

Report of the Review Team

Special Grants for Research on Factors Limiting
Symbiotic Nitrogen Fixation for Crop Production
in Developing Countries.

(PASA BST-0610-P-AG-2170-00)
PROJECT 931-0610

January 20, 1988

Revised February 15, 1988

Review Team: Dr. Mark D. Stowers, Chairman
Dr. Abdul Wahab
Dr. Barbara Webster
Dr. Delane Welsch

BIOLOGICAL NITROGEN FIXATION BIOTECHNOLOGY
LIMITING FACTORS RESEARCH
REPORT OF REVIEW TEAM

Executive Summary The Limiting Factors Program " aims to use U.S. expertise to conduct research in equal partner collaboration with developing country scientists on factors limiting the use of BNF in the developing country." The program has funded 82 grants to 53 scientists in 30 universities. Currently there are 22 active programs (all with research partners overseas) with 30 scientists in 19 countries. The program has supported 47 graduate students of which 17 were from LDCs.

The Limiting Factors Program has made significant contributions to the identification, understanding and elimination of factors that limit BNF in an extremely cost-effective manner. The following points summarize the review team's recommendations to make an already successful program to become more successful:

1. The program should be continued as recommended. Funding should be continued to allow support for a minimum of five new proposals per year.
2. Continue to develop new knowledge and new ideas related to BNF. Continue to conduct exploratory, potentially high-return, research as done for the past 11 years.
3. Continue to involve the organizational and methodological skills of U.S. personnel.
4. Continue to support on-going projects which show high promise of benefits to developing countries and to U.S. agriculture.
5. Continue to build upon those results which have potential for technology transfer.
6. Encourage in-country (host country) trained personnel, including those trained on the project and others who have skills and knowledge, to contribute to the transfer of BNF technology.
7. Involve in the program women and ethnic minorities to a greater extent.

BIOLOGICAL NITROGEN FIXATION BIOTECHNOLOGY
LIMITING FACTORS RESEARCH
REPORT OF REVIEW TEAM

Introduction: Biotechnology is becoming an increasingly important tool in providing the food supply for an expanding world population. The use of superior plant genotypes and biological nitrogen fixation (BNF) is one example. BNF provides particular benefits to leguminous plants by supplying nitrogen through a symbiotic association with root-nodule bacteria, called Rhizobium. The significance of BNF is its potential to increase legume yields with relatively low input. It is also a biotechnology which the small farmer is able to use with little technical training. The importance of BNF to the developing world is based on its ability to alleviate requirements for chemical nitrogen fertilizer and reduce energy costs. Equally important is the ability to produce high protein food crops, forages and wood with little or no nitrogen fertilizer.

The application of BNF to the small farm in developing countries offers significant opportunity for (1) increasing agricultural productivity in a relatively short time, and (2) the establishment of a working system with the end-user for the translation of further developments in agricultural biotechnology.

The Limiting Factors Program provides for research to optimize BNF by the selection of efficient bacteria matched with proper plant hosts. The application of this research is in developing countries through partnerships between principal investigators in the U.S. and developing countries. The success of the program can be measured by the technical achievements in overcoming factors limiting the use of BNF in developing countries and in organizational achievements in establishment of successful linkages between the U.S. and the developing countries.

Evaluation Methodology The review team was requested to assess the progress of the project, project design, operation of the project, the impact of the results and provide recommendations for the future directions. The review team consisted of Dr. Mark Stowers, Eastman Kodak Company, Chairman, Dr. Abdul Wahab, AID/AFR/TR/ARD/PA, Dr. Barbara Webster, University of California-Davis and Dr. Delane Welsch, University of Minnesota. Others present at the review: Dr. Lloyd Frederick, S&T/AGR, Project Officer, Dr. Gerald Elkan, USDA/CSRS and North Carolina State University, Program Director, and Dr. Charles M Smith, USDA/CSRS, Program Manager..

The review team was furnished the following documents for review prior to or during the review (November 16-19, 1987):

- 1). PASA between AID AND USDA (FY 1987 - 1988).
- 2). Project Evaluation Summary and Report of the Review Team Evaluation (June 30, 1981).

- 3) Project Authorization and Request for Allotment of Funds.
- 4) Proceedings: Coordinating Workshop for BNF Limiting Factors Program. Maui, Hawaii, August 1985.
- 5) Action Memorandum for Agency Director for Food and Agriculture, Bureau for Science and Technology.
- 6) Project Report for External Review/1987 Annual Report (November 1, 1987).
- 7) Scope of Work for External Review Team.

