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BEAN/COWPEA COLLABORATIVE RESEARCH SUPPORT PROGRAM  
External Evaluation of the  
BRAZIL/BOYCE THOMPSON INSTITUTE/ROBERTS/MAGALHAES PROJECT  
"Insect Pathogens in Cowpea Pest Management Systems  
for Developing Nations",

Antonio M. Pinchinat  
E.E. Panel Member

Lima, Peru  
December 15, 1986

BEST AVAILABLE DOCUMENT

## INTRODUCTION

As requested by the Management Office, this EEPM travelled to Brazil to evaluate the two Bean/Cowpea CRSP Projects at the Centro Nacional de Pesquisa Arroz e Feijao, of the Empresa Brasileira de Pesquisa Agropecuria, in Goiania, Goias, from December 8 through 10, 1986. The schedule of meetings and list of participants are presented in Annex 1. A fourth day, December 11, was used to review documents and organize relevant information on the Projects, but no formal meetings took place due to official festivities at CNPAF on that day.

The following is a condensed report on the B/C CRSP Roberts/Magalhaes project, structured according to the scope of work established by the MO (Annex 2).

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## I. PROGRESS OF THE PROJECT

### I.A. Progress toward Research Objectives

1. The project has identified a large number of promising pathogens of cowpea insect pests. Thus, *Erynia radicans* has shown considerable potential for control of *Empoasca* leafhopper pests of cowpea and other grain legumes. Other fungi, such as *Beauveria bassiana* and *Metarhizium anisopliae*, have been found to be highly pathogenic to coleopteran cowpea pests, principally *Chalcoedermus aeneus* and *Ceratoma arcuata*.

2. An Insect Pathology Resource Center has been established at CNPAF.

3. Over 200 isolates of entomopathogenic fungi have been placed in repositories at CNPAF and BTI, and new isolates are being added at both places, in an effort to broaden the range of insect pests that can be controlled in cowpeas and other crops.

4. In the near future, the patented dried-mycelium formulation of *E. radicans* may be routinely applied by farmers in Brazil and elsewhere to control *Empoasca* leafhoppers. Simple methods for production of *B. bassiana* and *M. anisopliae* formulations are being developed at CNPAF against chrysomelid beetles.

### I.B. Calibre of Research Conducted.

The calibre of research conducted in the Project is excellent.

### I.C. Contribution of Project toward Alleviation of Constraints identified in the Global Plan.

1. The Project has aroused considerable institutional interest in Brazil and elsewhere, in the field of entomopathology.

2. It is expected to offer to farmers effective, low-cost pathogen formulations to control insect pests in cowpea and other crops. This should greatly contribute to the increase of food production and income, especially on small farms in the less developed countries of the world.

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I.D. Level and Effectiveness of Collaboration between the Principal Investigators.

1. The level and effectiveness of collaboration between the PI's on the Project are highly satisfactory.
2. Project planning and budgeting is jointly carried out by the U.S. and Host Country teams.
3. The PI's reciprocally and regularly visit each other's institutional base.

I.E. Staff Support to Conduct Research.

Staff support to conduct research in the project is considerable, especially in the H.C.

I.F. Equipment Availability

Research equipment in the Project is considered to be adequate, but a shaker (not available in Brazil) is badly needed.

I.G. HC Support Provided to the Project.

The HC has provided generous support to the project, in human resources and physical facilities. If it were quantified in money equivalent and person/months, this would clearly demonstrate a strong institutional commitment to the project.

I.H. AID Representative's Knowledge and Support of the Project.

The involvement of the Representative of the U.S. Agency for International Development in Brazil regarding the Project has improved. It is expected to be cultivated and be strengthened during the extension period.

I.I. Progress toward Training Objectives/Needs.

1. The Project has made significant progress toward its training objectives.
2. According to the Technical Annual Report for Fiscal Year 1986, it has so far sponsored MS degree training for 5 Brazilians, and a sixth will complete his MS program at Cornell

before the end of FY 1987.

3. A U.S. student is enrolled in a PhD degree program under the Project.
4. Through annual short courses in Brazil, the Project has trained over 50 professionals in microbial insect control.
5. The HC PI on the Project is expected to enter a PhD degree program in the US, sponsored but not funded by the B/C CRSP.
6. Furthermore, intern training has been provided by the Project to post-BS graduates in Brazil.

#### I.J. Importance of Research for U.S. Agriculture.

1. Microbiological control of insect pests may be enormously valuable to US agriculture, both in cost effectiveness and possibly in ecological protection.
2. Field application of dry mycelium of *E. radicans* may become before long a novel means of controlling *Empoasca fabae* leafhopper in alfalfa, beans and other crops in U.S. agriculture, according to encouraging research results obtained by the project in the State of New York.

#### K. Logical Completion Dates for Specific Segments of the Project.

By the end of year 1989, commercial formulations of *E. radicans* and homemade preparations *B. bassiana* and *M. anisopliae* may become established technological inputs in cowpea and bean production in Brazil and interested LDCs or elsewhere.

#### L. Actions Needed to Enhance the Project.

1. On-farm testing and validation of microbial formulations as component of integrated insect pest management models may need to be intensified and expanded in Brazil, especially in the major cowpea and bean producing states of the country.
2. The economic value of such models should be assessed on real farm scale. Therefore the direct and active participation of an agricultural economist on the Project's research team is necessary. Such a role could be filled by Dr. Sonia Teixeira, of CNFAF, at no major personnel cost to the B/C CRSP.

3. Work with entomopathogenic bacteria may need to be increased within the Project or in cooperation with other projects or institutions, especially universities in Brazil and the U.S.

4. An annual National Workshop on microbial insect pest control in agriculture, could be sponsored by the Project in Brazil.

5. Intense participation of the Project in a CNPAF's Annual Bean and Cowpea Research/Production Workshop, should be fostered by the Project and institutionalized at CNPAF.

## II. LINKAGES OF THE PROJECT

### II.A National, Regional and International.

The Project has developed extensive linkages at the national and regional levels. They include the following, among others:

1) Cooperative work with the University of Sao Paulo at Piracicaba, Federal University of Lavras in Minas Gerais, and other universities, and

2) Research Centers and Stations of EMBRAPA or other National institutions.

2. Professionals from Perú, Chile and Mexico have participated in the Annual short course program offered by the Project at CNPAF.

3. There are plans to extend linkages at the international level, through the Centro Internacional de Agricultura Tropical, the Centro Agronomico Tropical de Investigación y Enseñanza at Turrialba, Costa Rica, and some B/C CRSP projects, among others. Some collaboration has been established with the International Institute of Tropical Agriculture, through its cowpea research project at CNPAF.

### II.B Interactions with Extension.

Some interactions with extension have been initiated through units of the extension system of Brazil (EMBRATER) especially in survey trips for the collection of insect

pathogens in the country. Based on collaboration begun with Dr. Sonia Teixeira, agroeconomist at CNPAF, such interactions should be strengthened and expanded by allowing a greater involvement of Dr. Teixeira and extension specialists in the project.

### II.C Actions Needed to Improve Linkages

1. Increase interactions with the extension system, through collaborative on-farm activities such as socio-economic evaluation and validation of technological models for microbiological insect pest management in cowpea production in Brazil.
2. Initiate and develop formal linkages with interested international or regional research/development centers such as CIAT, IITA, CATIE, and others.

### III. PROCEDURES FOR DISSEMINATING RESULTS AND ACTIONS NEEDED TO IMPROVE DISSEMINATION

The project has utilized various means to disseminate its research results. They include:

- 1) Chapters in books
- 2) Technical papers
- 3) Written contributions to the Technical Bulletin of EMBRAPA-CNPAF Pesquisa em Amdamento (Research in Progress)
- 4) Presentations at National and international meetings
- 5) Short courses
- 6) Seminars and lectures
- 7) Newspaper articles
- 8) TV presentation.

As technological innovations approach the stages of field testing and validation, prior to recommendation, communication with and dissemination through the extension system are expected to increase.

### IV. JUSTIFICATION FOR CONTINUING THE PROJECT IN BRAZIL, CONSIDERING CRSP GUIDELINES.

#### IV.A Effectiveness of transferring Results to other LDC's in the Region.

Based on information gathered during the evaluation

process, it appears that research results from the Project may be effectively transferred to LDC's in the region. Already some entomopathogenic fungal isolates from the Project have been shared with Argentina.

IV.B Need to Continue Research Efforts in Brazil rather than LDCs.

CNPAF would like to get to the point where entomopathogenic microbial formulations, at least those being developed around *E. radicans*, *E. bassiana*, and *M. anisopliae*, could be made available for farm use in Brazil and elsewhere. This may require one more year past the extension period, i.e. end of 1989. The HC institution has expressed a strong interest in maintaining the collaborative arrangement with the U.S. institution, beyond the life of the project per se, to pursue and expand research in microbial control of insect pests in cowpeas, beans and rice.

8

## Annex 1

SCHEDULE OF MEETINGS AND LIST OF PARTICIPANTS  
 CNPAF, GOIANIA, GO., BRAZIL

December 8 - 10, 1986

MONDAY, DEC. 8

Early\_morning

- |    |                               |  |
|----|-------------------------------|--|
| 1. | Emilio da Maia de Castro.     | Chief, CNPAF   |
| 2. | Antonio Renes Lins de Aquino, | Administrative Deputy<br>Chief, CNPAF                              |
| 3. | Jeffrey C. Lord,              | Resident Research Assoc.<br>B/C CRSP/Roberts/<br>Magalhaes Project |
| 4. | Bonifacio P. Magalhaes,       | HCPI, B/C CRSP/Roberts/<br>Magalhaes Project                       |
| 5. | Josias C. de Faria,           | HC CO-PI, B/C CRSP/<br>Bliss/CNPAF Project                         |
| 6. | Ricardo S. Araujo,            | HC CO-PI, B/C CRSP/<br>Bliss/CNPAF Project                         |
| 7. | Douglas P. Maxwell,           | US CO-PI, B/C CRSP/<br>Bliss/CNPAF Project                         |
| 8. | Antonio M. Pinchinat          | EPPM   |

Mid\_morning

- |    |                               |  |
|----|-------------------------------|--|
| 1. | J.C. Lord                     |  |
| 2. | B.P. Magalhaes                |  |
| 3. | Eliane Divas Quintela,        | Investigador, B/C CRSP/<br>Roberts/Magalhaes Project |
| 4. | Maria Gorette Araujo de Lima, | Investigador, B/C CRSP/<br>Roberts/Magalhaes Project |
| 5. | A.M. Pinchinat                |  |

Afternoon

- |    |                |
|----|----------------|
| 1. | J.C. Lord      |
| 2. | B.P. Magalhaes |
| 3. | A.M. Pinchinat |

TUESDAY, DEC 9

All day

1. Maria J. Zimmermann, Investigador, B/C CRSP/Bliss/  
CNPAF Project
2. J.C. de Faria
3. D.P. Maxwell
4. A.M. Pinchinat

WEDNESDAY, DEC 10

Morning

1. R.S. Araujo
2. D.P. Maxwell (part time)
3. A.M. Pinchinat

Afternoon\*

1. E. da M. de Castro
2. A.R.L. de Aquino
3. A.M. Pinchinat

\* Includes a courtesy visit with Ms Lourdes Ferreira Peixoto, CNPAF Accounting Technician.

## Annex 2

BEAN/COWPEA CRSP  
EXTERNAL EVALUATION PANEL SCOPE OF WORK FOR BRAZIL  
(Bliss/Maxwell-Araujo  
Roberts-Magalhaes)

- I. Review progress of project.
  - A. Progress toward research objectives.
  - B. Calibre of research conducted.
  - C. Contribution project makes toward the alleviation of constraints identified in the Global Plan.
  - D. Level and effectiveness of collaboration between the PIs.
  - E. Staff support to conduct research.
  - F. Equipment availability.
  - G. HC support provided for project.
  - H. AID representative's knowledge and support.
  - I. Progress toward training objectives/needs.
  - J. Importance of research for US agriculture.
  - K. Logical completion dates for specific segments of project (especially Maxwell work).
  - L. Actions needed to enhance project.
  
- II. Review linkages made by project.
  - A. National, regional and international.
  - B. Interaction with extension.
  - C. Actions needed to improve linkages.
  
- III. Procedures for disseminating results and actions needed to improve dissemination.
  
- IV. Justification for continuation of projects in Brazil in consideration of CRSP guidelines.
  - A. Effectiveness of transferring results to other LDCs in the region.
  - B. Need to continue research efforts in Brazil rather than LDCs.

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BEAN/COWPEA COLLABORATIVE RESEARCH SUPPORT PROGRAM

EXTERNAL EVALUATION  
OF THE

BRAZIL/UNIVERSITY OF WISCONSIN/BLISS/CNPAF PROJECT  
Plant Microbial Interactions in Beans: Improvement of  
Nitrogen Fixation and Disease Resistance".

Antonio M. Pinchinat  
E.E. Panel Member

Lima, Peru  
December 15, 1986

## INTRODUCTION

On request of the Management Office of the B/C CRSP, this EEPM travelled to Goiania, Brazil, to evaluate the two CRSP bean Projects, at the Centro Nacional de Pesquisa Arroz e Feijao, of the Empresa Brasileira de Pesquisa Agropecuaria, from December 8 through 10, 1986. The schedule of meetings and list of participants are given in Annex 1. An originally programmed fourth day of work on December 11th, was used to review documents and organize relevant information on the Projects, with no formal meetings due to official festivities at CNPAF on that day.

The following is a condensed report on the evaluation of the B/C CRSP Bliss/CNPAF Project, arranged according to the scope of work established by the MO (Annex 2). This new project results from the merging in May 1986 of two separate ones at CNPAF: 1) the Bliss/Araujo project "Identification of Superior Bean-rhizobia Combinations for Utilization in Cropping Systems Suitable to Small Farms in Brazil", and 2) the Maxwell/Faria project "Improved techniques for Development of Multiple Disease Resistance in *Phaseolus vulgaris* L." For each one, a separate Technical Annual Report for Fiscal Year 1986 (October, 1985-September 30, 1986) has been prepared and was available for the evaluation process. Because only very little technical interaction has developed between the two original projects since their merging under one United States and one Host Country Principal Investigators, their particular features are treated separately, as much as possible, in this report.

I PROGRESS OF THE PROJECT

IA. Progress toward Research Objectives

1. Based on the scientific and technical information, the promising improved germplasm, and methodology for enhanced biological nitrogen fixation (BNF) that have been produced in the project, the development of high N-fixing bean cultivars suitable to different farming systems should be possible in the near future.

2. Breeding methodology for multiple disease resistance (MDR) in beans may become more effective and efficient, as a result of the techniques developed by the project to sequentially test in a single season and the same population, and even on the same plant, reaction to four pathogens (angular leaf spot, rust, common bacterial blight, and anthracnose).

3. With increased emphasis on identifying sources of resistance or tolerance to the bean golden mosaic virus disease, the project may contribute to a dramatic increase of bean production in many parts of the world.

I.B. Calibre of Research Conducted

The calibre of research conducted in both legs of the project is quite high, covering an appreciable range of basic and applied studies.

I.C. Contribution of Project toward Alleviation of Constraints Identified in the Global Plan.

1. The project is getting closer to the point where it can measurably contribute toward the alleviation of constraints identified in the Global Plan.

2. If its planned on-farm technology testing and validation are successful, the project will make available to farmers improved production management packages which combine highly responsive cultivars with more efficient/effective Rhizobium strains for maximum BNF.

3. Introducing MDR into such a package, including resistance/tolerance to BGMV, should greatly

stabilize annual bean yield and production, particularly at the small-farm level in the bean producing less-developed countries.

I.D. Level and Effectiveness of Collaboration between PI's.

The level and effectiveness of collaboration between PI's are excellent.

Staff Support to Conduct Research

Staff support to conduct research is excellent at the professional (PhD/MS) level. But the technical level of the supporting staff (laboratory and field assistants) needs to be up-graded in both legs of the project at the HC.

I.F. Equipment Availability

1. In the Bliss/Araujo leg, available equipment is adequate to satisfy present research needs.
2. In the Maxwell/Faria leg, a rotor for the centrifuge and an ultra violet fractionator are badly needed.

I.G. HC Support Provided to the Project

1. The HC support provided to the project is exceptionally high, and needs to be quantified.
2. The present economic measures established by the Federal Government in Brazil, may be having negative/restrictive effects on transportation and travel in the project.

I.H. AID Representative's Knowledge and Support

The AID Representative's knowledge and support may have improved, but still need to be cultivated and strengthened.

I.I. Progress toward Training Objective/Needs

Some progress toward training objectives has been achieved, but Brazil (through EMBRAPA and other institutional structures) should have more professional human resources trained to satisfy the needs of the project. The HC BNF specialist has been proposed to pursue a PhD degree program in the US.

### I.J. Importance of Research to US Agriculture

The research results of the project are clearly important to US agriculture through its advancement of scientific knowledge, development of advanced methodology and techniques, production of improved bean germplasm, and exchange of information and materials on BNF and MDR in beans.

### I.K. Completion Dates for Specific Segments of Project

The timetable for completion of specific segments of the project encompasses the following stages:

1. Enhanced BNF capacity
  - 1) Selection of high N-fixing bean genotypes: end of year 1986, onwards.
  - 2) Development and release of high N-fixing bean varieties: end of 1988
  - 3) Field evaluation of highly N-fixing strains of Rhizobium phaseoli: end of 1988.
  - 4) Availability of superior strains of Rh phaseoli for preparation of commercial bean BNF inoculant: end of 1988.
  - 5) Factory production of highly effective and efficient Rhizobium bean inoculant for enhanced BNF: by end of 1989.
2. Improved MDR
  - 1) Technical guide for sequential testing of reaction of beans to selected multiple pathogens: published by end of 1987.
  - 2) Development of at least three bean breeding lines concurrently resistant to three of four pathogens (ALS, Anthracnose, Rust, CBB): by end of 1987.
  - 3) Insecticide management of bean white fly: by end of 1987.
  - 4) Detached leaf procedure to sequentially test bean reaction to ALS, CBB, rust and anthracnose: published by end of 1988.

- 5) Biomolecular characterization of BGMV: by end of 1989
- 6) Release of at least three bean varieties tolerant to BGMV: by end of 1989.
- 7) Established procedures and techniques to detect BGMV in plants: by end of 1990.

#### I.L Actions Needed to Enhance Project

##### 1. Enhanced BNF capacity

- 1) Intensify and extend on-farm testing and validation of superior bean lines and Rhizobium strains for enhanced BNF capacity.
- 2) Include economic analysis, under real-farm conditions, of enhanced BNF technology model developed (superior bean genotype plus superior Rhizobium strain for enhanced BNF capacity), by involving Dr. Sonia Teixeira, Agricultural Economist at CNPAF, as collaborator on the project's research team.
- 3) Intensify the conduction of fundamental microbiology research, such as Rhizobium soil ecology studies, to understand and reduce present uncertainty in BNF behavior and performance of Rhizobium strains in bean production under field conditions.
- 4) Assign a team of at least one plant breeder, a microbiologist, and an agronomist/physiologist, at the PhD degree level, in the Bliss/CNPAF leg of the project.

