carrillo-Morales, E.

RESEARCH ASSISTANT:

Myrna A. de Gaztambide