In addition to written documents, the review team heard presentations by several principal investigators and participated in one-on-one discussions with selected key principal investigators from the U.S. and LDCs during November 17-18, 1987, in Raleigh, North Carolina. The Chairman of the review team also reviewed a tape recording of a "brain-storming" session among several PIs discussing future directions of the project. The review team also traveled to Washington, D.C. to meet with Mr. David Bathrick, Director, Office of Agriculture, Dr. Clare Harris, Associate Director, USDA/CSRS, Dr. Charles Rumburg, Deputy Administrator, USDA/CSRS, Mr. Terry Pakovsky, Chief, Grants Administration and Mr. Dennis Brennan, Deputy Assistant Administrator, Science and Technology Bureau, AID.

External Factors: For the past eleven years the focus of the Special Grants Program for Research on Factors Limiting Symbiotic Nitrogen Fixation for Crop Production in Developing Countries (Limiting Factors Program) has been "to fund teams of U.S. and developing country scientists to collaboratively conduct research on the major factors limiting the full utilization of biological nitrogen fixation (BNF) technology by small farmers in developing countries". The approach has been to fund collaborative ventures where U.S. scientists are equal partners with collaborators in their own country. In the few cases where political situations have made it impossible to conduct collaborative activities, arrangements have been made to work with scientists in alternative countries.

Purpose: The Limiting Factors Program "aims to use U.S. expertise to conduct research in equal partner collaboration with developing country scientists on factors limiting the use of BNF in the developing country".

Achievements: Since its inception, the Limiting Factors Program has awarded 82 grants for 3 year duration (average) to 53 U.S. scientists in 30 universities at \$67,000 (average). Approximately 50% of the funding is designated for items that support the activities of the overseas collaborator. Currently 22 projects are active.

When the Limiting Factors Project was established 11 years ago, there was no requirement for formal overseas collaboration. Of the current 22 active programs, all have active collaboration with scientists overseas (30 scientists in 19 countries (Barbados,

12

Brazil, Cameroon, Ecuador, Egypt, Honduras, Kenya, Malaysia, Mexico, Nepal, Pakistan, Panama, Peru, Philippines, Santa Domingo, Swaziland, Tunisia, Turkey, and Venezuela)). There have been cooperative relationships with the international centers: ICRISAT, Hyderabad, India; IITA, Ibadan, Nigeria; CIAT, Cali, Colombia; and the International Fertilizer Development Center, Muscle Shoals, Alabama.

The Limiting Factors Program has supported 47 graduate students of which 17 were from LDCs. At least two individuals who received degrees through funding by the Limiting Factors Project have been awarded grants through the same program upon returning to their home country. This illustrates the success of the Limiting Factors Program in providing educational opportunities to individuals in LDCs who can make a larger contribution to their home country through obtaining research funding and making a contribution to solving critical agricultural problems.

Inputs: The project manager is Dr. Gerald Elkan, North Carolina State University, who replaced Dr. Robert Miller in 1981. All other personnel related to the project have remained as stated in the previous project evaluation of June 30, 1981. The project is administered by the USDA under PASA BST-0610-0-AG-2170-00 under the direction of Dr. Charles M. Smith. The AID project officer and technical backstop is Dr. Lloyd R. Frederick.

The total monies allocated to the project over the past eleven years are \$5,570,000 out of \$7,000,000 authorized. From the \$5,570,000 transferred to USDA, \$5,206,000 were awarded to participating scientists. For less than 14% of the funds, USDA/CSRS issued the requests for proposals to more than 300 addresses, organized and carried out the peer reviews both by mail and by conference, made the grants and transferred the funds, monitored the work agreements between the U.S. and LDC institutions, received the progress reports, and provided an annual report to AID.

The average number of new proposals funded between 1976 and 1981 was 8 per year at an average of \$48,169 for a 3-year period. The average number of new proposals funded from 1981 to 1986 was 6 per year at \$85,156 for a 3-year period. The total monies awarded annually from the project over the past three years has decreased significantly from \$675,200 (including \$334,700 in special monies for biotechnology research) in FY 1985 to \$163,500 in FY 1987. For the combined FY 1986/1987 (no new funding was made in FY 1986), 36 preproposals were received, and 6 were funded (16.7%). The decrease in project funding has limited the number of projects funded and the scope of the program as a whole. This situation exists in spite of (1) the increasing number of good scientists in the area of BNF, both in the U.S. and in developing countries and (2) the increased knowledge base about other biological systems which limit BNF (both factors can be attributed in part to the success of this program).