##### 2. Improved MDR.

- 1) Through the proposed involvement of an Agricultural Economist on the Project's research staff, assess the socio-economic impact of the project in bean production in Brazil and elsewhere.
- 2) Sponsor and lead national or multi-state workshops on bean pathology.
- 3) Publish a brochure which puts together in a logical sequence, the improved techniques developed by the Project on MDR in beans.

## II. PROJECT LINKAGES

### II.A National, Regional, International

The project has developed extensive linkages at the national, regional (Latin America) and international levels.

#### 1. BNF

- 1) The project has established work relationships with practically all institutions dealing with bean BNF research in Brasil.
- 2) It collaborates with the Centro Internacional de Agricultura Tropical, in the testing of bean germplasm and Rhizobium strains, as well as in the exchange of technical information for enhanced BNF in beans.
- 3) It has undertaken collaborative research with the International Atomic Energy Agency, for increasing N fixation in beans.
- 4) It also cooperates with CSRS and other bean projects at the Escuela Agrícola Panamericana in Honduras and elsewhere.

#### 2. MDR

- 1) The Project has developed cooperative research activity on BGMV with several institutions in Brazil, the U.S., CIAT, the United Nations Food and Agriculture Organization, and the B/C CRSP UNL/UPR/DR project.
- 2) It is working collaboratively with the Universidade Federal de Vicosa on variability for isozyme markers in bean anthracnose.

### II.B Interacion with Extension

Interaction between the Project and Extension has been so far at best marginal, but is expected to increase and intensify as management technology models developed by the Project in BNF and MDR are ready for on-farm testing and validation.

## II.C Actions Needed to Improve Linkages

The nature and extent of linkages in the Project are highly satisfactory. Efforts should continue to develop stronger work relationships with other relevant B/C CRSP projects, research institutes and universities in Latin America, the Caribbean, Africa and elsewhere.

## III. PROCEDURES FOR DISSEMINATING RESULTS AND ACTIONS NEEDED TO IMPROVE DISSEMINATION

1. The procedures for disseminating at the technical level research results obtained by the Project have been adequate. They include presentations of papers at technical meetings, lectures, and publications of scientific/technical articles or other types of documents.

2. But other means of dissemination should be utilized, for reaching a larger and more diverse audience. They cover at least the following:

- 1) Publication of a regular Technical Bulletin (Circular Técnica) at CNPAF, for each one of the two legs of the Project (BNF and MDR).
- 2) The convening of a regular Annual Workshop at CNPAF, to present research/training results, and plant program research/training and extension activities for the following year.
- 3) Publication of complete technological guides, as research results become firmly validated for use by farmers, through the extension service.

## IV. JUSTIFICATION FOR CONTINUATION OF THE PROJECT IN BRAZIL, CONSIDERING CRSP GUIDELINES

### IV.A Effectiveness of Transferring Results to other LDCs in the Region

1. Brazil faces most of the major constraints which limit bean production in the LDCs. Therefore, research results derived from the Project could be expected to be fully applicable, under similar conditions, to the LDC's where the common bean is a major crop socially and economically.

2. The Head of CNPAF has expressed during the evaluation, unrestricted commitment of that institution to share with any interested LDC technological information and material which result from the Project, directly or through CIAT, FAO, or other channels. This applies especially to the Portuguese speaking countries in Africa.

IV.B Need to Continue Research Efforts in Brazil rather than LDCs

Regardless of what happens to the Project at the end of its present extension period, CNPAF feels that the institutional linkages established between its bean research team and the US investigators involved in the Project, should be strengthened and expanded. Its administration and professional staff consider that the work on BNF and MDR should be continued on a collaborative mode until a solid scientific/technical base is firmly established to develop validated technology for improved bean production through enhanced BNF and increased MDR.

Annex\_1

SCHEDULE OF MEETINGS AND LIST OF PARTICIPANTS  
 CNPAF, GOIANIA, GO., BRAZIL

December 8 - 10, 1986

MONDAY, DEC. 8

Early\_morning

- |    |                               |  |
|----|-------------------------------|--|
| 1. | Emilio da Maia de Castro,     | Chief, CNPAF   |
| 2. | Antonio Renes Lins de Aquino, | Administrative Deputy<br>Chief, CNPAF                              |
| 3. | Jeffrey C. Lord,              | Resident Research Assoc.<br>B/C CRSP/Roberts/<br>Magalhaes Project |
| 4. | Bonifacio P. Magalhaes,       | HCPI, B/C CRSP/Roberts/<br>Magalhaes Project                       |
| 5. | Josias C. de Faria,           | HC CO-PI, B/C CRSP/<br>Bliss/CNPAF Project                         |
| 6. | Ricardo S. Araujo,            | HC CO-PI, B/C CRSP/<br>Bliss/CNPAF Project                         |
| 7. | Douglas P. Maxwell,           | US CO-PI, B/C CRSP/<br>Bliss/CNPAF Project                         |
| 8. | Antonio M. Pinchinat          | ECPM   |

Mid\_morning

- |    |                               |  |
|----|-------------------------------|--|
| 1. | J.C. Lord                     |  |
| 2. | B.P. Magalhaes                |  |
| 3. | Eliane Divas Quintela,        | Investigador, B/C CRSP/<br>Roberts/Magalhaes Project |
| 4. | Maria Gorette Araujo de Lima, | Investigador, B/C CRSP/<br>Roberts/Magalhaes Project |
| 5. | A.M. Pinchinat                |  |

Afternoon

- |    |                |
|----|----------------|
| 1. | J.C. Lord      |
| 2. | B.P. Magalhaes |
| 3. | A.M. Pinchinat |

TUESDAY, DEC 9

All day

1. Maria J. Zimmermann Investigador, B/C CRSP/Bliss/  
CNPAF Project
2. J.C. de Faria
3. D.P. Maxwell
4. A.M. Pinchinat

WEDNESDAY, DEC 10

Morning

1. R.S. Araujo
- 2 D.P. Maxwell (part tin
3. A.M. Pinchinat

Afternoon\*

1. E. da M. de Castro
2. A.R.L. de Aquino
3. A.M. Pinchinat

\* Includes a courtesy visit with Ms Lourdes Ferreira Peixoto, CNPAF Accounting Technician.

## Annex\_2

BEAN/CDWPEA CRSP  
EXTERNAL EVALUATION PANEL SCOPE OF WORK FOR BRAZIL  
(Bliss/Maxwell-Araujo -  
(Roberts-Magalhaes)

- I. Review progress of project.
  - A. Progress toward research objectives.
  - B. Calibre of research conducted.
  - C. Contribution project makes toward the alleviation of constraints identified in the Global Plan.
  - D. Level and effectiveness of collaboration between the PIs.
  - E. Staff support to conduct research.
  - F. Equipment availability.
  - G. HC support provided for project.
  - H. AID representative's knowledge and support.
  - I. Progress toward training objectives/needs.
  - J. Importance of research for US agriculture.
  - K. Logical completion dates for specific segments of project (especially Maxwell work).
  - L. Actions needed to enhance project.
- II. Review linkages made by project.
  - A. National, regional and international.
  - B. Interaction with extension.
  - C. Actions needed to improve linkages.
- III. Procedures for disseminating results and actions needed to improve dissemination.
- IV. Justification for continuation of projects in Brazil in consideration of CRSP guidelines.
  - A. Effectiveness of transferring results to other LDCs in the region.
  - B. Need to continue research efforts in Brazil rather than LDCs.

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BEAN/COWPEA COLLABORATIVE RESEARCH SUPPORT PROGRAM  
EXTERNAL EVALUATION

OF THE

Honduras/University of Puerto Rico/Beaver/Zuluaga Project

Improvement of bean production in Honduras through breeding for  
multiple disease resistance".

Antonio M. Pinchinat  
IICA, Peru  
External Evaluation Panel Member

Lima, Peru, December 4, 1986

24

## INTRODUCTION

On request from the Bean/Cowpea CRSP Management Office this EEPM reviewed the Honduras/UPR/Beaver/Zuluaga CRSP Bean Project in Honduras, from November 24 through 26, 1986, within the scope of work prepared by the MO (Annex 1). On November 24 and 25, the evaluation was jointly performed by the EEPM and Dr. M. Wayne Adams, a Bean/Cowpea CRSP Technical Committee member. The schedule of meetings and list of participants are presented in Annex 2. The evaluation team, formed by the TCM and EEPM, also visited some bean plots on the EAP campus. A condensed presentation of the results of the evaluation by the EEPM follows. Some of the conclusions and suggestions were shared with the participants for an early feedback, preceding the preparation of this report.



## I. ROLE OF THE ESCUELA AGRICOLA PANAMERICANA IN THE NATIONAL BEAN PROGRAM.

### I.A Establishment of Research Priorities

Until approximately the last review of this Project by the EEP in January 1986, the role of the EAP in the National Bean Program (NBP) conducted by the Secretaria de Recursos Naturales of Honduras (MOA), was at best informal and marginal. The institutionalization of the Project at the national level was judged by the EEP to be not promising.

The situation since then has changed toward integrating the station-based research/teaching activities at EAP with the on-farm research/extension activities at the MOA within the scope of the Project.

On July 16, 1986 the EAP bean research team met on campus with MOA Southern Zone bean research personnel to exchange information and explore areas for interinstitutional cooperation. Furthermore, EAP participated this year in the Uniform Yield Trial Network set up by the MOA/NBP.

Yet, these approaches have been based mostly on personal acquaintances or relationships, rather than on a formal institutional arrangement between the EAP and MOA. As a result, there has been so far no official mechanism allowing the two institutions to work jointly in establishing and harmonizing research priorities on a country level, although they share the common objective of improving bean production in Honduras.

### I.B. Procedures for Disseminating Research Results.

At least from 1985 to date bean research has been more concentrated at the EAP than at MOA, due in large part to the availability of a greater number of senior and better trained staff assembled by EAP to work on bean and to the technical and financial support of the B/C CRSP. On the other hand, MOA is officially responsible for the dissemination of research results in the agricultural public sector, through its on-farm demonstration, extension service and mass communication activities. Dissemination by other means, such as technical publications or meetings are by nature of limited direct value to

farmers, especially in less developing countries such as Honduras. Therefore the primary roles of the two institutions for improving bean production in the country are obviously complementary, suggesting that they need to be effectively integrated.

### I.C. HC\_Lead\_Institution\_of\_the\_Project

The Mission of the United States Agency for International Development in Honduras, as expressed during the evaluation by its Projects Officer, Mr. Richard L. Owens, fully supports the basing of this CRSP Project at EAP, as Host Country Lead Institution. This opinion especially takes into account the professional and managerial advantages of EAP over the MOA at this time, to get the Project moving. Similar considerations justify the Mission's support to the USAID-funded INTSORMIL CRSP, the AID/Honduras Integrated Pest Management (MIPH), and the AID/CSRS enhanced Nitrogen Fixation Projects, based on the EAP campus. The EAP Director, Dr. Simon E. Malo during the evaluation pledged EAP's unrestricted and sustained commitment to the Project. In spite of a rapid succession of HC Principal Investigators during the first five years, EAP has immediately and consistently assigned a new HCPI to the Project. More importantly, both the MOA's Vice-Minister of Natural Resources and the Director of the Department of Agricultural Research (DAR) maintained that they do not object to EAP being the HC LI of the CRSP bean Project in Honduras, as a joint effort between the two institutions.

### I.D. Actions\_Needed\_to\_Enhance\_the\_Project

The following are actions which may be needed to institutionally enhance the Project.

1. First, a signed agreement should be entered into between MOA and EAP/UPR, formalizing the joint participation of representatives of MOA, EAP and UPR in the planning, conduction, and management of the Project. A letter of understanding between EAP/UPR and MOA could be the simplest instrument required in this respect.
2. Joint research planning meetings between MOA and EAP/UPR staff on the Project, should become an established feature and should take place at least twice a year.

To avoid unnecessary duplication of efforts, the more fundamental and station-based research work would be carried out principally by EAP/UPR personnel, whereas the more applied, on-farm research/extension activities would be undertaken principally by MOA/NBP personnel on a country-wide basis.

3. Some amount of CRSP fund should be budgeted annually to support at least part of the research activities assigned to MOA/NBP through the joint planning meetings.
4. The CRSP Bean project should endeavour to recruit Hondurans (males and females) for formal and informal training, locally or abroad and facilitate the participation of MOA/NBP personnel in local and international technical meetings on bean. These include national seminars or workshops and the annual meeting of the Central American Cooperative Program for the Improvement of Food Crops (PCCMCA).
5. The work relationship that has been established between the HC PI and the NBP Director for the Southern Zone, should be officialized through the proposed agreement between MOA and EAP/UPR and broadened to involve other relevant units of the NBP.
6. For all conceptual and practical reasons the CRSP bean Project component at EAP/UPR should be regarded as an integral part of the MOA/NBP in Honduras.

## II. TYPES OF LINKAGES WITH NATIONAL, REGIONAL AND/OR INTERNATIONAL ORGANIZATIONS AND ACTIONS NEEDED TO IMPROVE LINKAGES.

1. The Project has developed work relationship with the NBP/Southern Zone Director, Eng-MS Federico Trece Ramos and his assistant, Eng Roldán Echeverría.

Both the EAP and UPR segments of the Project have been cooperating closely with the Centro Internacional de Agricultura Tropical (CIAT), and participating in the annual meetings of the PCCMCA. They have also collaborated with the bean research program of the U.S. Department of Agriculture/Agricultural Research Service at UPR/Mayaguez.

28

At EAP the Project has established linkages with the USAID-funded MIPH and ENF Projects.

2. The linkages at the HC national level would become more effective upon formalizing and broadening them through the proposed agreement between the MOA and EAP/UPR.

### III. PROGRESS OF THE PROJECT

Considering its difficult start, high turnover of HC PI's, and low budget ceiling, the Project can be considered to have made appreciable progress.

#### III.A Progress Toward Research Objectives

1. The project is making a unique contribution to the Global Plan of the B/C CRSP by focussing on small, red-seeded bean. Furthermore, results from the Malawi/Michigan State University/ Adams/ Msuku Project of the CRSP, tend to suggest that small-seeded and large-seeded bean landraces may belong to separate germplasm pools which if proved correct would add to that contribution..
2. Together the UPR and EAP segments of the Project have identified several bean lines which combine disease resistance, high grain yield and other desirable agronomic traits.
3. The Project has produced large populations of breeding lines, from which small, red-seeded, multiple disease resistant and agronomically suitable bean varieties may be developed in the long run, to be utilized in Honduras or elsewhere.

#### III.B Calibre of research Conducted

The technical calibre of the research conducted by the UPR and EAP segments of the Project is high. But greater emphasis on land race population genetics for adaptation and disease resistance could enhance its breeding methodology .

#### III.C Progress Toward Training Objectives/Needs

1. An updated cumulative list of formal and informal Project trainees was not available during the evaluation. The

Annual Technical Report of the Project for Fiscal Year 1986 shows that one Honduran is undergoing a BS degree program, whereas one U.S. and one Peru citizens are pursuing M.S. degree programs supported fully or partially with B/C CRSP funds.

2. Training needs especially at the MS and PhD degree levels are critical in the MOA/NBP, according to official information gathered during the evaluation. The FY 1986 ATR proposed that if additional funds were available during the Project extension period, it would be very desirable to offer opportunity for graduate training to one of the researchers of the NBP, to strengthen the ties between the CRSP project and the MOA.

#### III.D Contribution of the Project toward Alleviating Constraints Identified in the Global Plan

Diseases are among the major constraints to increase biological and economic yield in bean production worldwide. The Project therefore, in concentrating its efforts on breeding for multiple disease resistance, if successful, can make a significant contribution toward the improvement of bean production in Honduras and elsewhere. Moreover in focussing on small, red-seeded bean, it complements research that traditionally has been emphasizing other seed coat-colors and size.

#### III.E Level and Effectiveness of Collaboration between the PI's

The level and effectiveness of collaboration between the PI's are excellent, in spite of reduced CRSP funding of the Project.

#### III.F Adequacy of Staff Support to Conduct Research at EAP

The EAP administration has assigned a highly qualified professional team to bean research. This multidisciplinary group includes:

- 1) Silvio Zuluaga, PhD, HCPI, Plant breeding
- 2) Juan J. Alan, PhD, Germplasm Management

- 3) Juan Carlos Rosas, PhD, Agronomy/ENF
- 4) Jairo Castaño, PhD, Phytopathology
- 5) Alfredo Rueda, Eng, Pest Management

### III.G. Availability of Adequate Equipment

Available equipment seems to be adequate for Project purpose and present level of activities, but a bean plot thresher is badly needed at EAP.

### III.H. HC Support Provided for Project

The project has received the professional collaboration of Federico Trece Ramos and his assistant.

### III.I USAID Knowledge and Support of Project and Integration of CRSP into USAID Country Strategy.

The USAID Mission/Honduras is well aware of the work of the Project at EAP and feels that it fits into its country strategy. Furthermore, the Mission has shown interest in funding a joint bean project involving MOA/NBP, EAP/UPR and the USAID/ENF Project at EAP. It has suggested that the HC and US PI's of the CRSP bean project, the PI of the USAID/ENF Project, and an authorized representative of MOA/NBP get together to write an AID/Honduras Cooperative Bean Research/Extension Project document, modelled on the INTSORMIL Honduras Project Proposal which has been approved for funding by USAID/Honduras (US\$350,000 per year for three years). If submitted on time to the Mission, the CBRE Project (title to be defined) may be approved for financial support from USAID for US\$ 350,000 or more per year for three years or more, starting from the first quarter of FY 1987. The proposal, however must be backed by a formal agreement among the relevant administrative authorities of the EAP/UPR CRSP Project, USAID/EAP ENF Project and the MOA/NBP.

Consulted on this matter during the evaluation, MOA's Vice Minister of Natural Resources, Eng. Jose Montenegro showed strong interest in entering into the agreement and phoned the Representative of the USAID Mission/Honduras to work out its negotiation.

Therefore the prospects for additional funding to the CRSP bean Project at EAP are quite encouraging. The MO may want to be kept informed on the development of this initiative in Honduras.

### III.J. Actions Needed to Enhance Project

The suggestions offered in previous sections of this report would tend primarily to strengthen the institutionalization of the Project on a country level in Honduras. The following actions may be needed to enhance the Project more specifically at the technical level.

1. The HC PI should avoid to spread too thin his bean research activities. This concern was voiced during the evaluation because of his direct responsibilities in other bean projects already in progress or proposed for external funding, principally on ENF and drought tolerance.

2. If agreement is reached between EAP/UPR and MOA/NBP on the joint operation of the CRSP bean Project at EAP, it would be convenient to name a HC CO-PI drawn from MOA/NBP. This arrangement was suggested during the evaluation and was well received by the HC and US PI's. It was further proposed that the HC CO-PI would be placed ex-officio on the Agricultural Research Committee (on bean, maize, and sorghum) to be officially established soon at EAP.