Nonetheless, an optimum program is one in which from 30 to 40% of the proposals that are submitted are funded and chances for significant breakthroughs are maximized.

Outputs: The results of the research have provided significant progress toward understanding factors limiting BNF in developing countries. In some cases the research successes in this program represent breakthroughs not evident before, particularly with regard to reproducible inoculation responses with Rhizobium and development of superior nitrogen-fixing plant genotypes. In order to capitalize on the successes of the project and maintain its impressive record of successful research, continuation of the project with minor restructuring and refocusing is needed.

The Limiting Factors Program has been the most effective program seen by any member of the review team in the ratio of achievements to total monies spent by AID.

Beneficiaries: Up to the present time the major beneficiaries of the Limiting Factors Program have been the principal investigators of institutions in the U.S. and LDCs where research is conducted to establish and recommend solutions to factors that limit BNF in developing countries. There is considerable evidence to support the success of the project in awarding grants to institutions both here in the U.S. and in LDCs (\$5,206,000). The general scientific community has benefited greatly by the publication of more than 88 research articles, including the booklet, "Proceedings: Coordinating Workshop BNF Limiting Factors Program, Maui, Hawaii, August, 1985" (91p), and the book, "Biological Nitrogen Fixation Technology for Tropical Agriculture", CIAT (726p).

Various LDCs have also benefited from this program. The success in reproducible inoculation response in peanuts in Cameroon will impact both food and revenue production. The identification of elite lines of bean with superior nitrogen fixation potential will allow a greater opportunity for increased yields in Honduras and other areas in Latin America. Other successes in strain selection for effective rhizobia, mycorrhizae, and in incorporating legumes into farming systems profitably have also impacted local agriculture.

The logical next step is to seek ways to deliver the BNF technology to LDCs at small farmer level. To do so, activities need to be targeted to on-farm field trials, implementation methodology for rhizobia inoculation, and delivery of desirable plant germplasm. The Limiting Factors Program has done an excellent job of doing high quality research and the integration of LDC collaborators into the mainstream of BNF research. The opportunity to build upon the success of the program and the network established by the program is clearly there.

14

Recommendations:

The following recommendations are made to allow an already successful program to become more successful. The suggestions are not a change in focus, but an extension of effort addressing the limiting factors in the successful implementation of nitrogen fixation in developing countries. The review team recommends the adoption of all recommendations with sufficient funding to continue the Limiting Factors Program for five additional years (approximate funding required should equal \$5,000,000).

1). The Program should be continued to support exploratory, potentially high return, research as has been done for the past 11 years. This effort has been highly successful and cost effective. Funding should be continued to allow support for a minimum of five new proposals per year.

The review team suggests that the program continue its support of exploratory research in the understanding of limiting factors of BNF. The program has a very successful " track record " with this approach. Ideally, successes from this program component could be further developed and transferred to the small farmer in an integrated fashion.

2). The Program should be expanded with additional funding to focus on the transfer of its successful technology to small farmer applications.

The project has produced results that could have a significant impact on the small farmer in developing countries. It is now time to attempt to transfer these technologies (Rhizobium strains legume genotypes) to the end-user. The review team recommends that the existing project be expanded to establish the necessary technology for implementation of the successful results of previously funded research. Embodied in this recommendation is the need for (1) delivery systems for Rhizobium strains, (2) inoculant development, *i.e.*, Rhizobium fermentation research, inoculant stabilization, carriers, *etc.*, and (3) research on development of legume genotypes with superior traits, such as enhanced BNF for particular geographical regions. The review team recognizes the contribution of collaborators in developing countries in the successful transfer of technology. Given the immense success of the Limiting Factors Program in establishing key linkages between scientists in developing countries and in producing quality research, it is recommended that this program be the vehicle for the technology transfer. Additional funding would be required to support this activity (at a minimum, an amount equal to that required in recommendation 1), *i.e.*, support for at least five proposals).

3). The Program should be expanded with additional funding to focus on factors that are limiting the transfer of BNF technology to farms.

The review team suggests that the program be expanded to define specific factors that are limiting the transfer of BNF technology to farmers. The most significant limitation to the transfer of biotechnology from the laboratory to the field is the impact of the environment on the system. The review team recommends the compilation of available information identifying environmentally impacted limiting factors in developing countries and to formulate an approach for the assessment of success of BNF under conditions seen in various regions among developing countries such as tropical lowlands, temperate highlands, etc. Additional information will be gained from the transfer of technology recommended above. However, it is important that emphasis should be directed to research to insure the success of technology applied to new situations. A modest amount of funding would be required to produce the document/manual.

4) The Program should develop an action plan to coordinate research activities based on a common objectives, i.e., similar research approaches, such as, common plant species or geographical regions. The review team recommends that all funded work be integrated among projects that share common objectives either through common geographical regional issues or through similar research approaches or common crop species. In the past, formal workshops such as the one held in Maui, Hawaii in August, 1985, served this purpose. Perhaps local regional workshops representing not only the principal investigators but also key local officials--scientists, extension personnel, government staff and A.I.D. local mission individuals could be developed to promote local understanding of the significance of successful programs.

5) General administrative and organizational recommendations by the review team:

- A. The current relationship between the USDA and AID should be continued.
- B. The review team recommends that the peer review process be continued.
- C. The Program should endeavor to solicit proposals from all segments of the research community through continual revision of its mailing list to reflect all known interested parties. With regard to the adequacy of calls for proposals, a survey of research proposals funded indicates that funding went mainly to land-grant universities suggesting that the call may not have reached all segments of the research community. The review team has been made aware that the call for proposals goes to over 300 addresses, reaching a critical mass in the research field.
- D. The administrators should periodically convene the principal investigators to discuss their research, to maximize the information transfer, encourage coordination of resources and germplasm, and attempt to standardize research methodology.

E. A greater involvement of the private sector is encouraged both in the U.S. and in the developing countries. The Limiting Factors Program has created an opportunity for the private sector to provide the product to the end user. It is important that the private sector become a part of the program early in its development to facilitate technology transfer.

F. A greater involvement of the local AID mission is recommended. A tremendous positive advantage can be gained by an alliance with the local mission. An example of where the local mission can help is in the on-farm trials demonstrating the efficacy of the biotechnology of BNF.

G. An increased involvement of women and minorities is recommended in both the call for proposals and review of proposed research.

Unplanned Effects It is inconceivable that the founders of Limiting Factors could have envisioned the magnitude of the success of the project in the quality of research, the technical advances and the tremendous international network of collaborators with such a small amount of financial support.

Lessons Learned To summarize the lessons learned from Limiting Factors Programs, impacts can be made that positively affect agriculture through BNF in LDCs and an international network of scientists can be established with relatively small research funding. A lesson to be learned is how does one successfully transfer the successful technology generated through the program to the small farmer and how does one mobilize the excellent existing network of scientists to effect the transfer.

14



February 15, 1989

Dr. Lloyd R. Frederick
Office of Agriculture
Bureau for Science and Technology
Agency for International Development
Washington, D.C. 20523

Dear Lloyd:

I have received the copy of the report of the review team, and have no additional comments or suggestions. I am glad to see the report completed; however sad to hear that the program is scheduled to die.

The Limiting Factors Program has been an extremely successful program, as indicated in the report of the review team, in grants awarded, graduate students educated and scientific and technical achievements in the field. As a review team it was difficult to translate the exploratory research successes presented by the principal investigators to quantitative impacts on agriculture in developing countries. In my mind, it is like quantifying the impact of automobile, airplane or telephone in 1900 on the 1990s. In 1900 there were indications that each of these would have an impact; and there were individuals who saw the future opportunities to revolutionize the world, but no one could quantitate the impact.

It is a shame that there is lack of foresight at AID for the potential of this program given the tremendous infrastructure and technical basis already accomplished.

Thank you for the opportunity to serve on the review team. It was pleasure to work with you and the review team. I wish you success in your endeavors and hope to see you in the near future.

Very best regards,

A handwritten signature in cursive script that reads 'Mark'.

Mark D. Stowers, Ph.D.
Technology Manager
Bio-Products Division

18

ACTION MEMORANDUM FOR THE AGENCY DIRECTOR FOR FOOD AND AGRICULTURE,
BUREAU FOR SCIENCE AND TECHNOLOGY

FROM: S&T/AGR, Mr. David D. Bathrick, Director

SUBJECT: Scope of Work for Team Evaluation of the Project,
N-Fixation/Biotechnology Limiting Factors, (931-0610),
with USDA Cooperative States Research Service (PASA
BST-0610-P-AG-2170-00).

Background:

Your approval is required to proceed with an in-depth evaluation of the subject project. The last review of the project was conducted in June, 1981. This review will evaluate the performance of the project over the past six years and provide guidance to AID regarding additional authorization. This review was planned so the review team could visit several grantees at a coordination workshop to be held November, 1987.

Recommendation: In order to carry out this team review, your approval is required both for the Scope of Work and travel costs of the team.