## IV. CONTRIBUTIONS OF EAP TO THE PROJECT

The EAP has committed a fair share of human resources and physical facilities to the Project. None of the EAP Project personnel as shown in the FY 1986 roster, except one field assistant (Agr. Concha M. Elvir) is paid from CRSP fund assigned to the Project.

### IV.A Operation of the Project in the Collaborative Mode

1. Within EAP, the Project operates in a large cooperative research network, involving the following professional staff:

- 1) Dr. Juan Carlos Rosas, FI, ENF project funded by USAID/CSRS BNF, limiting Factors Program and Director, ENF Potential project, funded by the Board on Science and Technology for International Development/National Research Council/National Academy of Sciences.

- 2) Dr. Juan José Alan, Specialist, Plant Germplasm Resources.
- 3) Dr. Jairo Castaño, Acting Head, Crop Protection Department.
- 4) Ing. Alfredo Rueda, Acting Head, MIPH Project.

The cooperative activities would be more effective and steady though, if they were specifically defined, programmed and incorporated, as definite commitments into the Project's Annual Workplan.

2. One of the proposed Planning meetings could be part of an Annual Workshop of the CRSP bean Project, gathering MOA/NBP and EAP/UPR Project Staff and collaborators, including Project trainees enrolled in the announced BS degree program at EAP to be started in April 1987. This would insure and enhance the collaborative mode of the Project.

#### IV.B MOA's Acceptance and Promotion of Implementation of Research Results Generated by the CRSP/EAP Bean Project.

During the evaluation, at the MOA's Headquarters, the Vice Minister of Natural Resources and the Director of DAR assured the EEFM that MOA would both accept and promote the implementation of research results generated by the CRSP bean Project based at EAP, if such results were consistent with the country's technology needs to improve its bean production. That condition is more likely to be met if the Project were fully integrated with the MOA/NBP, through the agreement suggested by the USAID Mission in Honduras.

## Annex\_1

BEAN/COWPEA CRSP  
EXTERNAL EVALUATION PANEL AND TECHNICAL COMMITTEE  
SCOPE OF WORK FOR HONDURAS (Beaver-Zuluaga)

- I. What is the role of the EAP in the National Bean Program.
  - A. How are research priorities established.
  - B. What are the procedures for disseminating research results.
  - C. Should the CRSP have a private lead institution? If not, what are the alternatives?
  - D. Actions needed to enhance project.
  
- II. What types of linkages have been established with national, regional and/or international organizations and actions needed to improve linkages.
  
- III. What is the progress of the project.
  - A. Progress toward research objectives.
  - B. Calibre of research conducted.
  - C. Progress toward training objectives/needs.
  - D. Contribution project makes toward the alleviation of constraints identified in the Global Plan.
  - E. Level and effectiveness of collaboration between the PIs.
  - F. Adequate staff support to conduct research.
  - G. Adequate equipment available.
  - H. HC support provided for project.
  - I. USAID Mission knowledge and support of project and integration of CRSP into USAID country strategy.
  - J. Actions needed to enhance project.
  
- IV. What are the contributions of EAP to the program.
  - A. Does the project operate in a collaborative mode?
  - B. Will the MOA accept research results generated by the CRSP/EAP and promote implementation of results with the same determination as with a MOA project?

## Annex\_2

SCHEDULE OF MEETINGS AND LIST OF PARTICIPANTS  
DURING THE EVALUATION OF THE HONDURAS/UPR/BEAVER/ZULUAGA  
PROJECT IN HONDURAS  
November 24-26, 1986

MONDAY, NOV 24 AT EAP, ZAMORANO

Morning\_and\_afternoon

- |    |                       |  |
|----|-----------------------|--|
| 1. | Francisco Trece Ramos | MOA/NBP, Coordinator Southern<br>Zone Coordinator. |
| 2. | James S. Beaver.      | EAP/UPR CRSP Bean Project, US PI                   |
| 3. | Silvio Zuluaga,       | EAP/UPR CRSP Bean Project, HC PI                   |
| 4. | M. Wayne Adams,       | TCM  |
| 5. | Antonio M. Pinchinat, | EEPM   |

Late\_afternoon

- |    |                 |               |
|----|-----------------|---------------|
| 1. | Simón E. Malo,  | EAP, Director |
| 2. | F. Ramos        |               |
| 3. | J. S. Beaver    |               |
| 4. | S. Zuluaga      |               |
| 5. | M.W. Adams      |               |
| 6. | A. M. Pinchinat |               |

TUESDAY, NOVEMBER 25 AT EAP, ZAMORANO

Morning

- |    |                   |                                  |
|----|-------------------|----------------------------------|
| 1. | Richard L. Owens, | USAID/Honduras. Projects Officer |
| 2. | S. Zuluaga        |                                  |
| 3. | J.S. Beaver       |                                  |
| 4. | M.W. Adams        |                                  |
| 5. | A.M. Pinchinat    |                                  |

Early afternoon

1. Leonardo Corral. EAP, Agronomy Dept., Head
2. Juan Carlos Rosas, EAP, USAID/CSRS and BOSTID/NCR/NAS  
ENF Bean Projects, Director
3. Juan José Alan, EAP, Agronomy Dept., Assoc. Prof
4. Alfredo Rueda, EAP, USAID/MIPH Project, Acting  
Head.
5. Dan Meckenstock, EAP, CRSP INTSORMIL Project, PI
6. J.S. Beaver
7. S. Zuluaga
8. M.W. Adams
9. A.M. Pinchinat

Late Afternoon

1. S.E. Malo
2. L. Corral
3. M.W. Adams
4. A.M. Pinchinat

WEDNESDAY, NOVEMBER 26, TEGUCIGALPA

Early morning, at the MOA Headquarters

1. José Montenegro B., MOA, Vice-Minister, Natural Resources
2. Leopoldo R. Alvarado, MOA, Director, DAR
3. A.M. Pinchinat

Morning and Afternoon

1. José Alberto Franco, IICA Honduras Office, Director
2. A.M. Pinchinat

*N.J. Hortik*

D R A F T

REPORT OF THE BEAN/COWPEA CRSP EXTERNAL EVALUATION PANEL FOR FY 86

TABLE OF CONTENTS

I. Introduction

    Five-Year Review in January 1986 . . . . .

    Current Review Covers Activities in FY 86 . . . . .

    Members of the 1986 External Evaluation Panel . . . . .

    Organization of the Bean/Cowpea CRSP . . . . .

    1986 EEP Review: Sequence of Events . . . . .

II. Program Evaluation: Summary . . . . .

III. Program Evaluation: Summary and Recommendations . . . . .

    Bases of Evaluation . . . . .

    Rating Categories/Format . . . . .

    Project Ratings and Recommendations . . . . .

IV. Program Evaluation: Overall Fiscal and Administrative Management . . . . .

    Adjustments to 1986 Budget Reductions . . . . .

    CRSP Funding in FY 86 . . . . .

    Administrative Management . . . . .

V. Attachments

    Attachment A: Scope of Work for External Evaluation Panel . . . . .

    Attachment B: Individual Project Reviews . . . . .

    Attachment C: Members and Affiliations of the 1986 EEP . . . . .

    Attachment D: Letter re Overseas Audits . . . . .

REPORT OF THE BEAN/COWPEA CRSP EXTERNAL EVALUATION PANEL FOR FY 86

I. Introduction

A. Five-Year Review (through FY 85) Held January 19-24, 1986.

The CRSP's sixth year is now being reviewed.

B. Evaluation Covers FY 86 Activities Including a Portion Funded from the First Year of the Three-Year Extension Which Began May 7, 1986.

1. Evaluation based on review of project reports written by project Principal Investigators (Honduras and Brazil also include site visits).

2. Discussions with Management Office officials.

C. Members of the 1986 External Evaluation Panel.

1. During 1986, two of the original members of the EEP--Dr. Melvin Blase and Dr. Luis H. Camacho--retired from the EEP.

2. Current members, all appointed in 1980-81, are:

Clarence C. Gray, III (Chair)  
Virginia Polytechnic Institute and State University

A. H. Bunting  
University of Reading

Antonio M. Pinchinat  
IICA

Peter E. Hildebrand  
University of Florida

Charlotte E. Roderuck  
Iowa State University

D. Organization of the Bean/Cowpea CRSP.

1. The Bean/Cowpea CRSP was originally comprised of eighteen projects in thirteen countries of Africa and Central and South America in collaboration with ten US institutions with major roles (nine Land-Grant Universities and one private institution). By the end of 1986, there were thirteen projects for review (beans--eight; cowpeas--five) in eleven countries with ten US institutions.

<u>Host Country</u>	<u>Crop</u>	<u>US Institution</u>
Botswana	Cowpeas	Colorado State University
Brazil	Cowpeas	Boyce Thompson Institute
Brazil	Beans	University of Wisconsin
Cameroon	Cowpeas	University of Georgia
Dominican Republic	Beans	University of Nebraska
Guatemala	Beans	Cornell University
Guatemala/INCAP	Beans	Washington State University
Honduras	Beans	University of Puerto Rico
Malawi	Beans	Michigan State University
Mexico	Beans	Michigan State University
Nigeria	Cowpeas	University of Georgia
Senegal	Cowpeas	University of California-Riverside
Tanzania	Beans	Washington State University

2. The Bean/Cowpea CRSP projects are developed and executed by Principal Investigators in collaborating US and Host Country institutions. Oversight and approval plans and budgets are made by the Technical Committee, Management Office/Management Entity and Board of Directors.

E. Sequence of Events--1986 EEP Review.

1. Development of a Scope of Work (see Attachment A) by the Program Director/MO and Chair of the EEP. Distribution of the Scope of Work to Principal Investigators to guide preparation of 1986 annual reports due in MO on or about November 1, 1986.
2. Outline of information needed by EEP re fiscal and administrative management evaluation provided to MO on or about November 15, 1986.
3. Annual reports of individual projects sent to ELP members on or before December 1, 1986.
4. Each EEP member assigned three to four projects for intensive study/review prior to January 1987 EEP meeting. Draft reviews, assigned, prepared by EEP members in advance.
5. Draft reviews discussed by EEP at January meeting. Final evaluation made on basis of discussions and additional information as requested from MO and AID Program Officer.
6. Fiscal and administrative management evaluation made from data provided by and from discussions with the MO.
7. Summary overall evaluation of the Bean/Cowpea CRSP made on basis of results of individual project reviews, information provided by the MO and discussions with officials of the MO.
8. Draft EEP report prepared January 8, 1987 and discussed with Technical Committee, Management Office and others on January 9, 1987.

## II. Program Evaluation: Summary

Thirteen individual CRSP projects were evaluated with special regard to status, funding, progress, plans and prospects. Annual reports prepared by project Principal Investigators provided the principal bases for individual evaluations and ratings. Two site reviews were made in 1986 (in Honduras of the University of Puerto Rico project and in Brazil of the Wisconsin and BTI projects). Six projects were rated highly satisfactory; four, satisfactory; one, satisfactory with suggested changes; and none, unsatisfactory. Two were not evaluated for reasons given.

With few exceptions, individual CRSP projects appear well organized and operated with good to excellent prospects for contributing knowledge and technologies to increase the production and utilization of beans and cowpeas in developing countries and the US.

In addition to substantial progress in many projects toward research objectives, a prototype processing plant was established in a village in eastern Nigeria to apply, on a commercial scale, the methods for preparing cowpea meal which were developed by the University of Georgia/University of Nigeria project.

In 1986, one person completed the requirements for the B.S. degree, nine for the M.S. degree and one for the Ph.D. degree. In addition, 110 persons completed various non-formal technical training programs. Currently, 10 persons are enrolled for the B.S. degree, 37 for the M.S. and 33 for the Ph.D.

During 1986, CRSP officials initiated or completed actions to correct weaknesses in collaboration between US and Host Country institutions. Some projects were brought to a close by the end of FY 86, others were consolidated during that year.

While no specific external financial audits were made on the use of funds for FY 86, a cursory examination of expenditures indicates US Government funds were used for the purposes authorized, the overall 25 percent matching requirement was met, and cooperating Host Countries made significant contributions in in-kind and in local currencies. The CRSP was able to sustain the reduction in funding imposed in FY 86 and continue operations at satisfactory levels.

The present mode of funding by the US Government inevitably leads to difficulty in planning and maintaining continuity in both research and training and materially reduces cost effectiveness. The EEP recommends that a system of three-year forward funding, as provided by CRSP Guidelines,<sup>1</sup> be instituted to minimize these difficulties.

<sup>1</sup>Board for International Food and Agricultural Development and Agency for International Development. 1985. Guidelines for the Collaborative Research Support Programs, Washington, DC, p. 31.

The CRSP is operating effectively with experienced and capable Principal Investigators, supported by the Technical Committee and effectively assisted by the Management Office.

Overall, the Bean/Cowpea CRSP and its operations in FY 86 are judged very satisfactory.

### III. Program Evaluation: Summary and Recommendations

#### A. Bases of Evaluation

Following BIFAD/AID Guidelines,<sup>2</sup> a Scope of Work was developed which provided for an evaluation of the status, funding, progress, plans and prospects for each CRSP project (see Attachment A). These criteria were assessed on the bases of the reports submitted by the projects' Principal Investigators, project site visits, data provided by the MO and discussions with MO officials. Each CRSP project was given one of the following category designations, ratings and recommendations for FY 86:

<u>Category</u>	<u>Rating and Recommendation</u>
1	Highly Satisfactory
2	Satisfactory
3	Satisfactory--CRSP officials may wish to consider major adjustments.
4	Unsatisfactory--CRSP officials may wish to consider orderly phaseout.

#### B. Project Ratings and Recommendations.

Category 1 Brazil/University of Wisconsin, Brazil/Boyce Thompson Institute, Guatemala/Cornell University, Nigeria/University of Georgia, Senegal/University of California-Riverside, Tanzania/Washington State University

Category 2 Botswana/Colorado State University, Dominican Republic/University of Nebraska, Honduras/University of Puerto Rico, Mexico/Michigan State University

Category 3 Malawi/Michigan State University

Category 4 None

Not Rated Cameroon/University of Georgia, INCAP/Washington State University

<sup>2</sup>Ibid., p. 12.

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IV. Program Evaluation--Overall Fiscal and Administrative Management

A. Adjustments to 1986 Budget Reductions.

In FY 86 the Bean/Cowpea CRSP assumed a substantial budget reduction. The impact was felt in both the projects and management components. In accommodating to this reduction, several actions were taken:

1. Eighteen projects were reduced to thirteen by closing-out three projects, four projects were consolidated into two, and the budgets of three projects were considerably reduced through reductions in their programs.
2. The technical assistance component of two projects was phased-out.
3. A moratorium on non-essential travel and equipment was placed on the projects.
4. For three months (February-April 1986), projects reduced expenditures to essential personnel only.
5. The initiation of new degree training was discouraged.
6. The numbers of meetings for the TC and BOD were reduced with the substitution of conference calls to facilitate the actions of these groups.
7. The EEP met for the FY 86 review without direct input from PIs and only limited Host Country site reviews.
8. The MO was reduced from 5.0 FTE to 3.5 FTE and the activities of the MO were significantly reduced (publications, travel, etc.).

B. CRSP Funding in FY 86.

1. CRSP funding reductions were sudden and substantial: FY 84--\$4.2 million; FY 85--\$4.7 million; FY 86--\$4.2 million; and projected FY 87--\$2.7 million. Thus, there has had to be *been* unanticipated curtailment of scheduled activities, along with an increase in uncertainty as to activities which could be sustained. Despite the suddenness and pervasiveness of the circumstances, CRSP officials and participants at all levels acted responsibly, swiftly and successfully in maintaining CRSP operations. Overall, approximately <sup>2.8</sup>~~45~~ percent of CRSP funds were spent in Host Countries. Although project by project the percentages varied widely from approximately 24 to 75 percent, project requirements generally justified the differences. Similarly, expenditures for personnel, equipment, travel and other varied widely according to specific requirements and needs <sup>3.2</sup>

or projects; however, the EEP suggests CRSP authorities review project personnel rosters, both in the US and in Host Countries relative to project requirements.

2. Data available indicate that the 25 percent matching requirement by US institutions has been met.
3. Reports on expenditures are current within six months and indicate US funds have been used for the purposes intended.

Budget Process--Financial management of the Bean/Cowpea CRSP is facilitated by extensive support and monitoring by the MO. Included in the process is direct participation in budget preparation and project allocation by the MO and the TC with final approval from the BOD. Each of the lead institution's Principal Investigators and the Contract and Grant Officers, with whom the MO maintains active communication, as well as the Host Country PIs is involved in the process.

Each year the MO prepares a projected budget document for the TC and BOD which is the basis for planning and eventually for advising the PIs in the development of a preliminary budget. An analysis is made from the financial history of each project, previous project reviews, the proposed scope of work and the current budgetary situation.

Formal preliminary budgets are forwarded from the PIs through their contract officers to the MO for review. The MO budget review includes line item screening against the total budget for each project. Previous quarterly reports are compared to the proposed spending pattern in the new budget. The preliminary budgets are forwarded to the TC, with the scopes of work, for their review and recommendation to the BOD. MO recommendations for the project budgets are taken into consideration by the TC. The budgets are then forwarded to the BOD where TC recommendations are analyzed and the budgets are given final approval.

Upon final budget approval, the MO notifies the PIs in writing and requests from each of them a detailed budget (ten-column spread sheet). These figures establish the detailed budget which the MO monitors. The five-months advance of funds, allocation of new monies and amendments to the sub-grants are administered by the MO. The quarterly reports are reviewed and matched against the budgets to control overspend. Cost sharing is closely monitored to meet compliance with AID regulations. When questions arise, the PI or the Contract Officer is contacted. Reimbursements to the projects are controlled by the MO and directed to the MSU Contract Officer for payment. The CRSP Administrative Officer and the MSU Contract and Grant Officer maintain constant communication to insure appropriate fiscal management of the projects.

International travel requests and requests for purchase of equipment are screened and processed by the MO. The requests are reviewed against the project's annual approved travel plan and budget.

4. The financial accounts of Michigan State University were audited in 1985 by Arthur Young and Company. This audit covered a sample of all University accounts, domestic and international, including the CRSP for the years ended June 30, 1985 and 1984. Plans are underway for an audit in early 1987 of CRSP accounts in a representative six projects in Africa and Central and South America.
5. Balance in the use of funds for CRSP activities.

Balance in the use of funds in the CRSP has to be considered in several ways. A balance of approximately 50 percent in expenditures in or on behalf of Host Countries is required by AID. We find that this balance is 46/54 HC/US over the period for which figures are available. This ratio varied from 24 to 75 percent in Host Country. We have examined the reasons for this variation and are satisfied that they are in agreement with the approved purposes of the projects.