APPROVED: _____

DISAPPROVED: _____

DATE: _____

Attachment: Scope of Work

Clearances:

S&T/AGR/RNR, L. Frederick <i>L.F.</i>	date	30 Oct 87
S&T/AGR/RNR, T. Gill <i>T.G.</i>	date	10-31-87
S&T/AGR, E. Roche	date	
S&T/PO, V. Anderson	date	

Info:

S&T/AGR, J. Cohen
S&T/FNR, J. Sullivan

DRAFTED BY: LFrederick:ryh:10/29/87:Wang#5111g

SCOPE OF WORK

In-Depth Team Review

Project Title: Studies of Factors limiting N-Fixation (Biotechnology) for LDC
Crop Production (Biotechnology, Limiting Factors)

1. Project #: 931-0610
2. PASA #: BST-0610-P-AG-2170-00
3. AID Project Manager: Dr. Lloyd Frederick

Contractor: USDA - Cooperative States Research Service Contract Management

1. USDA Program Manager: Dr. Charles Smith, USDA-CSRS, Room 119, JS Morrill, Washington, DC 20251, Ph (202) 447-2039
2. Other Program Staff: Dr. Gerald Elkan, Department of Microbiology, North Carolina State University, Raleigh, NC 276595, Ph (919) 737-3945

Purpose of the Evaluation:

This project aims to use U.S. expertise to conduct research in "equal partner" collaboration with developing country scientists on factors limiting the use of biological nitrogen fixation (BNF) in the developing country. The evaluation will assess the caliber of U.S. scientist involved, the collaboration, types and progress of research activities funded to date, the impact of the project on LDC agricultural science and technology, and direction and scope of future activities. The project is now in its 11th year, and is approved through September, 1989.

Dates and Places of Evaluation:

1. Raleigh, NC, November 16-18, 1987 Sub-project site and attend special meeting of P.I.s.
2. Washington, DC, November 19, 1987 Visit USDA and AID Administration.
3. Draft report due December 20, 1987
4. Final report due January 15, 1988

Composition of Team:

The team has people of wide and varied experience, including international dimensions. The following persons have agreed to serve:

- o Dr. Barbara Webster, Assoc. Dean of Agriculture, University of CA. Davis, CA 95616 (714) 752-2075

Crop Scientist, research and university administration, international experience, CRSP researcher, BOSTID (NRC-NAS) member.
- o Dr. Donald Plucknett, CGIAR Secretariat, World Bank, 1818 H St. N.W., Washington, D.C. 20433 (202) 334-8033

Agronomist, farming systems, International Agr. Res. Centers research, international development
- o Dr. Delane Welsch. Prof. of Agricultural Economics, Asst. Director International Programs, University of Minnesota, St. Paul, MN 55108 (612) 624-3221

Agriculture economist, BNF analysis, international experience, farm record analysis.
- o Dr. Abdul Wahab, Agriculturalist, AID/AFR/TR/ARD/PA, 2941 NS, Washington, D.C. 20523 (202) 647-8717

Agronomist, tropical research, seed technology
- o Dr. Mark Stowers, Director of Agriculture Technology, Eastman Kodak Co, 1700 Lexington Ave., Bldg. 610, Rochester, N.Y. 14650 (716) 722-6531

Microbiologist, molecular genetics, international business

Other Participants:

- o Dr. Lloyd Frederick, AID/S&T/AGR/RNR, Room 420 SA-18, Washington, D.C. 20523 (703) 235-1275
- o Dr. Charles Smith, USDA-CSRS,
- o Dr. Gerald Elkan, Prof. of Microbiology, N. Carolina State University, Raleigh, N.C.

Cost Analysis for Evaluation:

<u>Name</u>	<u>Travel</u>	<u>Per Diem</u>	<u>Salary/ Consultant fee</u>	<u>Source of funds</u>
Dr. Barbara Webster	600	382	None	S&T/AGR ¹
Dr. Donald Plucknett	172	158	None	S&T/AGR ¹
Dr. Delane Welch	523	382	None	S&T/AGR ¹
Dr. Mark Stowers	360	382	None	S&T/AGR ¹
Dr. Abdul Wahab	172	158	None	S&T/AGR ²
Dr. Lloyd Frederick	172	158	None	S&T/AGR ²

Total cost to S&T/AGR

Operating expense: \$660
Program funds: \$2959

- 1 - purchase order program funds
project 936-4109
- 2 - operating expense funds

22

Project Background:

This project was initiated in FY 76 with the goal to improve food production in developing countries and reduce inputs for fertilizer nitrogen through greater exploitation of biological nitrogen fixation (BNF) by legumes. To achieve this goal, the project was to increase LDC research capability by support of outstanding U.S. scientists in collaboration with developing country scientists to conduct research to overcome factors that limit the use of BNF in these countries. Major activities of the project have included:

1. since inception, 82 grants have been awarded to 53 U.S. scientists in 30 research institutions,
2. the average funding per project was \$67,000 for three-year studies with approximately 50% of the funding used for overseas collaboration,
3. currently 30 scientists in 19 LDC countries are active collaborators in the 22 active projects,
4. coordinating workshops are held about every third year, and
5. about 43 graduate students have earned advanced degrees; about half of these were from developing countries.