Balance is also important between the different components of projects such as management, travel, training, field and laboratory operations, equipment and personnel. Through FY 85, total personnel costs appear high. We are satisfied that the oversight by the MO and AID of expenditures on travel and equipment ensures that these expenditures are in accordance with purposes approved. One hundred fifty-nine persons have received or are receiving degree training and 777 have had training of shorter duration. We are not able to estimate the total expenditure on this component, but it is evident this is one of the most valuable products of the CRSP.

#### C. Administrative Management

Management of the CRSP in 1986 during a period of funding reductions and uncertainty has been quite difficult. Notwithstanding and under stress of reduced availability of personnel, the MO has carried out its functions in an exceptional manner, with the exception of the requirement to observe and monitor CRSP activities in the US and overseas on a regular basis. This deficiency is becoming increasingly apparent and requires correction. The EEP requests the Board of Directors and Management Entity to consider whether the MO's responsibilities would not be more effectively discharged if staff of the MO were enabled to visit overseas and domestic locations more frequently than has been possible in the past several years. The EEP feels that the MO requires more funds to enable it to perform its supervisory duties effectively as its obligations to AID require. The EEP does not believe it is desirable to achieve further economies

US

by decreasing yet further the allocations to individual projects. In the EEP's view, funds can only be freed for these purposes by rearrangements within CRSP projects, which may have to include the termination of part or all of specific projects.

The ME should look into opportunities for increasing the efficiency of the MO by expanding its electronic capabilities for handling data and communications.

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## 1986 EXTERNAL EVALUATION PANEL SCOPE OF WORK

I. PROGRESS.

- A. Specific research contributions (to date and in early prospect) toward amelioration of national (HC and US) and global constraints. Cite constraint and specific contribution, with special regard to the following:
1. Research in process in Host Country and in US.
  2. Research results disseminated and in use in Host Country and US. Give examples such as:
    - a. Improved cultivars; inoculants; tests; methods; systems; and technical papers, reports and bulletins produced and released for public use.
    - b. Evidence of extent of use.
  3. Other research-related results, such as:
    - a. Germplasm conservation and use.
      - (1) Accessions collected/acquired/in storage and kinds and amounts distributed domestically.
      - (2) International exchange.
    - b. Seed production (or other materials) and distribution of CRSP-produced cultivars (or materials).
    - c. Impact of other CRSP-produced or -recommended technology, including production inputs such as fertilizers, inoculants, insecticides, equipment and machines.
    - d. Contributions to and participation in international bean/cowpea research networks, e.g., IARCs and other.
    - e. How the research findings specifically address the needs of small-scale farmers and women.
- B. Changes in national production of beans and cowpeas in Host Country.
1. Hectares planted.
  2. Yields per hectare.
  3. Total production.
- C. Training (only CRSP-sponsored funded in 1986).
1. Numbers and kinds in process in US, HC and elsewhere.
  2. Numbers and kinds completed--US and HC.

3. Cumulative training totals--thru 1986.
  4. Project training targets during three-year extension period (1986-88).
- D. Institutional development, f.e. strengthening Host Country bean and/or cowpea research and improvement systems.
1. Cite changes in 1986.
  2. Over life of project (where are we?).
  3. In prospect (where are we going and how long to get there?).

II. FUNDING/FISCAL MANAGEMENT.

- A. Levels and sources 1985.
1. Total.
  2. USAID totals for 1985 and 1986 and %.
  3. US university totals for 1985, 1986 and %.
  4. Host Country totals for 1985, 1986 and %.
- B. Use of funds--budgets and expenditures by categories for 1985 and 1986.
1. Salaries.
  2. Vehicles.
  3. Equipment, machines, apparatus.
  4. Supplies.
  5. Training.
  6. Conferences/meetings/consultations.
  7. Travel.
  8. Other.
- C. Custody and maintenance of vehicles, equipment and other non-expendable CRSP-purchased property.
1. Inventory (or records).
  2. Accountable individuals and institutions.

- D. Audit/project management reviews.
  - 1. Date, by whom, and findings and follow-up.
  - 2. If no audit, has one been requested?
- E. Adequacy of funding (to accomplish objectives) by CRSP participants.
  - 1. USAID.
  - 2. Host Country--comments/actions.
  - 3. US university--comments/actions.
- F. Problems regarding funding, budgeting, release of funds, procurement and other--in US and Host Country.
- G. Adequacy of current policies and procedures (especially regarding follow-up on use of funds and commodities).

### III. PLANNING.

- A. Work plan for 1986.
  - 1. TC and/or ME guidance/approach, if any.
  - 2. How prepared?
  - 3. Who prepared?
  - 4. When prepared?
  - 5. Budget and work plan related?
- B. Review of 1986 work plan during implementation.
  - 1. Adjustments/changes/additions/deletions--ME notified? TC?
  - 2. 1986 work plan--accomplishments and shortfalls.
- C. Plans for 1987.
  - 1. Research in Host Country and US.
  - 2. Expected changes/additions/deletions from 1986 regarding funding, personnel, research activities, commodities or other and their reasons (i.e. availability of funds; failures; marginal activities; inadequate performance; unrealistic plans).

### IV. STATUS.

- A. Appropriateness of activities to goals of Global Plan.

- B. Balance between research and training.
- C. Balance of domestic vs overseas activities with respect to program constraints.
- D. Level of collaboration/cooperation between US and Host Country institutions and personnel.
- E. Relative contributions of collaborating institutions and individuals towards accomplishment of objectives.
- F. Interest, involvement and support of US and Mission and/or US Embassy.
- G. Domestic and international linkages and cooperation/collaboration.
- H. Cost effectiveness, especially regarding level of activity vs. funding.
- I. Institutionalization of Host Country component--evidence of.

PROSPECTS.

- A. Adequacy of performance (personnel, institutions) and arrangements (funding for personnel and facilities).
- B. Project problems--present and in prospect.
- C. Project successes/achievements--present and in prospect.
- D. Overall outlook.

VI. FOLLOW-UP ACTIONS.

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**ATTACHMENT B**

## 1986 EEP REVIEW

### BOTSWANA/COLORADO STATE UNIVERSITY RFAN/COWPEA CRSP PROJECT

"Development of Integrated Cowpea Production Systems in Semiarid Botswana"

#### I. PROGRESS

##### A. Research Contributions

##### 1. Research in process in Botswana

A large number of research activities were planned and were to be undertaken at several locations in Botswana: at Sebele, at district experimental farms at Goodhope, Mahalapye and Motopi; and perhaps at unspecified locations. These planned research activities included:

- a. Variety testing and screening trials re agronomy, pathology and entomology;
- b. Evaluation of breeding lines developed in cooperation with IITA and SAFGRAD;
- c. Initiation of a Botswana cowpea breeding program;
- d. Evaluation of local cowpea germplasm and maintenance of cowpea genebank;
- e. Evaluation of cultural practices and animal-drawn equipment and harnesses;
- f. Evaluation of intercropping of sorghum and cowpeas;
- g. Investigation of integrated approaches to pest control;
- h. Investigation of micronutrient (B, Cu, Mo, Zn) and secondary nutrient (Mg and S) requirements for cowpeas in Botswana;
- i. Study of the effect of leaf harvesting on grain yield;
- j. Study of cooking time and quality of seven cowpea genotypes.

The severe drought in Botswana in 1986, reduction in CRSP funding and shortcomings in GOB support combined to sharply curtail several of the planned activities; however, very important progress was made in (1) continuing the identification of very early maturing cowpea varieties adapted to Botswana conditions and (2) increasing, describing, maintaining and using (including international exchange) a significant Botswana cowpea germplasm collection.

2. Research results disseminated and in use

- a. Cowpea variety ER-7, developed by IITA, was tested by the CRSP and released by the GOB for use in 1983-84. Approximately 18 tons of ER-7 seed were multiplied in 1984-85 and distributed to farmers.
- b. Two additional varieties, TVX 3236-01G and IT82E-9, also developed by IITA, have been tested by the CRSP and recommended to the GOB for release.
- c. A third volume of the Botswana Cowpea Germplasm Catalogue has been completed. Two earlier volumes in the series prepared by the CRSP were published by the GOB and distributed to interested individuals and institutions, including several international agricultural research centers (IARCs).

3. Other research-related results

a. Germplasm conservation and use

- (1) The CRSP-sponsored cowpea germplasm collection has grown to 852 accessions. This represents a substantial but incomplete portion of Botswana's cowpea resources. A total of 390 accessions have been grown in the field for evaluation and seed increase. With the departure of the CRSP-sponsored PI and his associate (and spouse), the collection, thought to be the largest in southern Africa, has been turned over to a newly appointed Botswana research officer for care and maintenance. Current facilities for housing the collection are inadequate.
- (2) The CRSP has been involved in the exchange of cowpea germplasm to IITA (450 accessions sent) and to other CRSP projects in Nebraska and California (Davis and Riverside).

b. Seed production and distribution

Previously reported under 2a above.

c. Impact of other CRSP-produced or recommended technology

A CRSP-developed, animal-drawn, prototype planter has been evaluated by the Botswana Rural Industries Innovation Center and approved for replication and further testing by Botswana Agricultural Field and Extension Services. In addition, the CRSP has introduced improved donkey harnesses which promote greater work output and prevent injury. Along with other animal-drawn, light-weight, tillage implements, these addi-

tions--the planter and the improved harness--have direct benefits for small farms, especially those involving women as farm workers.

B. Changes in National Production of Cowpeas

No data provided, but yields per hectare of cowpeas are thought to be ". . . less than 25 percent of long-term average." The long-term average is not given.

C. Institutional Development

Transfers of responsibilities for activities carried out in Botswana by CRSP-provided personnel have been made to GOB personnel. In addition, several M.S. degree students are expected to complete their studies and return to Botswana by the end of 1986. One is expected to become the Host Country Principal Investigator for the project. In the interim, arrangements have been made for a US Peace Corps volunteer to manage the project. The TC and MO/ME may wish to determine if this arrangement is appropriate.

Plans are underway for the US PI to spend two months each year in Botswana to assist with continued improvement of cowpea research and development. This arrangement should be reviewed and approved by the TC and the MO.

Prospects for satisfactory continuation of this CRSP project appear uncertain and suspect, given the inexperience of current and prospective Botswana personnel; the general lack of necessary arrangements, facilities and infrastructure for the conduct of reliable agricultural research; and the likely inability of the GOB to provide adequate financial support. Credit must be given to the CRSP and the GOB for their efforts to make the best of a difficult situation, but their efforts probably cannot take the place of more promising options. One option might be for an assistance donor (multilateral or bilateral) to arrange appropriate technical assistance to help Botswana build a capacity to conduct cowpea research. Another option might be to designate Botswana as a CRSP prime country site and arrange for long-term assignments of US scientists in Botswana (see pages 8-9, Guidelines for Collaborative Research Support Program, June 21, 1985).

Botswana is a prime site for the INTSORMIL CRSP. Under further budget reductions, an arrangement whereby the two CRSPs jointly support resident US scientists in Botswana may be a way to sustain and build on the investment and progress made in Botswana with sorghum and cowpeas. Any such arrangement should be in accordance with the priorities of the GOB and should be associated with the regional SADCC research coordination program.

II. FUNDING/FISCAL MANAGEMENT

A. Custody and Maintenance of Vehicles and Equipment

1. Inventory/records--Satisfactory
2. Accountable individuals--Satisfactory

B. Audit/Project Management Reviews

1. Management review in 1985--Satisfactory
2. No audit made or requested

C. Adequacy of Funding

Satisfactory until recent funding reductions created dislocations and termination of some activities.

D. Other Problems

The US PI reports that the land made available by the Government of Botswana was inadequate in respect to both quantity and quality. This is a serious shortcoming that needs attention if the project is to continue.

E. Adequacy of Current Policies and Procedures

Satisfactory.

III. PLANS FOR 1987

The EEP notes that plans and arrangements for 1987 are in place. These plans are judged satisfactory.

IV. STATUS

A. Appropriateness of Activities to the Goals of the Global Plan

Most of the activities undertaken under this CRSP project are location-specific, designed for Botswana. At some point in time, some of the cultivars developed and accompanying adapted technologies may be useful elsewhere. So far, Botswana has been the recipient of improved varieties and technologies developed at IITA and elsewhere. The Botswana germplasm collection may prove to be valuable in cowpea breeding and improvement programs in other locations, especially in areas with conditions similar to Botswana. In this connection, it should be noted that descriptions of conditions at the experimental sites in Botswana were not provided in the annual report and there is no indication such data is included in experimental reports.

B. Balance between Research and Training

Satisfactory

C. Balance between Domestic and Overseas Activity

Very little activity in the US. Plans are underway to achieve a better balance of activities.

D. Level of Collaboration between US and Host Country

Excellent

E. Relative Contributions of Collaborating Institutions and Individuals Toward Accomplishment of Objectives

Heavily weighted toward the US PI in Botswana.

F. Interest, Involvement and Support of USAID Mission and/or US Embassy

Excellent

G. Domestic and International Linkages and Cooperation/Collaboration

Outstanding--diverse, highly supportive linkages

H. Cost Effectiveness, Especially Regarding Level of Activity vs Funding

Satisfactory

I. Institutionalization of Host Country Component

Improving, but capacity of GOB to continue satisfactory cowpea research without direct technical assistance is considered to be doubtful.

V. PUBLICATIONS

Output satisfactory, but all except one report was authored by the US PI or his associate.

It would appear desirable for most publications, particularly those using Host Country data, to have at least a junior author from the Host Country, in order to reflect the collaborative nature of CRSP projects.

VI. OVERALL RATING: 2--Satisfactory

Although the project is judged satisfactory, future prospects are uncertain, perhaps bleak. It is recommended that the Technical Committee and Management Office review this project with special regard to plans and prospects, including role of Colorado State University,

and report their findings to the Board of Directors for final review and disposition. Any future activity in Botswana should be developed in the light of the results of farming system research in Botswana by the team led by David Norman and colleagues.

With the departure of the US PI from Botswana, adequate maintenance of the Botswana Cowpea Germplasm Collection should be a matter of concern. Loss of this collection would be a serious setback. The GOB should be encouraged to continue its present practice of insuring the safe, long-term storage of cowpea material collected in Botswana.

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## 1986 EEP REVIEW

### BRAZIL/UNIVERSITY OF WISCONSIN BEAN/COWPEA CRSP PROJECT

#### "Plant Microbial Interactions in Beans: Improvement of Nitrogen Fixation and Disease Resistance"

## I. PROGRESS

### A. Specific Research Contributions

#### 1. Research in process in Host Country and US

- a. The project has identified superior bean rhizobial isolates, has produced promising improved bean germplasm, and is developing advanced breeding and cropping methodology, for enhanced biological nitrogen fixation. This, if properly exploited, should lead to the development of high N-fixing bean varieties suitable to different farming systems, especially in the LDCs where the use of commercial N fertilizer in bean production is limited.
- b. Breeding methodology for multiple disease resistance (MDR) to increase bean production could become more effective and efficient as a result of the techniques that have been developed by the project to sequentially test reactions of the plant to several fungal and bacterial pathogens.
- c. By emphasizing research in molecular biology of the bean golden mosaic virus and in identification of sources of resistance/tolerance to the disease, the project may greatly contribute to alleviating this major constraint to bean production in many parts of the world.

#### 2. Research results disseminated and in use in Host Country and US

- a. Superior N fixing breeding lines of beans selected by the project are being evaluated in several regions in the HC.
- b. Selection for N-fixation is becoming an integral part of bean research at CNPAF.
- c. The MDR techniques developed by the project, including the dry inoculum method for the initiation of diseases, are being used in bean research in Brazil and elsewhere.
- d. Research results from the project have been published in scientific journals, books or other media.

#### 3. Other research-related results

Bean germplasm and rhizobial strains collected or developed by the project are being preserved in the HC and US. Some of the material has been exchanged with interested scientists or institutions.

**B. Changes in National Production of Beans in Host Country**

It is too early for the project to have any meaningful impact on bean production in the HC. This will require the availability of superior bean varieties and cropping technologies suitable to different farming systems, strong linkages between research and extension, and favourable official policies. Over the last five years, the country's bean production has slightly increased, but seasonal yields have remained very low.

**C. Training (only CRSP-sponsored funded in 1986)**

**1. Numbers and kinds in process in US, HC and elsewhere**

a. US PhD: 1

b. HC MS: 1

**2. Numbers and kinds completed - US and HC**

a. US: None reported

b. HC: 4 technicians

**3. Cumulative training totals-through 1986**

a. PhD: 1

b. MS: 1

c. Tech: 33

**4. Project training targets during three year extension period (1986-1988)**

PhD: 1

MS: none

**D. Institutional Development in Host Country**

**1. Changes in 1986**

a. Evaluation of N-fixation in preliminary stages of development of improved bean varieties.

b. Intensification of research on BGMV

c. Initiation of work on isozyme markers in fungal pathogens.

d. Introduction of silica gel technique for long-term storage of plant pathogenic fungi into the bean research program at CNPAF.

2. Over life of Project

- a. Enhanced N-fixation has developed into a strong line of work in the National Bean Research Program in Brazil.
- b. Bean pathology research is being strengthened at CNPAF.

3. In prospect

Significant contribution to CNAP's institution building, aimed at improving bean production in Brazil.

II. FUNDING/FISCAL MANGEMENT

A. Custody and Maintenance of Vehicles, Equipment and Other Non-Expendable CRSP-Purchased Property

1. Inventory--Information incomplete
2. Accountable individuals and institutions--Satisfactory

B. Audit/Project Management Reviews

No audit or management problems have been reported. The project was reviewed by an EEP member in December 1986.

C. Adequacy of Funding by CRSP Participants

1. USAID--Adequate
2. Host Country--Adequate
3. US University--Adequate

D. Problems Regarding Funding, Budgeting, Release of Funds, Procurement and Other- In US and Host Country

Present rules on procurement at USAID and in the HC caused serious difficulties in equipping the project. Cumbersome administrative procedures regarding CRSP funding and release of funds, complicated project management by the PIs. The uses of funds and the split between expenditures in the US and Brazil may be questionable.

E. Adequacy of Current Policies and Procedures

Policies and procedures regarding follow-up on use of funds and commodities, seem to be adequate; however, slowness in AID.

### III. PLANNING

#### A. Plans for 1987

1. Research in HC and US will be centered on enhanced BNF and resistance/tolerance to BGMV.
2. The major change in the project MDR research plan, sums up to decreasing work on fungal and bacterial diseases of beans and increasing activities in BGMV. In rhizobiology, more attention will be directed to:
  - a. Developing a non-nodulating bean genotype.
  - b. Improving methods of estimating N-fixation capacity in bean, especially using isotope N-marker.
  - c. Studying ecology of R. phaseoli in field rhizospheres, and
  - d. Understanding premature nodule senescence.

These plans are subject to review by the Technical Committee

### IV. STATUS

#### A. Appropriateness of Activities to Goals of Global Plan

The activities of the project conform to the goals of the CRSP Global Plan, regarding the reduction of plant response limitations and alleviation of disease constraints. The nature and level of project research on BNF and BGMV appropriately complement research in the other B/C CRSP projects.

#### B. Balance Between Research and Training

Research seems to have edged training in the project. It may be desirable to have more Brazilians trained at the graduate level (especially PhD degree) in rhizobiology, plant breeding and molecular virology for bean improvement.

#### C. Balance of US Versus Overseas Activities with Respect to Program Constraints

The balance between US and HC research activities has been quite satisfactory, especially in the BNF leg of the project.

#### D. Level of Collaboration between US and Host Country Institutions and Personnel

The level of collaboration and interaction between the US and HC research personnel and institutions has been excellent.

E. Relative Contributions of Collaborating Institutions and Individuals toward Accomplishment of Objectives

The relative contribution of US and HC personnel and institutions toward accomplishment of the project objectives also has been excellent.

F. Interest, Involvement and Support of USAID Mission and/or US Embassy

Interest, involvement and support of USAID, through the US Embassy in Brazil, has been reported to be improving, although qualifications of Brazil as HC base for CRSP-funded projects may have been questioned in the U.S.

G. Domestic and International Linkages and Cooperation/Collaboration

The project has developed strong and extensive linkages in the HC, US and international community. Cooperation with the Centro Internacional de Agricultura Tropical (CIAT) has markedly grown during FY 1986.

H. Cost Effectiveness, Especially regarding Level of Activity versus Funding.

The project appears to be cost effective, when judged by the amount of voluntary support it receives from the participating US and HC institutions, relative to accomplishments in research.

I. Institutionalization of the HC Component

The project is being institutionalized at CNPAF and has become an integral part of the National Bean Research Program in Brazil.

V. PROSPECTS

A. Adequacy of Performance (Personnel, Institutions) and Arrangements (Funding for Personnel and Facilities)

Prospective development of the project seems to be very promising.

B. Project Problems - Present and Future

Except for cumbersome administrative procedures like those reported for in FY 1986, no major problem is anticipated in the operation of the project.

C. Project Successes/Achievements Present and Future

The project has been quite successful in advancing research on enhanced BNF and developing techniques for improving breeding

methodology for MDR in beans. This is laying strong scientific and practical basis for improving bean production in the world.

D. Overall Outlook

The project, especially as restructured, is expected to make significant contributions toward achieving the objectives of the B/C CRSP Global Plan.

VI. PUBLICATIONS

Satisfactory

VII. OVERALL RATING: 1--Highly Satisfactory

The two University of Wisconsin projects have been merged. The work on BNF continues to be outstanding. Research on MDR is satisfactory. The EEP recommends that means be sought to enable Dr. Bliss to contribute to the work on biological nitrogen fixation in any projects in the CRSP.

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## 1986 EEP REVIEW

### BRAZIL/BOYCE THOMPSON INSTITUTE BEAN/COWPEA CRSP PROJECT

#### "Insect Pathogens in Cowpea Pest Management systems for Developing Nations"

## I. PROGRESS

### A. Specific Research Contributions

#### 1. Research in process in Host Country and in the United States

##### a. In Brazil:

- 1) The project in Brazil during fiscal year 1986 added 24 new fungal isolates to the culture collection of entomopathogens at the Centro Nacional de Pesquisa Arroz e Feijao, thereby increasing its potential for microbial control of insect pests in cowpeas and other crops. The same isolates were shared with the USDA collection at BTI.
- 2) Very high pathogenicity resulted from direct spraying of the fungus Beauveria bassiana onto larvae of the Chalcoedermus aeneus weevil of cowpea.
- 3) Preliminary research in the ecology and epizootiology of entomopathogens is providing basic information for improving microbial control of the cowpea pests.
- 4) Simple-technology formulations of B. bassiana and Metharhizium anisopliae are in the initial stage of development at CNPAF, for low-cost control of coleopteran cowpea pests in Brazil.

##### b. In the US:

- 1) At BTI, refinements of laboratory bioassay protocol have revealed the extremely high infection potential of the fungus Erynia radicans against Empoasca leafhoppers.
- 2) Additional basic information has been gathered on moisture and temperature requirements as well as on invasion processes of E. radicans into Empoasca fabae leafhopper, a major insect pest of beans, cowpeas and other leguminous crops.
- 3) New protectants are being researched to prevent rapid loss of activity in entomopathogenic fungus formulations, especially in those based on B. bassiana and M. anisopliae.

4) Work with E. radicans dry mycelium is showing great potential for possible control of the forage legume alfalfa and beans in the US, and suggesting that introduction of the fungus into cowpea field showing closed canopy would prevent leafhopper populations from increasing to serverely damaging levels.

2. Research results disseminated and in use in Host Country and US

- a. Isolates of B. bassiana, M. anisopliae and E. radicans, from the project are reported to be in experimental use at several institutions in Brazil, but they are not being used by cowpea producers. Isolates of E. radicans are being field tested in two states of the US.
- b. Research results about the dried-mycelium inoculation technique have been widely disseminated in the US, Brazil and other countries.
- c. In fiscal year 1986, 20 publications ranging from book chapters and journal articles to notes in technical bulletins, have been produced by authors or co-authors from the project.

3. Other research-related results

- a. Over 200 isolates of fungal entomopathogens are being preserved at CNPAF and BTI and some of them have been exchanged with interested institutions in Brazil and elsewhere.
- b. Eventual development of simple-technology, low-cost entomopathogen formulations will facilitate insect pest control at the small farm level, especially benefitting cowpea production in the LDCs.

B. Changes in National Production of Cowpeas in Host Country

From 1970 through 1983, in Northeastern Brazil, which is the major cowpea producing region of the country, the area planted increased by 2.2%, but yields decreased by 7.6%, causing an output reduction of 5.4% per year.

From approximately 500 kg/ha in the early 1970's, yields were about half that much in the early 1980's with few exceptions. These figures are at best rough estimataes, since statistics on cowpea production in the country are normally pooled with those on common bean production. Total cowpea production may have increased in the NE region since 1984-1986 (informal communication from CNPAF), but not as a direct result of the project.

Though the scientific achievements of the project are satisfactory and promising, no operational product has emerged as yet. It therefore has not affected cowpea output in the country.

65

C. Training (only CRSP-sponsored funded in 1986)

The CRSP-sponsored training program in the project is as follows:

1. Numbers and kinds in process in US, HC and elsewhere
  - a. US: 1 PhD  
1 MS
  - b. HC: 4 MS
2. Numbers and kinds completed
  - a. US: None
  - b. HC: 12 technicians
3. Cumulative training total, through 1986
  - a. MS: 5
  - b. PhD: 1
  - c. Tech: 143
4. Project training targets during three year extension period (1986-1988)
  - a. MS
    - 1) US: None
    - 2) HC: 1
  - b. PhD
    - 1) US: 1
    - 2) HC: None

D. Institutional Development

1. The new CNPAF administration recognizes the Insect Pathology Laboratory on its campus, as an integral part of its National Cowpea Research Program.
2. The project has sponsored training of five professionals from Brazil at the MS degree level. They are expected to decisively contribute toward the strengthening of research in microbial control of insect pests in the country's farming systems.
3. Actions are being taken to enroll the HC Principal Investigator in a PhD degree program in the US.

4. The next short course in microbial control of bean/cowpea pests is scheduled for June 1987 at CNPAF.

## II. FUNDING/FISCAL MANAGEMENT

- A. Custody and Maintenance of Vehicles, Equip  
Non-Expendable CRSP-Purchased Property
  1. Inventory--Not available
  2. Accountable individuals and institutio
- B. Audit/Project Management Reviews
  1. None
  2. None requested. Management review accomplished 1986.
- C. Adequacy of Funding
  1. USAID--Marginally adequate and unpredictable
  2. Host Country--Satisfactory
  3. US Institution--Satisfactory
- D. Problems Regarding Funding, Budgeting, Release of Funds, Procurement and Other--US and Host Country.
  1. The project continued to receive unpredictable amount of money from CRSP during FY 1986.
  2. Restrictive rules at AID on the purchasing of non-US-manufactured equipment and similar rules adopted by the Brazilian Government on imports caused serious difficulties in the procurement of non-expendable equipment for the project from CRSP funds.
- E. Adequacy of Current Policies and Procedures

Current policies and procedures on the use of funds and commodities and follow-up both at CNPAF and BTI, seem to be adequate, although the administrative paper work may be excessive.

## III. PLANNING

- A. Work Plan for 1986

The 1986 work plan was prepared jointly by the US and HC PIs, with inputs from the Management Entity and the TC. The budget seemed adequate for proposed activities.

67

B. Review of 1986 Work Plan during Implementation

1. Adjustments/changes/additions/deletions:  
Some adjustments were deemed necessary, and have been reported
2. 1986 work plan accomplishments and shortfalls

The accomplishments as related to the work plan are highly satisfactory, with no noticeable shortfalls.

C. Plans for 1987

1. Research in HC and US

- a. Research in 1987 will continue to be centered on E. radicans, B. bassiana and M. anisopliae.
- b. In the HC, development of simple technology formulations of entomopathogenic fungi (especially B. bassiana and M. anisopliae) and field/laboratory studies on E. radicans will be emphasized. So will be research on the impact of entomopathogens on non-target insects.
- c. In the US, research will focus principally on entomopathogen penetration processes (especially in leafhoppers and chrysomelid beetles). Techniques for prolonging the effectiveness of entomopathogenic formulation will be further advanced.

2. Expected Changes/Additions/Deletion from 1986

In addition to the change in research emphasis, there will be some modification in research team composition. Dr. J. Lord will be replaced by Dr. S.P. Wraight in Brazil. This latter and Dr. S. Galaini-Wraight will be replaced by an insect pathology/microbial control specialist at BTI.

IV. STATUS

A. Appropriateness of Activities to Goals of Global Plan

The work on microbial control of insect pests in cowpeas is quite appropriate for meeting the objectives of the Global Plan, by attempting to remove severe insect constraint to bean/cowpea production worldwide.

B. Balance between Research and Training

The balance between research and training in the project has been excellent.

**C. Balance of Domestic US Overseas Activities with Respect to Program Constraints**

The project has maintained a remarkable balance between US and HC based activities with respect to program constraints, especially in its training segment. In research, the more sophisticated, laboratory studies at BTI are completed with the more applied, field work in the HC.

**D. Level of Collaboration between US and HC Institutions and Personnel**

The level of collaboration between the US and HC institutions and professional personnel on the project has been extremely high and effective.

**E. Relative Contributions of Collaborating Institutions and Individuals toward Accomplishment of Objectives**

The US and HC institutions and personnel have contributed in a balanced way toward achieving project objectives, coupling the advanced scientific knowledge and experience of BTI with the eagerness and drive of CNPAF.

**F. Interest, Involvement and Support of USAID Mission and/or US Embassy**

The FY 1986 TAR seems to suggest that the interest, involvement and support of USAID, through the US Embassy/Brazil, have markedly increased with regard to the project.

**G. Domestic and International Linkages and Cooperation/Collaboration**

The domestic linkages of the project are extensive and effective. International relationships need to be strengthened.

**H. Cost Effectiveness, Especially Regarding Level of Activity versus Funding**

The project seems to be cost-effective, when judged on the number of professionals trained, amount of research performed and voluntary institutional support received in relation to effective CRSP budget consumed.

**I. Institutionalization of HC Component**

The project is on its way to being firmly institutionalized at CNPAF. Its Insect Pathology Laboratory there is bound to play the role of an active resource center for insect pathology research in Brazil and other countries.

V. PUBLICATIONS

Outstanding

VI. OVERALL RATING: 1--Highly Satisfactory

Insect pathology is developing worldwide in both developing and developed countries (including the US) as a means of controlling pests. This project has been able to utilize the environmental diversity and the relatively advanced infrastructure of Brazil to explore the prospects of this line of bio-control research for developing countries.

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1986 EEP REVIEW

**CAMEROON/UNIVERSITY OF GEORGIA BEAN/COWPEA CRSP PROJECT**

**"Pest Management Strategies for Optimizing Cowpea Yields in Cameroon"**

The Cameroon project is not being reviewed for FY 86 because plans are underway to restructure the project. The EEP wishes, nevertheless, to record its appreciation of the technical quality of the work by the University of Georgia under the direction of Dr. Richard C. Chalfant in Cameroon. The Cameroon has made substantial progress in building a capacity to do cowpea research. The EEP notes the important, effective work of Dr. Moffi Ta'Ama.

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## 1986 EEP REVIEW

### DOMINICAN REPUBLIC/UNIVERSITY OF NEBRASKA BEAN/COWPEA CRSP PROJECT

#### "Biology, Epidemiology, Genetics and Breeding for Resistance to Pathogens of Beans with Emphasis on Those Causing Bacterial and Rust Diseases"

#### I. PROGRESS

##### A. Research Contributions

##### 1. Research in progress in Host Country and in US

##### a. US--Nebraska

Ongoing studies in the US have provided a basic set of tools that are being used in a number of experiments, including the cloning of virulence and pathogenicity genes of Xanthomonas campestris pv. phaseoli (Xcp). Due to the simplicity of the methodologies, technical persons from the DR will be able to conduct similar epidemiology studies in their country. The studies may also provide information as to why cultivars bred in the US under long photoperiods for resistance to common blight are susceptible in the tropics and why susceptible tropical lines in the DR are moderately tolerant under long days in Nebraska.

Inheritance studies indicate that single plant selection for resistance would not be effective in early generations. Lines should be evaluated for resistance in replicated tests in advanced generations.

Studies in the variation of rust virulence indicate a major effect of environment on the appearance of pathogen races rather than a selection of host genotypes. Hence, resistance genes must be identified in both field and greenhouse trials for use in a breeding program.

In seed hardness studies, genotype x temperature x humidity and genotype x date of planting x humidity x temperature interactions were observed.

##### b. US--Puerto Rico

Work on beans at the University of Puerto Rico provides useful background and a location for screening of material from Nebraska, CIAT and other projects.

##### c. HC--Dominican Republic

Replicated disease nurseries were conducted over different planting dates at several locations to detect sources of disease resistance and improved yields. An important collection of variants of Pompadour germplasm was also

evaluated. The red-mottled bean PC-157 (Type I) yielded well under stress conditions and appears promising for small farmer situations, however, the seed size of Type I and Type II red-mottled lines is too small for consumer acceptance.

An experiment was conducted to study the effect of location of production, type of storage container and months in storage on germination and water uptake of 8 varieties. Germination was affected by all three factors but amount of water uptake at 24 hours did not differ among varieties.

2. Research results disseminated and in use in HC and US

Foundation seed of two recently released and recommended small red-mottled cultivars and one black seeded variety was produced and will be increased for distribution to small growers in the DR. The small white Arroyo Loro #1 is now being grown in the DR. However, this type of bean occupies only a small part of the bean production. A testing method to screen for resistance to ashy stem blight was developed in the DR and is now used in screening and genetic studies. The importance of leaf age in screening for resistance to rust was detected and has led to standardization of age to provide a consistent comparison between lines within and between tests.

3. Other research-related results

a. Germplasm conservation and use.

Germplasm collections for use in genetics, breeding and plant pathological and physiological experiments are maintained under suitable conditions in the DR, PR and NE.

b. Seed production

The project has cooperated with the Seed Department of the Ministry of Agriculture (SEA) in the DR in producing 5.3 million tons of foundation seed of PC-150, Bat 1412-CIAT, and PC-157.

c. Impact of other CRSP-produced or recommended technology

The annual report states that "the introduction of the new disease resistant varieties served to increase (also stabilize) yield, produce a better quality seed for consumer use and reduce costs of production (no fungicide needed)". (The underline is the reviewer's.) Review of the report indicates no evidence to substantiate this statement.

d. Cooperation with CIAT

Several activities (training, testing and workshops) have been held in cooperation with CIAT.

e. Needs of small farmers and women

Disease resistant varieties will reduce costs for those farmers who spray and will increase yields for small producers. But again, no evidence is presented and statements are futuristic.

B. Changes in National Production of Beans in the DR

The years 1982 and 1985 are compared. For red-mottled beans, the most important in the country, production increased 26% (21% increase in area and 5% increase in yield). The figures presented for black beans have an error so no comparison can be made. A comparison of only two years is hardly adequate to show trends.

C. Institutional Development.

1 and 2. Changes over life of project

An identifiable bean program now exists in the DR. Before 1981 only a loose legume program geared to testing CIAT lines existed. A breeding/research bean program commitment was made by the SEA of the former government.

3. In prospect

To be discussed with the new government will be the objective that the DR pay most or all of the current Title XII bean personnel so that when the project is terminated, the bean research program will be maintained at a high level of activity. At the present time, the project is paying 100% of the salary of 19 persons in the DR including the HC PI, and part of the salary (an average of 21.4%) of another 17 persons.

Future prospects for the project look dim given the perpetual state of the budget in the DR and the rather drastic swings in funding and program when the government changes. With such a large component being paid by CRSP funds, it is difficult to have confidence in the institutionalization of the project in the HC.

4. Training targets

Three students from the DR are expected to complete 2 MS and 1 PhD degrees at UNL in 1987-89. Two will attend UPR for MS degrees programmed for completion in 1988. Two of the 3 at UNL are financed by LASPAU.

## II. FUNDS/FISCAL MANAGEMENT

### A. Custody and Maintenance of Vehicles, Equipment, etc.

All items appear in an inventory in Appendix A of the report.

### B. Audit/Project Management Reviews

An audit was conducted at UNL on 7/86. One was scheduled in the DR for the fall of 1986 but is not reported on in the review.

### C. Adequacy of Funding

1. Reported as generally not adequate. Also lack of forward funding for the 'new' grant caused many problems at all three locations. The decrease in funding is reducing basic research under the project.
2. Financial management reported efficient in the HC over the past year because of reorganization in the SEA.
3. Funding reductions combined with reduced state and industry support, are reported to have seriously eroded research capacity at UNL. Note: No mention was made of effect at UPR.

### D. Problems Regarding Funding, Budgeting, etc.

Budgeting is reported as being more difficult each year with less money and more reporting. The HC nearly lost the bean program due to an election transition when no funds were available for 2 months.

### E. Adequacy of Current Policies and Procedures

Overregulation and overreporting are reported to limit research time. Requires some solution.

## III. PLANS FOR 1987

The EEP recommends that the Technical Committee review and approve plans for 1987 with respect to the work being done in the Dominican Republic, particularly with regard to seed size and color. There is need at UPR to develop a selection and breeding strategy to improve disease resistance in large-seeded beans. The work on small-seeded beans may be useful for other countries.

## IV. STATUS

### A. Appropriateness of Activities to Goals of Global Plan

The work to develop stable genetic resistance to rust and to common blight and to other diseases is fully appropriate to the Global Plan.

**B. Balance between Research and Training**

Excellent.