Research accomplishments are:

1. reported in more than 88 scientific publications, numerous oral and poster presentations, and workshop proceedings, including the book, Biological Nitrogen Fixation Technology for Tropical Agricultures, published by CIAT;
2. results of studies on 10 food legumes, several forage legumes, and three tree legumes; highlighted by:
 - (A) breeding methods that increased the nitrogen fixation capability of common beans,
 - (B) discovery and characterization of a rhizobium strain that increased yields of certain peanut cultivars in soils already containing compatible rhizobia,
 - (C) acid tolerant rhizobia for leucaena and other legumes,
 - (D) oil-based, lyophilized rhizobia as an improved inoculant,
 - (E) yield increases due to rhizobia inoculation on different soils with different legumes, including some tree legumes, beneficial effects of mycorrhiza on nodulation and BNF,
 - (G) root knot nematode reduced plant growth, but had no specific effect on BNF,

82

- (H) found some rhizobial strains were more stable genetically and developed a screening technique to identify the more stable strains,
- (I) improved small farmer storage and hand methods for application of rhizobia inoculant,
- (J) measurement of actual amount of BNF in mixed cropping systems using ^{15}N , and
- (K) new Medicago falcata and associated rhizobia germ plasm for breeding work was collected.

Problems and Issues to be Addressed by the Team:

While not excluded from this external evaluation exercise, the quality and quantity of the research performed under this program, as evidenced by the number of scientific papers published in refereed journals, is apparently quite high. Therefore, the principal concern of AID senior management, given the severe competition for limited funds both within the field of BNF and in other areas of agricultural research, is with questions of relevance, impact and cost-effectiveness vis-a-vis alternative programming approaches. Special issue statements are being provided to guide the evaluation team to questions of importance and timeliness to AID, and whose analysis and recommendation will help in subsequent decision-making.

Progress:

1. Is the project proceeding satisfactorily?
2. Are LDC collaborating scientists benefitting and supportive of the project?
3. Is the work sufficiently completed that the project is no longer needed?
4. ISSUE: NEED FOR VALIDATION/CLARIFICATION OF PROGRAM PURPOSE
The purpose, as given in the Research Project Statement, is to conduct research which will (i) identify and examine those factors that limit optimum BNF in tropical and sub-tropical agriculture, (ii) developing ways to overcome these limiting factors, and, (iii) devise new and improved ways to provide BNF technology to LDC small farmers.

24

The limiting factors of BNF were categorized as soil; plant; and rhizobial inoculant, strain selection and inoculation response. As a way to provide an effective and economical means to obtaining research by qualified workers on these factors, the USDA-CSRS is mandated to issue research grants for projects which address existing knowledge gaps on factors limiting BNF in developing countries.

The team is requested to review the progress and result achieved under each of the three elements in this purpose statement and, in combination with other issues which follow, provide its advice on whether (a) the purpose is too broad or narrow and (b) whether a small grant program is the most cost-effective method of such a purpose.

Project Design:

1. Is the scope of the project too broad? too narrow?
2. Are objectives being achieved for:
 - a. training of national scientists in research?
 - b. overcoming some limiting factors in BNF through research?
 - c. linkages and networking?
 - d. technical assistance?
3. How adequate are the calls for proposals, the selection techniques, the awarding of grants, and the follow-up on grant activities?
4. How adequate is the reporting system?
5. Are the available resources adequate? Is this research project cost effective?
6. ISSUE: APPROACH AND FOCUS

The project statement calls for a Technical Specialist Group from USDA and AID to be convened and consulted to define the factors/problem areas that limit biological nitrogen fixation in tropical cropping systems that can be ameliorated by research. A USDA/AID Selection Committee awards grants on the basis of objectives, scientific merit, pertinence to development, design, methodology, feasibility etc. Increasing reliance is being laid on "Limiting Factors Program Coordination Workshops" for focus and coordination. The last one was held in Hawaii in 1985. At this session, suggestions were made, inter alia, to emphasize better nitrogen-fixing, higher yielding cultivars, include more genotypes and rhizobial strains, appropriate emphasis on biotechnology, and research findings implemented in farmers fields through extension oriented activities. The questions...