**C. Balance of Domestic vs. Overseas Activities**

Integration of the UNL and UPR components has improved and will continue to improve since the projects merged with UPR providing an effective interface between UNL and the DR. Efforts should be focused to evaluate materials over a wide range of environmental conditions in the DR to enhance progress in developing adapted and preferred varieties.

**D. Level of Collaboration between US and HC Institutions and Personnel**

Appears to be fully adequate given the problems of the changing government in the DR.

**E. Relative Contributions of Collaborating Institutions and Individuals toward Accomplishment of Objectives**

Satisfactory

**F. Interest, Involvement and Support of US and Mission and/or US Embassy**

Fully satisfactory.

**G. Domestic and International Linkages and Cooperation/Collaboration**

Strong linkages exist within the organizations and disciplines with which the PIs are associated and with CIAT. Linkage with other projects within this CRSP should be improved.

**H. Cost Effectiveness**

Difficult to evaluate for this specific project. The general argument that the funds leverage a large amount of scientific expertise otherwise not working on this specific effort in a coordinated manner is relevant and sound. The capability the project provides for evaluating materials across climates is valuable and is resulting in new discoveries which probably would have been longer in coming in the absence of the project. The outlook is for improved disease resistant cultivars for both the US and tropical situations which should reduce costs of production and improve productivity of the resources used. However, it would appear that the output of the HC component is not in keeping with the number of persons directly employed by the project in the DR.

**I. Institutionalization of HC Component**

An identifiable bean program now exists in HC, and a breeding/research commitment was made by the SEA of the former government. Until the new government takes action, the permanence

of this progress will be uncertain. Because of the large number of persons in the HC on the payroll of the CRSP (including the HC PI), it does not appear certain that the project will be successfully institutionalized.

V. PUBLICATIONS

Several presentations were made by project personnel during the year and an impressive list of articles published or accepted for publication. Fully acceptable.

VI. OVERALL RATING: 2--Satisfactory pending appropriate review by the Technical Committee and CRSP authorities

With the merger of the UNL and UPR components, the division of research seems to be progressing well and in a coordinated manner. The DR component should be reviewed indepth to ascertain if improvements can be made in the process of developing adapted disease resistant and preferred cultivars. The review should also address the size of the payroll in the HC and the potential for institutionalizing a bean program in the DR as well as the appropriateness of hardness research at UNL and seed deterioration in storage research in the DR.

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## 1986 EEP REVIEW

### GUATEMALA/CORNELL UNIVERSITY BEAN/COWPEA CRSP PROJECT

#### "Agronomic, Sociological and Genetic Aspects of Bean Yield and Adaptation"

#### I. PROGRESS

##### A. Research Contributions

This report was particularly difficult to evaluate. The account of work done in 1986 consists almost entirely of statements of a general, repetitive and rhetorical nature, unsupported by specific observational or experimental data. It is difficult to see how CRSP funds amounting to \$120,000 in FY 86 were spent. Only in the light of other knowledge of the phenological, morphological and physiological components of the yield of indeterminate plants in specific locations is it possible to assess what may actually have been done in this project in FY 86.

##### 1. Research in progress in Guatemala and Cornell

The research has been directed to better understanding the factors--physiological and morphological characteristics of beans--that determine crop yield. The report indicates that procedures have been developed which allow these characteristics to be selected in early generations after crosses. It seems likely that these procedures will be more efficient and thus less costly than conventional selection for yield alone in large populations. The sociological component is now being handled by collaborators in Guatemala.

##### 2. Research results disseminated and in use in Guatemala and the US.

The above philosophy for improving the efficiency of breeding for higher bean yield are in use in both Guatemala and New York. As this work began, inclusion of the whole-plant yield-system made it difficult to explain. The current more holistic inclusion of time duration and rates is not difficult to comprehend, and its application facilitates improved efficiency of breeding for higher yield. Acceptance and application by other breeders will require time and favorable results, but should be forthcoming. With this prospect, a symposium on breeding for higher yield will be conducted in Guatemala in April, 1987, and a similar, but more in-depth symposium will be conducted in the US in the near future.

##### 3. Other research-related results.

###### a. Guatemala

Analysis was completed on 1984 data collected from the F2 populations of the six possible crosses among four Guatemalan cultivars of different maturities each planted

the same day at three different locations: 1786 meters, 19 degrees; 895 meters, 23 degrees; and 50 meters, 29 degrees. Compared with the high and low temperatures, the intermediate temperature reduced the range and variation of days to flowering for all six crosses. This indicates limited expression of genetic differences by the different F2 genotypes at the intermediate temperatures, which the fewest days to flowering and the lowest variability.

The inheritance of maturity of climbing beans for the tropical highlands of Guatemala was shown to be controlled by only one or two genes, similar to the inheritance for bush beans.

b. New York

F2 segregation of a Redcloud (early and photoperiod insensitive) x Redkote (late and photoperiod sensitive) cross varied from no apparent gene control (all plants early in the growth chamber under short daylength), to two genes with dominance for earliness (in the growth chamber under long daylength), to two genes with dominance for lateness (in the field under long daylength and a warm night summer), to one gene with dominance for lateness (under the same long daylength but a cool night summer). The results (four flowering phenotypes labeled early, intermediate, late, and very late, indicate activity by zero, one, or two genes, depending on the daylength-temperature.

In breeding for higher yielding cultivars for New York, 1985 plant weights were extremely low because of drought, and because the drought led to a large population of aphids which brought about more bean virus than for any of the last 30 years. The summer of 1986 was the opposite, having about the most rainfall of any year. This caused the 1986 yield trials to be destroyed by anthracnose which had never before been devastatingly present. This illustrates the ever present difficulty that yield expression is vulnerable to negative impacts by one or only a few of its thousands of physiological genetic components.

B. Changes in National Production of Beans in Guatemala

In the southeast, the production per unit of land area is generally upward, because more and more farmers are using improved varieties. The 1986 yields are down due to drought. New bean production is emerging in the northeast where sole cropping is being practiced. The more accessible highlands are changing from bean/maize to vegetable production.

**C. Institutional Development**

The Guatemalan PI now devotes nearly 100% of his time to the CRSP. He was made bean program leader emeritus with responsibility to concentrate on breeding for higher yield. This was possible because CRSP and other training permitted increasing the responsibility of bean program staff.

**II. FUNDING/FISCAL MANAGEMENT**

**A. Custody and Maintenance of Vehicles, Equipment and Other Non-Expendable CRSP-Purchases Property.**

The inventory value of equipment and other non-expendable property exceeds equipment purchased by \$3,376. With information furnished it is not possible to determine source of the additional property. This is not viewed as a serious problem.

**B. Audit/Project Management Reviews**

The only review was made by the EEP. As suggested, the social science component for Guatemala is now being handled by ICTA.

**C. Adequacy of Funding**

1. USAID--Reported as adequate

2. Host Country--Funding has been adequate for biological component, but there were some problems with international transfer of funds. Additional funds may be needed for FY 1987-88 for field testing of potential high yielding cultivars under on-farm environments. Some may be made available by cessation of long-term training.

3. US university--Not reported.

**D. Problems Regarding Funding, Budgeting, Release of Funds, Procurement and Other--in US and HC.**

Management difficulties are reported for this project by the US institution. Funds are received three to six months after the start of the budget period. The USAID Mission has refused to assist in transferring funds into Guatemala. It is also nearly impossible to have unspent funds returned to the US.

The 50/50 expenditure ratio is impossible to implement because the rate of spending by the HC cannot be controlled. To maintain parity would restrict US activity caused by delays in HC expenditures. Resulting HC expenditure is 42.5% of total to date.

Equipment approval in USAID continues to be woefully slow and appears to contractor to be arbitrary.

E. Adequacy of Current Policies and Procedures.

Nothing reported.

III. PLANS FOR 1987

The plans for 1987 that follow for Guatemala and New York have not been approved by the Technical Committee.

A. Guatemala

The knowledge gained about relationships among maturity, adaptation and yield will be used to divide the breeding for higher bean yield into three efforts. One will aim to maximize yields on marginal lands (mostly steep, sloping hillsides) by developing early bush cultivars. A second will develop later maturing cultivars for the more productive lands. A third effort will breed higher yielding climbing beans that are relatively early (less aggressive) and therefore do not reduce the yields of the associated maize.

B. New York

Homozygous F8 genotypes will be grown under long daylength in the field and growth chamber and under the short daylength of winter to see if the expected two gene and zero gene controls will be expressed. Yield system analysis of the International Bean Flowering and Adaptation Nursery will be continued. Yield trials that differentiate the phenotypic and genetic components of the yield system characteristics for 100 bean accessions of multiple country origin will be continued.

IV. STATUS

A. Appropriateness of Activities to Goals of Global Plan

The goal of elucidating the near-fully integrated components of yield and learning how to apply them toward more efficiently breeding for higher yield is fully appropriate.

B. Balance between Research and Training

There is no training summary in the report nor a comparison between research and training.

C. Balance of Domestic vs. Overseas Activities with Respect to Program Constraints

Very well conceived and executed

D. Level of Collaboration/Cooperation between US and HC Institutions and Personnel

Among the best of the CRSP. Excellent.

E. Relative Contributions of Collaborating Institutions and Individuals toward Accomplishment of Objectives

Highly balanced, near equal participation

F. Interest, Involvement and Support of USAID Mission

Little involvement or support

G. Domestic and International Linkages and Cooperation/Collaboration

Excellent

H. Cost Effectiveness, Especially Regarding Level of Activity vs. Funding

Apparently excellent. The CRSP contribution strengthens the Bean Program in ICTA and permits a level of excellence not often found in a developing country.

I. Institutionalization of Guatemalan Component--Evidence of

Outstanding

V. PUBLICATIONS

None reported for 1986. One reported for 1985 and several in process for publication in 1987. Perhaps could be improved.

VI. OVERALL RATING: 1--Highly Satisfactory

Overall, very well balanced and productive. Appears to be making a significant impact on bean breeding in Guatemala and with potential for global impact from the breeding and selecting methods developed. The Technical Committee is invited to determine whether the work of this project cannot now be carried out entirely by ICTA.

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82

## 1986 EEP REVIEW

### HONDURAS/UNIVERSITY OF PUERTO RICO BEAN/COWPEA CRSP PROJECT

#### "Improvement of Bean Production in Honduras through Breeding for Multiple Resistance"

#### I. PROGRESS

##### A. Research Contributions

##### 1. Research in process in Puerto Rico and in Honduras

The University of Puerto Rico is engaged in a broad range of bean research activities, CRSP and non-CRSP sponsored, which benefit the CRSP directly and indirectly. The University collaborates with several international organizations in conducting bean germplasm evaluation nurseries of special value to the CRSP.

In 1986, the following nurseries were carried out at selected locations in Puerto Rico: the Central American Yield and Adaptation Nursery (VICAR), the International Bean Research Nursery (IBRN), and the International Bean Golden Mosaic Nursery (IBGMN). CRSP funding has supported the screening of disease resistant bean germplasm for biological nitrogen fixation, the screening of Honduran varieties for resistance to common mosaic, and an investigation of seed-borne pathogens associated with seed grown by small farmers. These several bean research activities underway, CRSP and non-CRSP, are complementary and supplementary.

The CRSP bean research being carried out in Honduras is linked directly to and benefits greatly from research in Puerto Rico; in fact, the Honduran work appears to be largely an extension of some of the work underway in Puerto Rico. Through the CRSP, the strong bean program in Puerto Rico is brought into direct, close support of bean improvement in Honduras--a good example of effective international collaboration.

The bean breeding program in Honduras, which seeks to develop small, red-seeded bean germplasm with multiple disease resistance, holds great promise because yields of beans are quite low due mainly to susceptibility of existing cultivars to various diseases. An extensive crossing program is underway with progeny being tested in Puerto Rico, as well as in Honduras. The CRSP work in Honduras is being conducted by Dr. Silvio Zuluaga at the Escuela Agrícola Panamericana (EAP) for the Government of Honduras. Dr. Zuluaga's research in the Zamorano Valley is directed toward developing desirable cultivars (small, red-seeded beans) with resistance to local strains and races of pathogens--a highly appropriate line of research. Very likely, this Honduran research could produce results of value elsewhere in Central America. The development of this research appears to be in its early stages--some years away from producing improved varieties for farmer-use.

2. Research results disseminated and in use

None reported

3. Other research-related results

None reported

B. Changes in National Production of Beans in Honduras

1. Hectares

Over the past twenty years, there has been an increase from 73,000 ha to 83,000 ha, an increase of 10,000 ha--less than 14 percent in twenty years.

2. Yields

Bean yields in Honduras have been stagnant at about 600 kg/ha, plus or minus, over the past twenty years.

3. Production

Production during the period 1961-65 averaged 48,000 tons. In 1984, production was estimated at 52,000 tons.

C. Institutional Development

Substantial progress in developing a capacity in Honduras to conduct quality bean research is being reported. This change is said to be the result of attention and arrangements made by the Honduran Ministry of Natural Resources and by the EAP. The External Evaluation Panel has been critical of the EAP arrangement. As a private institution, the EAP has been judged as being an inappropriate institution for CRSP research. Recent events suggest that this judgement may not be valid under the circumstances prevailing in Honduras.

The efforts directed towards the improvement of grain legumes, including beans, by the Government of Honduras in association with several government agencies and organizations and the EAP are reported to be impressive and worthy of re-evaluation. Because of favorable policies and actions taken by the Government of Honduras, existing circumstances in Honduras, and the urgent need for progress in bean improvement, the appropriateness of CRSP bean research arrangements should be re-appraised. The existing arrangement with the EAP may be satisfactory for CRSP activities. CRSP authorities may wish to discuss the arrangements, especially financial inputs, with the Director of Research, Ministry of Natural Resources, Government of Honduras, and secure an appropriate Memorandum of Understanding.

## II. FUNDING/FISCAL MANAGEMENT

### A. Custody and Maintenance of Vehicles, Equipment and Other Non-Expendable CRSP-Purchased Property

Reports indicate satisfactory arrangements and/or actions taken during year.

### B. Audit/Project Management Reviews

No audit made or requested

### C. Adequacy of Funding

USAID funding reductions in Puerto Rico and Honduras have caused some retrenchment and delays in conduct of scheduled activities. The PIs report ". . . \$50,000 is the absolute minimum needed to maintain a credible Bean/Cowpea CRSP project in Honduras."

### D. Problems Re Funding, Budgeting, Release of Funds, Procurement and Other--US and Host Country

Mid-year reductions in funding caused "considerable disruption" in project activities and added/unexpected expenses (leave pay for employees discharged because of funding reduction). Delays in reporting quarterly funding requirements by Honduras (EAP) to the University of Puerto Rico presented some funding problems for the EAP.

A major concern of the PIs is the level of assured funding. Uncertainty does not favor effective planning and execution of project activities and delays progress toward achievement of objectives.

## III. PLANS FOR 1987

The PIs have developed a coordinated plan for 1987 which continues previous research. It builds logically on and extends the work underway. There is no deviation/diversion of planned activities away from project targets and objectives. Subject to the CRSP Technical Committee's final approval, the plan is judged to be a sound and adequate blueprint to follow toward achievement of objectives.

## IV. STATUS

### A. Appropriateness of Activities to the Global Plan

Fully appropriate. Advances in securing small, red-seeded, disease-resistant, early-maturing bean cultivars in Honduras are valuable and useful elsewhere in Central America.

### B. Balance Between Research and Training

Satisfactory

C. Balance of Domestic vs Overseas Activities with Respect to Program Constraints

Excellent. Well-thought-out division of effort and an equitable, appropriate division of funds.

D. Level of Collaboration Between US and Host Country

Satisfactory

E. Relative Contributions of Collaborating Institutions and Individuals Toward Accomplishment of Objectives

Balanced, complementary and supplementary

F. Interest, Involvement and Support of USAID Mission and/or US Embassy

Adequate

G. Domestic and International Linkages and Cooperation/Collaboration

Satisfactory (domestic) to Excellent (international)

H. Cost Effectiveness, Especially Level of Activity vs Funding

Appears to be quite effective. A small amount of CRSP funds appears to be leveraging substantial Puerto Rican and Honduran funds as well as benefiting from inputs of several regional and international agencies.

I. Institutionalization of Host Country Component

Uncertain, but outlook appears promising.

V. PUBLICATIONS

Adequate/satisfactory

I. OVERALL RATING: 2--Satisfactory

With the arrival of Dr. Zuluaga, bean research in Honduras has increased and its focus has been sharpened. Strongly supported by the University of Puerto Rico, integrated into a national grain legume research network, and adequately accommodated and funded at the EAP, prospects for this CRSP project to achieve its objectives and contribute to the Global Plan have improved dramatically. If arrangements for the EAP to be the CRSP institutional host in Honduras are deemed appropriate, the project is judged fully satisfactory for continued support without changes. Given the location of the CRSP PI at the EAP in Zamorano Valley, CRSP officials may wish to monitor closely relationships with bean research at other Honduran locations under the Ministry of Natural Resources. In this connection, CRSP officials may wish to secure a Memorandum of Understanding that details the relationships between the EAP, the Ministry and the University of Puerto Rico. Perhaps an annual workplan for EAP/Ministry activities would be desirable.

1986 EEP REVIEW

INCAP/WASHINGTON STATE UNIVERSITY BEAN/COWPEA CRSP PROJECT

"Improved Biological Utilization and Availability of Dry Beans"

The External Evaluation Panel did not find it possible to evaluate the annual report as submitted. It was unable to distinguish work done in 1986 with CRSP funding from work done in earlier years or with other funding. Similarly, the EEP was not convinced that the work proposed for 1987 could be accomplished with the CRSP budget as proposed. The EEP therefore requests that a revised report be submitted, confined strictly to work done in 1986 with CRSP funding and work proposed for 1987 with CRSP funding. The EEP reiterates the suggestion made at the last meeting that this project should concentrate on the hard-to-cook phenomenon. Such a restriction would allow a decrease in funding requirements.

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## 1986 EEP REVIEW

### MALAWI/MICHIGAN STATE UNIVERSITY BEAN/COWPEA CRSP PROJECT

#### "Genetic, Agronomic and Socio-Cultural Analysis of Diversity among Bean Landraces in Malawi"

## I. PROGRESS

### A. Research Contributions

1. The stable yield of mixtures of bean seeds raised a question about whether or not genotypic shifts occur in farmers' fields and what would be the significance of such changes.

Progeny of 980 single seeds in the germplasm collection (1600 accessions) at Bunda College were planted and data on nine measurements were accumulated. The remaining accessions will be treated similarly after they are planted in November 1986. A complete catalog of information is expected to be available by the end of 1987.

Sixty-six collections of bean mixtures from three regions of Malawi have been increased twice at Bunda. Fluctuation in seed types observed from two generations of multiplication will be analyzed.

A manuscript on advantages of competition in intraspecific mixtures has been prepared by Dr. Eric Ayeh.

Grower selection of seed has not produced more uniform mixtures over time. Seed exchanges sometimes occur but removal of damaged seeds at planting time may be the principal method of selection. Some dietary and culinary preferences may exert a certain amount of influence on selection, but seed shortages do also. Data from in-depth questionnaires and observations of farm families will be analyzed at MSU where necessary computation facilities are available.