- a) the "programming" approach taken seems largely passive, i.e., guidelines are issued, and could sometimes be self-serving, e.g. developing a consensus amongst participating parties. How are research priorities developed, monitored and changed and can the process be improved? Is it reasonable to expect a relatively small and short-term grant program to operate in a "programmatic" fashion?
- b) concern has been expressed that the grants are scattered, lacking focus, are too small and of too short duration to bring any meaningful results. After 11 years, what do the facts and figures indicate regarding this concern? Given the project purpose, is it more justifiable to encourage open-endedness and innovativeness or, conversely, to encourage research in pre-selected priority areas closely coordinated with other AID-sponsored activity in BNF?
- c) Is the PASA mechanism with USDA/CSRS the most effective one for achieving programmatic results? What are the advantages and disadvantages of alternative approaches, e.g., assigning the function and funds to AID's NIFTAL project (a Cooperative Agreement between AID and the University of Hawaii)?
- d) How can or should the IARC's be involved effectively in this program, particularly in utilization of results, developing technology packages and extension?
- e) Should system-based research (e.g., IBSNAT) methodology, be used for developing a complete package of practices and an expert system for outreach?

Project Operations Management:

1. Is there good cooperation between USDA and AID?
2. Is the collaborative arrangement between the grantee U.S. institution and the co-investigator institution adequate and appropriate?
3. How does the LDC scientist and institution contribute to the project?
4. How does the U.S. scientist and institution contribute to the project:

Personnel:

1. Is the staffing adequate and appropriate?

U6

Impact of Unplanned Events:

1. How have changes in AID personnel, in USDA personnel affected project? Other?

Impact of Results:

1. Are the results currently being achieved both applicable and useful to developing countries? Where? What effects can be measured?
2. Is there any indication that the technology improvement developed by this project have been, or will be, used by farmers in the developing world?
3. Can the impact of this project on research capability of developing country scientists and institutions be measured?
4. Has this project had a positive/negative impact on U.S. agriculture?
5. ISSUE: RELEVANCE AND IMPACT

The grants, particularly those involving cooperative field studies with developing countries, are intended to result in benefits which include:

- (1) increased knowledge concerning the response of major legumes in LDC's to inoculation; (2) development of research program and trained personnel in BNF within developing countries which should help in-country BNF long after these grants have ended; (3) the chance to demonstrate the benefits as well as the techniques for legume inoculation to small landholders within on LDC.
 - (a) what are its actual or potential benefits?
 - (b) what evidence do we have that this grant program has assisted developing countries in becoming aware of the potential of BNF and have begun programs and institution-building to apply the research results achieved to date? In short, is anything changing on the farm which can reasonably be attributed to this program?

Recommendations:

1. What are team recommendations regarding the project objectives, goals, relative value?

2. Does the project contribute to sustainable agriculture, low-resource agriculture, low-input agriculture, biotechnology, and rural income?
3. Should this project be extended?
4. ISSUE: OVERALL ASSESSMENT

Based on the documentation supplied and discussion of the above issues with evaluation participants, provide an overall assessment at the following levels:

- (i) research products, i.e., quality, quantity and cost-effectiveness;
- (ii) relevance of research results to agricultural problems in tropical and sub-tropical areas in the developing world; and
- (iii) actual/potential impact of program in developing countries and on-farm

Executive Summary:

Should not be more than one page, single spaced.

List of Documents to be reviewed by the Team:

1. Current PASA and amendments
2. Project Paper
3. 1986 Annual Report
4. Proceedings: Coordinating Workshop BNF limiting Factors Program

Proposed Schedule of Events:

- | | |
|--|-------------|
| 1. Approval of Scope of Work | 10/20/87 |
| 2. Distribution of Scope of Work and Documents | 11/12/87 |
| 3. In depth team evaluation | 11/16-20/87 |
| 4. Team leader submits final report to S&T/AGR | 1/31/87 |