Assay of six isozymes in Malawian beans has been accumulated for 85 percent of 375 selected lines. Variability has been limited to two major patterns, rather than the sixty-four possible patterns of alleles expected. Large-seeded beans have the set of alleles called Pattern A and small-seeded beans have Pattern B. These two patterns also distinguish large-seeded beans and small-seeded beans from cultures in North and South America and thus do not appear to be the result of natural selection for adaptation to environmental pressure in Malawi. Barriers to crossing the two germplasm groups are known to exist in the Americas and in Africa. In Malawi, genetic diversity of fifteen bean landraces was implied by analysis of twenty-one different measured phenotypic traits (G. Martin, M. S. thesis). Because the isozymes studied are considered primary gene products, the diverse phenotypic findings are not compatible with the observed

limited number of isozyme patterns. The previous hypothesis of genetic structure or organization of Malawian landraces must now be reassessed.

## 2. Publications

- a. Two papers by Martin and Adams have been accepted for publication in Economic Botany in 1987.
- b. A chapter on structure of bean landraces has been prepared by Adams for book on Evolution and Domestication of Phaseolus, edited by P. Gepts.
- c. Short article by Adams has been accepted for publication in Diversity (journal).
- d. Paper (poster session) presented by S. Morss-Sprecher at International Legume Symposium in June 1986 in St. Louis, MO.
- e. Barnes-McConnell has submitted a manuscript entitled "Keepers of the Trust" to CERES for possible publication.
- f. Host Country researchers--no publications or papers cited.

## B. NA

- C. Two MS students have returned to Bunda College and are teaching but are not engaged in research. Two additional Malawians are studying for the doctoral degree at MSU (one in food science, one in plant physiology) and a third Malawian is expected within the current extension period. Two US doctoral students are also being trained on this project.

## D. Institutional Development in Host Country

Institutionalization of bean research in Malawi has made no significant progress in 1986. Funding in Malawi is largely provided by the CRSP.

## II. FUNDING/FISCAL MANAGEMENT

- A. Custody and Maintenance of Vehicles, Equipment and Other Non-Expendable CRSP-Purchases Property.

Maintenance and custody of vehicles and other equipment in Malawi is the responsibility of the HC PI, Dr. Wilson Msuku, Bunda College.

- B. Audit/Project Management Reviews

No audit has been conducted or requested.

### C. Adequacy of Funding

Funds are tight and have limited certain activities, reduced domestic and foreign travel. The HC in-kind contribution has included land for field experiments and technical support.

## III. PLANS FOR 1987

### A. Research in Host Country and US

#### 1. US research

- a. Complete isozyme analyses of Malawian landraces.
- b. Continue restriction endonuclease analysis of genetic diversity.
- c. Finish the thesis research of a Malawian student on drought resistance in Malawian beans.
- d. Complete analysis of socio-cultural data obtained in 1984-86 and integrate and interpret all data obtained in MSU project.

#### 2. Host Country research

- a. Continue measuring genetic changes in landrace populations over time, using farmer cooperators in two areas and in both natural and contrived conditions at Bunda.
- b. Continue evaluation of germplasm for resistance to pests and diseases.
- c. Conduct follow-up socio-cultural research to clarify issues raised by data obtained from 1984 to 1986.
- d. Initiate social science studies in the central region.

### B. Expected Changes/Additions/Deletions

1. Anne Ferguson has replaced P. Barnes-McConnell as the social scientist on the project.
2. If funds are available and teaching commitment at Bunda College allows, bring one or more faculty personnel more actively into the program.

## IV. STATUS

- A. Studies on genetic diversity and its maintenance in Malawi has significance beyond the national interest and has global significance in the broad area of germplasm resources.

- B. Teaching likely has been strengthened at Bunda College, but research time is not yet available, or in only limited amounts, for faculty members.
- C. From 1987, most research should be conducted in Malawi and training in the US.
- D. Collaboration has been satisfactory but too little time allocated to research at Bunda College.
- E. Most of the recent research in Malawi has been conducted by MSU personnel in Malawi.
- F. USAID Mission personnel have changed so additional efforts may be necessary to inform them about the project and gain their support.
- G. A trip by Dr. E. Ayeh, Bunda College, to the CIAT bean project in Rwanda has been supported. Some germplasm from Malawi has been used in MSU's breeding program for possible distribution to Michigan producers.
- H. No information provided.
- I. Little evidence of institutionalization at Bunda College, primarily because local funds are not available. All reports of project progress, however, are submitted to the Director of Research in the Ministry of Agriculture for his use in development of the Annual Guide to Agriculture Production in Malawi. This publication, which has a section on beans, is provided to all extension agents and many farmers.

V. PUBLICATIONS

Satisfactory, see I.A.2.

VI. OVERALL RATING: 3--Satisfac

Project is judged satisfactory; however, in January 1986 the EEP recommended that phaseout of this project be considered. The EEP reiterates this recommendation because the project appears to have completed its tasks and the EEP does not envision any further development gains by its continuation. We hope the diverse genetic materials and information will not be lost. The EEP encourages the completion of the analysis of 1984-86 socio-economic data.

## 1986 EEP REVIEW

### MEXICO/MICHIGAN STATE UNIVERSITY BEAN/COWPEA CRSP PROJECT

#### "Improving Resistance to Environmental Stress in Beans through Genetic Selection for Carbohydrate Partitioning and Efficiency of Biological N-Fixation"

## I. PROGRESS

### A. Specific Research Contributions

#### 1. Research in process in Host Country and in US

The investigations reported for 1986 are as follow:

##### a. Mexico

#### 1) Field screening and testing for adaptation to dry conditions.

- a) 200 entries selected for further testing out of 3500 grown out at Durango (moderate drought in August after flowering) and Augascalientes (severe drought before flowering). Prostrate lines with small leaves and many small pods (described as semi-domesticated) and "cacahuete" types (whatever they may be) are reported to be well adapted to dry conditions. The report does not say how many of the selected lines did well under dry conditions at both locations.
- b) 184 entries selected out of 1500 tested in 1985 were grown as a "drought nursery" at four locations. 10 named entries "performed well" under drought.
- c) 49 entries (described as genotypes) derived from initial screening in 1984 and selected from the drought nursery of 1985 were tested under irrigated, rainfed and droughted (presumably by rain shelters) conditions. Two named entries were well adapted. Their names do not appear among the ten mentioned in the preceding paragraph.
- d) A nursery of 16 entries from an earlier screening was grown at six locations. Two named entries appeared outstanding, but once again their names are new. However, these varieties are thought likely to be useful commercially in Zacatecas and Durango.
- e) A number of attributes (not specified except for leaf water potential and leaf temperature) were measured or recorded on 16 varieties grown under undefined "stressed" and "unstressed" conditions at Durango. This is a continuation of a similar trial in 1985, the analysis of which is mentioned below.

No quantitative data on yields, even of the successful entries, or on the time courses of the water balances through the seasons at the different locations, are presented in the report. It is not possible to tell how consistent the results were, how marked was the success of the successful entries, or how far variations in the nature of the dry conditions may explain differences among varieties and sites. No one entry appears to have been successful in all trials: one might have thought that successful entries from earlier years would be included in later trials to provide some standard of reference or comparison. It does not seem that any useful general conclusions can be drawn to guide future breeding or agronomic research.

b) Rhizobium

60 strains of R. phaseoli were tested for "fixation efficiency" in the glasshouse and 25 were studied for survival in the field at Zacatecas in 1986. No data are yet available. 300 entries (lines) of beans were tested in 1985 for "N-fixation efficiency" in a drought nursery at Chapingo, with and without inoculation (with what?) and with varying levels of N and P fertilizer. 150 of them were similarly grown in 1986. No data are offered.

Without any numbers at all, it is not possible to evaluate these reports or to feel confident that they will lead, some day, to a Rhizobium industry or to the incorporation of characters conferring superior N-fixing ability on host plants into the breeding program in Mexico. Some of the best talents in the world in this field are associated with the Bean/Cowpea CRSP. In the 100th year after the seminal publication by Wilfarth and Hellriegel, ought we not to be doing better than this?

b. United States--MSU

1) Field studies

Field studies of the effects of dry conditions on entries of beans were conducted at Prosser, WA; in Montcalm County, MI (2 trials); and at MSU.

a) The Prosser experiment used a line source sprinkler system to compare the effects of subsoiling and distance from source on the growth and yield of 9 entries. No data are offered on the quantities of water present in the profile before the trial began, or on the differences in water regime associated with the differences in position. Although the site

appears to have been so variable that the report questions the value of an "in-depth" analysis, it would have been helpful to go as far as the calculation of treatment means and an analysis of variance. It is clear that subsoiling had little average effect and that there was a substantial and consistent main effect of position. Without an analysis of variance, it is not possible to separate what look like real differences between entries in potential yield from the entry x position interaction, which is what the experiment was intended to measure and analyze. The most important thing is to analyze and interpret the primary data. In the absence of that analysis, some interesting flirtations with ratios and some selected tabulations of intermediate data do not help to explain what happened at Prosser.

However, it seems that the trial confirmed useful adaptation to dry conditions in four of the entries. It is suggested that the reasons for the differences in adaptation are to be sought in the distributions of roots, on which no information was collected.

- b) In Montcalm County 1, ten navy and black bean entries were grown with or without small supplemental sprinkler irrigations (2 x 1 in.)(2 replications each).

Though no means are presented for the water treatment, a percentage reduction in yield associated with "drought" is offered for each entry, and there do seem to be important differences between the entries. In the absence of standard errors or an analysis of variance, it is not possible to assess their significance, but the data are said to support the release of entry N84016, more or less the first equal in yield (with the known drought adapted N81017 [C. Samper]) without irrigation, and more or less the second-equal under irrigation.

No information is recorded on the water balance conditions in this experiment, though the store of water in the soil from winter precipitation must be important in interpreting the results.

- c) In Montcalm County 2, 99 lines derived from crosses between Puebla 152 and two other entries, Jamapa and Sanilac, backcrossed to Jamapa and Sanilac and then selfed "to homozygosity" and tested by Dr. Fred Bliss "for N-fixation" by the acetylene reduction

method, were grown, along with the parents and five check varieties under contrasted water conditions. The entries covered a range of capability to fix N. The object was to find out whether a bean genotype can be both tolerant of drought and efficient as a nitrogen fixer.

No data were available when the report was written. Moreover, the report casts doubt on the logical structure of the trial, since none of the parents is known to have any special adaptation to dry conditions.

- d) These difficulties may be avoided in an experiment at MSU of which the analysis has not yet been completed. 121 entries of F6 material from eight CIAT crosses (presumably made in 1983), between lines varying in drought resistance and capability to fix nitrogen, were grown, with the parents as checks, inside and outside the rain-out shelter at MSU. One of the parents in two of the crosses was N81017, which C. Samper found to be well-adapted to dry conditions in 1984. It is not clear whether it was selected for this reason or because it is also good at fixing nitrogen.

The data tabulated show that the shelter did indeed decrease growth and yield, but no information is yet available on the performance of the entries in respect of the evidently considerable number of variates recorded or measured. The text indicates that N81017 was first equal in yield outside the shelter. It is to be hoped that this potentially very interesting study will be completed.

## 2) Glasshouse investigations

The report includes an account by E. Watt on a comparative study made in 1984 of the effect of variations in water supply on the growth and partitioning of dry matter in beans and cowpeas. It is interpreted to show that in N81017 a larger proportion of the seed weight in plants which had experienced water shortages came from materials originally derived from assimilation before anthesis, and from anthesis to mid-podfill, than in the drought-susceptible variety B790131. The two cowpea varieties did not behave according to specification, but it is clear that growth in these cowpeas differed in many respects from growth in the two bean varieties. Much interesting material could yet be extracted from this report.

3) Analysis of data from stress experiment at Durango, 1985

In this experiment 22 variates or derived variates were measured or calculated for each of 16 entries grown either under water stress or unstressed. The experimental details are not given. The association among the variates, pooling all entries, were examined for the stressed and unstressed treatments separately, by factor analysis. This was done in such a way that all the variance was partitioned among five factors. As the report points out, the next stage is to imagine what the material significance of the factors may be. As interpreted, the factors are assigned different meanings in the two conditions, three of which are more or less common to the two conditions.

In itself, this does not in fact get us much further its use is to form testable hypotheses to be examine in further research. It is not clear whether this is reflected in the proposed program for 1987, which does however provide for the analysis of the data from the comparable field trial at Durango in 1986.

c. United States--Minnesota

Peter Graham at Minnesota cooperates with MSU and with CIAT in evaluating bean materials for capability to fix nitrogen and in selecting and testing strains of Rhizobium. In the work on strains, 348 were screened: there were large differences in yield (no information presented on nitrogen fixed per unit of carbon retained) and 42 were selected for further study.

In the work on microbial strains, clear differences were once more found in competitiveness and effectiveness in fixing N. Unfortunately the strains which succeed in one experiment are not heard of in the others.

d. General comment on research

Though the title of the project refers to environmental stress, the main constraint with which it is concerned is "drought"; and its main defect is that the diverse natures of drought, whether in the Host Country environment or in the field or glasshouse experiments in the US, are not adequately specified, either quantitatively or qualitatively. It seems to be implicitly assumed that drought at Aguascalientes or Durango, at Prosser, WA, or in Montcalm County, MI, or in pots in a glasshouse are all essentially the same and that the same attributes (or genes) will serve to adapt a bean (or cowpea) variety to all of them.

The start of any study of drought should surely be a description of the drought to which adaptation is sought or which was experienced in a particular season at a particular place, in terms of the seasonal course of the water balance in the soil-plant-atmosphere system. No such descriptions are offered in the report under review, with the partial exception of Watt's pot experiment. Of course, there are general biophysical attributes and maybe some morphological ones, which may be helpful in any arid environment; but if the nature of the experimental environment is so basically different from the target environment as that of Michigan is from that of Durango, work in it is not likely to identify or analyze the important attributes required in the target environment.

2. Research results disseminated and in use in Host Country and US

No improved cultivars, inoculants, tests, methods or systems have yet gone out from this work, although some may be on the way.

3. Other research-related results

a. Germplasm conservation and use.

A great deal of material is held in Mexico by INIA and in the US by Dr. M. W. Adams and his colleagues. All the material in the US is probably duplicated in safe storage by USDA, but only a small portion has been evaluated or documented. The report offers no information about the fate or future of the thousands of lines reported from Mexico.

- b. Seed production (or other materials) and distribution of CRSP-produced cultivars (or materials)
- c. Impact of other CRP-produced or recommended technology.

The report contains no evidence that any seed or inoculum or any new technical methods for use by farmers have so far gone out from this project, either in the US or in Mexico. This may reflect a lacuna in the report rather than the facts of the case.

d. Contributions to and participation in international bean/cowpea research networks, e.g. IARCs and other

Both the MSU and the University of Minnesota workers cooperate effectively with CIAT and, through CIAT and no doubt also the US Bean Cooperative, with workers in other nations.

- e. How the research findings address the needs of small farmers and women

It can be maintained that all of the work is relevant to the needs of women in their capacities as producers of food and providers of family meals. Insofar as many of the producers of beans in the drier areas of Mexico and elsewhere are "small farmers," they could benefit at the end of the day from a reliable supply of reliably drought-adapted bean seeds of types in demand in the home or in the market place.

B. Changes in National Production of Beans and Cowpeas in Host Country

1. Hectares planted.
2. Yields per hectare.
3. Total production.

The report does not cover these points sufficiently. The FAO production yearbook 1985 and the trade yearbook 1984 record (from Mexican official data) the following:

	<u>1979-81</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Area harvested, m ha	1.584	1.996	2.158	2.032
Yield, kg/ha	641	642	589	534
Output, m tons	1.015	1.282	1.270	1.085

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Imports (pulses), tons	148,430	1,675	119,119	
Exports (pulses), tons	64,664	113,714	175,510	
Net imports (+) or exports (-), tons	+83,766	-112,039	-56,391	

Without further information, it is not possible to interpret the data.

C. Institutional Development

1. Changes in 1986

The report says that there were none.

2. Over life of project

The report refers to one doctoral student in the US, one graduate who is back in Mexico, and two dropouts from Minnesota and to some research equipment provided for the Mexican workers.

3. In prospect

Two Mexicans are expected to graduate and return to Mexico in 1987-88.

4. Project training targets during three-year extension period (1986-88)

No firm arrangements for further training yet.

II. FUNDING/FISCAL MANAGEMENT

A. Custody and Maintenance of Vehicles, Equipment and Other Non-Expendable CRSP-Purchased Property

Not reported.

B. Audit/Project Management Reviews

1. Date, by whom, and findings and follow-up--None

2. If no audit, has one been requested--None planned

C. Adequacy of Funding by CRSP Participants

1. USAID--Reported as not being adequate

2. Host Country--Reported as not adequate

3. US university--Satisfactory

D. Problems Regarding Funding, Budgeting, Release of Funds, Procurement and Other--in US and HC

Some problems in Government of Mexico funding of MSU students.

E. Adequacy of Current Policies and Procedures

Reported as satisfactory

III. PLANS FOR 1987

A. Research in Host Country and US

The proposals represent a continuation of what has been done in 1986. There are no proposals for comparative water regime or other agro-climatological studies, which seem to be essential to characterize the long- and short-term attributes of the environment. The long-term features determine the goals of the programme, and the attributes of each year are essential to explain the results obtained in it.

B. Expected Changes/Additions/Deletions

None reported.

#### IV. STATUS

##### A. Appropriateness of Activities to Goals of Global Plan

The objectives are appropriate, but EEP notes that a far more specific program of physiological and morphological research on adaptation to drought may emerge from the analysis of the mass of data from the experiment to be conducted for a third time at Durango in 1987.

##### B. Balance between Research and Training

Satisfactory

##### C. Balance of Domestic vs Overseas Activities with Respect to Program Constraints

Satisfactory

##### D. Level of Collaboration/Cooperation between US and Host Country Institutions and Personnel

Appears to be fully satisfactory

##### E. Relative Contributions of Collaborating Institutions and Individuals towards Accomplishment of Objectives

Satisfactory

##### F. Interest, Involvement and Support of USAID Mission and/or US Embassy

Not applicable

##### G. Domestic and International Linkages and Cooperation/Collaboration

Cooperation with CIAT and with the University of Wisconsin, University of Minnesota and Washington State University/USDA seem to be very satisfactory.

##### H. Cost Effectiveness

Not able to review

##### I. Institutionalization of Host Country Component

Seems to be fully embedded in INIA and collaborating well with the University of Chapingo.

#### V. PUBLICATIONS

No publications in 1986

VI. OVERALL EVALUATION: 2--Satisfactory

Satisfactory for continuation with the recommendation that close attention be given to the specific agro-ecological circumstances in which droughts arise in different experimental situations.