In Friedrich - from
Chenck, Smith
NOV - 1 REC'D

98-DEC. 22, 1981

PUBLIC LAW 97-98-DEC. 22, 1981

95 STAT. 1315

of providing such services has been

"PROGRAM EVALUATION STUDIES

**FUNDS FOR EXISTING AND CERTAIN NEW
SEARCH PROGRAMS**

National Agricultural Research,
Act of 1977 (7 U.S.C. 3311) is amended

300,000 for the fiscal year ending
section (a) and inserting in lieu
fiscal year ending September 30,
fiscal year ending September 30, 1983,
fiscal year ending September 30, 1984, and
fiscal year ending September 30, 1985,";
300,000 for the fiscal year ending
section (b) and inserting in lieu
fiscal year ending September 30,
fiscal year ending September 30, 1983,
fiscal year ending September 30, 1984, and
fiscal year ending September 30, 1985,"; and
of a new subsection as follows:
provision of law effective beginning
5 per centum of the total funds
available for the conduct of the
programs provided for under the Act of March 2,
1987 Act (7 U.S.C. 361a et seq.); the
amount provided for under the Act of
1987 as the McIntire-Stennis Act (16
U.S.C. 178 et seq.); and the research
programs (c) of the Act of August 4, 1965 (7
U.S.C. 3101 et seq.) provided for under
the native latex research program
Commercialization and Economic
Development Act (7 U.S.C. 178 et seq.); and the research
programs for which funds are appropriated
under heading or a successor heading,
of State agricultural experiment
stations of the Act of March 2, 1887."

FUNDS FOR EXTENSION PROGRAMS

National Agricultural Research,
Act of 1977 (7 U.S.C. 3312) is amended
for the fiscal year ending Septem-
ber 30, 1981, of "\$350,000,000 for the fiscal
year ending September 30, 1982,
\$360,000,000 for the fiscal year
ending September 30, 1983,
300,000 for the fiscal year ending
September 30, 1984, and
300,000 for the fiscal year ending
September 30, 1985."

OTHER PROVISIONS

National Agricultural Research, Extension, and
Conservation Act (7 U.S.C. 3101 et seq.) is amended by
the following sections:

7 USC 3317.

"SEC. 1471. (a) The Secretary shall regularly conduct program
evaluations to meet the purposes of this title and the responsibilities
assigned to the Secretary and the Department of Agriculture in this
title. Such evaluations shall be designed to provide information that
may be used to improve the administration and effectiveness of
agricultural research, extension, and teaching programs in achieving
their stated objectives.

"(b) The Secretary is authorized to encourage and foster the regular
evaluation of agricultural research, extension, and teaching pro-
grams within the State agricultural experiment stations, cooperative
extension services, and colleges and universities, through the devel-
opment and support of cooperative evaluation programs and program
evaluation centers and institutes.

**"GENERAL AUTHORITY TO ENTER INTO CONTRACTS, GRANTS, AND
COOPERATIVE AGREEMENTS**

7 USC 3318.

"SEC. 1472. (a) The purpose of this section is to confer upon the
Secretary general authority to enter into contracts, grants, and
cooperative agreements to further the research, extension, or teach-
ing programs in the food and agricultural sciences of the Department
of Agriculture. This authority supplements all other laws relating to
the Department of Agriculture and is not to be construed as limiting
or repealing any existing authorities.

"(b) The Secretary may enter into contracts, grants, or cooperative
agreements, for periods not to exceed five years, with State agricul-
tural experiment stations, State cooperative extension services, all
colleges and universities, other research or education institutions
and organizations, Federal and private agencies and organizations,
individuals, and any other contractor or recipient, either foreign or
domestic, to further research, extension, or teaching programs in the
food and agricultural sciences of the Department of Agriculture.

"(c) The Secretary may vest title to expendable and nonexpendable
equipment and supplies and other tangible personal property in the
contractor or recipient when the contractor or recipient purchases
such equipment, supplies, and property with contract, grant, or
cooperative agreement funds and the Secretary deems such vesting of
title a furtherance of the agricultural research, extension, or teach-
ing objectives of the Department of Agriculture.

"(d) Unless otherwise provided in this title, the Secretary may
enter into contracts, grants, or cooperative agreements, as authorized
by this section, without regard to any requirements for competition,
the provisions of section 3709 of the Revised Statutes (41 U.S.C. 5),
and the provisions of section 3648 of the Revised Statutes (31 U.S.C.
529).

**"RESTRICTION ON TREATMENT OF INDIRECT COSTS AND TUITION
REMISSION**

7 USC 3319.

"SEC. 1473. Funds made available by the Secretary under estab-
lished Federal-State partnership arrangements to State cooperative
institutions under the Acts referred to in section 1404(16) of this title
and funds made available under subsection (c)(2) and subsection (d) of
section 2 of the Act of August 4, 1965 (7 U.S.C. 450i) shall not be
subject to reduction for indirect costs or for tuition remission. No
indirect costs or tuition remission shall be charged against funds in

Ante. p. 1297.

Ante. p. 1304.

29