3314C:skb:010887

## 1986 EEP REVIEW

### NIGERIA/UNIVERSITY OF GEORGIA BEAN/COWEPA CRSP PROJECT

#### "Appropriate Technology for Cowpea Preservation and Processing and a Study of its Socio-Economic Impact on Rural Populations in Nigeria"

This project seeks to increase availability of cowpeas to consumers in Nigeria through improved technologies to reduce postharvest storage losses and to simplify preparation of cowpeas for human consumption by making meal/flour suitable for use in making traditional West African foods.

#### I. PROGRESS

##### A. Research in Progress

##### 1. In Nigeria

- a. In summer 1986 University of Nigeria personnel conducted a socio-economic survey of 300 households in 11 of the 14 communities in Isi-Uzo local government area of Anambra State (located on the northern border of the capital, Enugu). The smallest community, Ogbodu-Aba (population 4,037) was selected as the site for installation and operation of a Village mill to process cowpeas. The Ogbodu-Aba Community Development Association and the community's traditional ruler, Igwe Okwor, provided substantial material assistance in construction of the mill. Equipment is being installed and a team will be trained to operate the mill. It is expected that the mill will be operational by early December, just about the time cowpeas will be harvested locally.

The community of Ogbodu-Aba was one of the areas in which a nutrition survey had been conducted several years earlier. The same survey will be repeated, with some additional information to be gathered. A subsample of the 250-300 selected households will be drawn for measurement of 4-day and 7-day weighed food intakes. (Not clear when this information will be collected--both before and after mill is operating?) The contribution of cowpea to nutrient intake will be monitored.

Previous studies of infant feeding practices in Anambra State have shown that cereals, legumes, roots and tubers predominate. Cowpeas were introduced into infants' diets between 7 and 12 months by almost 2/3rds of the mothers. One-third introduced cowpeas between birth and six months and a few only after one year. In an urban area (Onitsha), 2/3rds of the mothers interviewed did not know that cowpea flour was available in Nigerian markets. Almost 90% said they would be willing to buy a weaning food based on cowpeas if it was within their financial resources.

The amount of cowpeas fed to infants was not as large as recommended by health workers because the time required for cooking was too long. Blends of cowpeas and corn, cowpeas and rice, cowpeas and sorghum, and cowpeas and yams were evaluated for biological value and net protein utilization with growing rats. Except for the blend of cowpeas and yam, the blends of cowpeas were similar in nutritional value. Organoleptic evaluation of the blends by 110 mothers from different economic strata indicated that acceptability of cowpeas with corn, cowpeas with rice and cowpeas with yams were not statistically different.

Five all-vegetable protein diets based on sorghum, maize, brown cowpea, white bean, bambara groundnut, and rice were assayed with rats for nutritive value. A 20:80 mixture of bambara groundnut and rice was equal to a 30:70 mixture of corn and cowpea and was cheaper. Motherless babies in care centers were fed mixtures with corn, rice, bambara groundnut, cowpea, and powdered milk. Retained N data indicate that rice as a source of nitrogen was inferior to corn, but the other mixtures met the N needs of the infants.

Studies of flatulence factors in cowpeas were made with several populations in both rural and urban communities (200 households, 80 students in secondary schools, 100 undergraduate students at the University of Nigeria, 60 children). By structured questionnaire, general food habits and consumption patterns of cowpeas are being obtained. Oligosaccharides will be assayed in cowpea preparations and metabolic studies will be conducted to determine stool weight and frequency, microflora in the stool, transit time and N balance.

Physico-chemical properties of protein fractions of various cowpea pastes are being measured and so is susceptibility of dehulled and undehulled cowpeas to insect infestation during storage.

b. In Georgia

The effects of pre-decortication drying temperatures from 50° to 130° C on characteristics of the subsequently prepared cowpea meal, paste and akara have been measured at the University of Georgia. Percent extraction rate was high (ca. 90%) for each of the pretreated samples and did not differ statistically. Thiamin content was reduced by increasing temperature but riboflavin was not. Meal color was not adversely affected from 50 to 110° C, but water absorption capacity, protein solubility and starch yield decreased when the predrying temperatures were above 90° C. Organoleptically, akara prepared from cowpeas dried at 50°, 0° and 90° C compared favorably with the unheated control.

The particle size distribution of the heated cowpeas differed from the control unheated sample of dehulled cowpeas. As temperature rose from 50 to 90° C, particle size increased, then decreased from 90° to 130° C. Although the pretreatment drying at 130° C resulted in a meal with particle sizes similar to the control, the akara prepared from the meal had unacceptable sensory attributes. Hence, particle size is not the sole factor affecting the acceptability of the prepared cowpea product (particle size distribution had been reported earlier as essential for good akara-making quality). The akara from cowpeas pretreated by drying at 50°, 70° and 90° C was generally acceptable with respect to color, flavor, tenderness and sponginess.

Long-term storage of cowpea meal at -18°, 21° and 37° C (up to 12 months) indicated that no microbiological deterioration occurred, nor were there changes in thiamin and riboflavin content and in protein digestibility. At 37° C, the meal developed a deeper yellow color over time, had a reduced water absorption capacity after eight months, and had a reduced protein solubility after two months. The quality of cowpea meal for akara preparation was maintained through 12 months of storage at -18° and 21° C.

Solar energy to dry cowpeas produced no adverse changes in color and effectively killed adult beetles. The development of the hard-to-cook attribute in cowpeas can be accelerated during storage. Germination is associated with increased alphagalactosidase activity and presumably reduced oligosaccharides.

## 2. Dissemination of Research Results

Papers have been presented at professional meetings and published in refereed journals. The researchers at the University of Georgia have produced 6 refereed publications and 15 papers in edited proceedings or at professional meetings. The University of Nigeria has published 2 papers in Tropical Science (refereed) and 2 papers at professional meetings (1 of which is in a compilation of papers from a workshop).

In Nigeria, processors of cowpeas have adopted the pre-decortication drying treatment developed by the Bean/Cowpea CRSP project and actively seek advice from the Food Science and Technology faculty members at Nsukka.

The active cooperation of community groups in construction and operation of a new mill for processing cowpeas further demonstrates development of active cooperation between practitioners and researchers in food science and technology.

3. a. NA
- b. NA
- c. NA
- d. A visiting scientist, Dr. Bene W. Abbey, from the Department of Nutritional Biochemistry, University of Port Harcourt, Nigeria, spent nine months at the University of Georgia where she is studying the contribution of cowpea components, in addition to oligosaccharides, to flatulence.
- e. The major beneficiaries of the research will be women who are the principal individuals responsible for storage, processing and preparation of cowpeas as food for the family. Ready-to-cook meal will reduce the time and effort required to prepare traditional cowpea foods and will encourage consumption of larger quantities of cowpeas. The mill installed in a Nigerian village, if successful, should increase opportunities for women to find additional employment outside the home.

**B. Changes in National Production of Beans and Cowpeas in Host Country**

Too early to observe whether increased demand for cowpeas will result and therefore whether production of cowpeas will be increased to meet demand.

**C. Institutional Development**

Laboratories in Nigeria and Georgia are much better equipped to examine science and technology related to storage and utilization of cowpeas than before the CRSP began. The Host Country institution is increasing its capacity to offer educational and research programs in legume utilization. Three students at the University of Georgia and seven at the University of Nigeria are expected to finish M.S. (3) and Ph.D. (7) degrees by 1988. Plans are being made for workshops in Nigeria on uses and applications of new cowpea products. Training programs for small-scale, rural food processors and millers will be conducted at the village mill site.

**II. FUNDING/FISCAL MANAGEMENT**

- A. Audits annually are conducted at University of Georgia and at University of Nigeria. No findings with respect to B/C CRSP have been reported at either location.
- B. The University of Nigeria pays salaries of senior scientists in CRSP project and supports students so that CRSP funds can be used for technical support, travel and supplies. At the University of Georgia, CRSP funds are budgeted primarily for personnel and travel, so operating funds are a constraint.

Transfer of funds to the Host Country is a slow, tedious process requiring constant attention of CRSP personnel. Shipment of items to Nigeria also presents problems that have required considerable time and effort on the University of Georgia's part and on the University of Nigeria's representative in Lagos (to claim shipments on arrival). Annual inventories are maintained for vehicles and equipment purchased with CRSP funds. Repairs and modifications are handled by university support services, service contracts with the supplier, or the manufacturer. Consultation of University of Georgia personnel with the bursar at University of Nigeria may improve release of funds for research in Nsukka before official acknowledgment of the transfer of funds has occurred (Georgia will send a photocopy of check, when issued, to the bursar).

### III. PLANS FOR 1987

#### A. Research in Host Country and US

Scope of work for FY'87 was submitted to Management Office in September 1986.

B. No expected changes/additions/deletions from 1986.

C. No change/additions/deletions from 1986 plans.

### IV. STATUS

#### A. Appropriateness of Activities to Goals of Global Plan

Goals for Global Plan addressed by this project are to increase availability and consumption of cowpeas through (a) reduced losses during storage, (b) development of convenience foods, thus eliminating the time-consuming activities necessary in preparing traditional cowpea dishes, and (c) reduction of oligosaccharide content of cowpeas, thus making possible consumption by individuals particularly susceptible to indigestible sugars.

#### B. Balance between Research and Training

Students are conducting research for advanced degrees within the B/C CRSP project at both University of Georgia and University of Nigeria. When the village mill becomes operable, training will be expanded to include millers and small-scale entrepreneurs.

#### C. Balance of Domestic vs Overseas Activities with Respect to Program Constraints

Both teams of researchers (in Georgia and in Nigeria) are conducting studies using complementary strengths of the two institutions. Initially, the work being carried out in the two institutions seemed

poorly coordinated, but over time collegial relationships have developed. Research objectives and work plans are developed collaboratively and activities assigned to each institution on the basis of appropriateness. Program may appear to be larger in Nigeria, but related research has been reported in addition to project research. Georgia has conducted research on underlying factors affecting nutritional, functional and microbiological characteristics of fresh and stored cowpea products. Nigeria is dealing with implementation and assessment of technology in a village site as well as development and evaluation of technology in its research laboratories.

D. Level of Collaboration/Cooperation between US and Host Country Institutions and Personnel

Both institutions are making contributions through published papers and presentations at workshops and professional meetings. Of especial interest was the initiation of information exchange among the CRSPs that have food science, food technology and nutritional components.

E. Relative Contributions of Collaborating Institutions and Individuals toward Accomplishment of Objectives

See above

F. Interest, Involvement and Support of USAID Mission and/or US Embassy

No involvement of USAID Mission but US and contact at Embassy in Lagos is kept informed.

G. Domestic and International Linkages and Cooperation/Collaboration

Linkages in the US include those with the INCAP/Washington State University project on hard-to-cook phenomenon in beans and with food science components of other CRSPs.

H. Cost Effectiveness, Especially Regarding Level of Activity vs Funding

Satisfactory

I. Institutionalization of Host Country Component

The B/C CRSP project at the University of Nigeria has involved nearly all staff members in food science and nutrition departments. Laboratory facilities are primarily used for CRSP or CRSP-related research. The University of Nigeria has provided additional funds for research and pay salaries of research staff.

V. PUBLICATIONS

See I.A.2.

VI. OVERALL RATING: 1--Highly Satisfactory

3308C:skb:010887

## 1986 EEP REVIEW

### SENEGAL/UNIVERSITY OF CALIFORNIA-RIVERSIDE BEAN/COWPEA CRSP PROJECT

"A Program to Develop Improved Cowpea Cultivars, Management Methods, and Storage Practices for Semiarid Zones"

#### I. PROGRESS

##### A. Specific Research Contributions

###### 1. Research in process in Host Country and US

Of all the projects in this CRSP, this is the only one which works in the West African Sahel; and it is fortunate that it is also one of the most effective.

Production methods. In each of the three zones of the arid northern regions of Senegal five minikit trials, testing three varieties, were conducted by farmers. Adjacent fields were intended to provide comparative information, but it seems that the farmers managed the trials better than they or their neighbors managed their fields, which were highly variable in respect to varieties and the effects of caterpillars and aphids.

Eleven trials succeeded, and an IITA variety (TVx 3236) was the most productive in all three zones. The season was dry (described at one point as the start of another cycle of drought) and the IITA variety seems to have fitted the timetable better than the longer cycle variety 58-57 which was developed in Senegal in earlier years. An even shorter season type yielded less well. More work will be needed, in part because TVx 3235, which has been vigorously promoted, was less acceptable to producers and less saleable in the market than the other varieties.

California Blackeye 5 (CB5) was not included in these trials, although their recent experiences have led producers to value it. However it is sensitive to cowpea aphid and to pod rots, so that it may have to be reselected, if it contains sufficient variation, or replaced by a more resistant variety of similar phenology--which may indeed exist already in West Africa.

The project staff and cooperators believe that producers in this arid, variable and unpredictable environment need at least two cowpea varieties, of different phenology, to buffer them against the environmental risks. Consequently, the breeding part of the program seeks to produce an appropriate range, equipped also with resistances to pests and diseases, and the agronomic part is studying how best the materials might be combined with each other and with other crops in cropping systems (not necessarily as mixed cultures).

Materials found in California to be adapted to heat and drought, in trials designed to simulate the seasonal cycle of water balance of the Sahelian region, are being tested in Senegal. This has already made the work in the US at least as relevant as that of any other project in this CRSP to the specific environmental conditions of the Host Country.

The ureide method of assessing the fixation of nitrogen by nodules, applied a number of years ago at IITA, has been used successfully in petiole tissues at UCR and has been transferred to Senegal. In growth physiology, a study of the partitioning of carbohydrate in different varieties has begun, which could evidently benefit from closer association with Dr. Summerfield and his colleagues at the Plant Environment Laboratory at Reading.

Studies of the population dynamics of insect pests of the crop, and of their predators and parasites, have led to successful trials of methods of chemical control. In work on storage, methods of using preparations and extracts of neem (Azadirachta indica) (long known as an insecticide and repellent in India) have advanced, and work continues on hermetic storage.

2. Research results disseminated and in use in Host Country and US

The project scored a notable public success in 1985, after a severe drought year in 1984 and against the background of the continuing difficulties of the region, when the Government of Senegal, with help from the European Economic Community and USAID, imported some hundreds of tons of seed of CB5. CB5 had been grown by the project, but it had not yet been recommended for Senegal. It was chosen because it was the most likely candidate variety of which significant amounts of reliable seed could be obtained quickly. The crops produced from this seed are said to have saved one million people from famine because they were photoneutral and short season and were able to yield in the difficult conditions of the 1985 season. The experience was repeated in 1986.

The gamble paid off, but it had risks which are still with us. Farmers value CB5, although (like TVx 3236) it is not without defects. Perhaps the most important benefits have been the increased importance which Government now assigns to cowpeas, the confidence the operation has given the Senegalese cowpea workers, the realization that phenology is all-important in adaptation to dry conditions, and the demonstration of the value of international cooperation conducted as between equals.

Materials from the program are being tested (by Sudanese graduates of UCR) in the Western Sudan. In the US, heat tolerance is being incorporated in varieties of vegetable cowpeas, originally introduced from India, in the hope of

producing heat-adapted types for producers in th US as well as in developing countries.

3. Other research-related results

a. Germplasm conservation and use

1) Accessions collected/acquired/in storage and kinds and amounts distributed domestically

The project holds a small collection (447) of cowpea entries and thousands of breeding lines. It is important that arrangements be made for the conservation and documentation of these; and this should be discussed with IITA, which may be able to provide storage for duplicates of the Senegal collection.

2) International exchange

Advanced breeding materials have been distributed to cooperators in many countries.

b. Production and distribution of seed (or other materials) produced by the CRSP

The project has cooperated with the Senegalese extension agency SODEVA in developing methods for multiplying, insecting and certifying healthy seed.

c. Impact of other technical methods produced or recommended by the CRSP, including production inputs such as fertilizers, inoculants, insecticides, equipment and machines

The report refers to the use by Senegalese farmers of modified peanut planters to sow cowpeas, of horse-drawn cultivators, and of storage in sealed drums. Of these only the last is likely to be primarily due to the project: we should beware of claiming too much.

d. Contributions to and participation in international bean/cowpea research networks, e.g. IARCs and other

In the work of the project on the screening of cowpeas for adaptation to heat and sensitivity to photoperiod, and in subsequent breeding, the project has cooperated closely with IITA. As has already been suggested, it could benefit from fuller association with the Reading crop physiology group.

- e. How the research findings address the needs of small farmers and women

Small farmers who harvested little or no millet or peanuts in 1985 and 1986 have been sustained by cowpeas, both as food for their own use and as a marketed crop which enables them to buy other foods. The work of the project is claimed to have expanded the market for cowpeas in northern Senegal and to have made it more stable and competitive. Improved storage can help farmers to take advantage of the new opportunities. All this lessens hardship and poverty and benefits all members of the family.

B. Changes in National Production of Beans and Cowpeas in Host Country

1. Hectares planted.
2. Yields per hectare.
3. Total production.

The following data, for total pulses, are from the FAO production yearbook for 1985 and the trade yearbook for 1984.

	<u>1979-81</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Area harvested, ha	52,000	40,000	53,000	121,000
Yield, kg/ha	401	329	303	546
Output, tons	21,000	13,000	16,000	66,000
	<u>1982</u>	<u>1983</u>	<u>1984</u>	
Imports, tons	212	307	270	
	355	132		

The output gain in 1985 seems likely to have been due in part to the influence of the CRSP, in cooperation of course with the EEC and USAID, and above all with the national staff, the farmers, and the Government of Senegal. Without the CRSP, and Dr Hall's earlier endeavours in Senegal (since the mid-seventies), it is most unlikely to have occurred.

C. Institutional Development

1. Site changes in 1986.
2. Over life of project (where are we?).
3. In prospect (where are we going and how long to get there?).

The Government of Senegal began actively to promote cowpeas in 1985 and this continued in 1986. Since 1976, research on cowpeas has advanced substantially and an effective team is now in place. The team is close-knit and productive, and it seems to know how to operate on the national stage. It is closely associated with UCR.

4. Project training targets during three-year extension period (1986-88)

None reported.

II. FUNDING/FISCAL MANAGEMENT

A. Custody and Maintenance of Vehicles, Equipment and Other Non-Expendable Property Purchased with CRSP Funds

1. Inventory (or records)

Satisfactory

2. Accountable individuals and institutions.

Satisfactory

B. Audit/Project Management Reviews

1. Date, by whom, and findings and follow up.

No audit performed

2. If no audit, has one been requested?

None requested

C. Adequacy of Funding (to accomplish objectives) by CRSP Participants

1. USAID.
2. Host Country--comments/actions.
3. US university--comments/actions.

The Government of Senegal seems to be playing its part well, and no defects in the support of UCR are reported. A donor is sought to fund closer collaboration between IITA and the project in Senegal. The most useful suggestion is that the Government of Senegal should consult those of its multilateral and bilateral donors who are also donors to IITA and suggest to them that parts of their aid allocations to Senegal be used to fund the cooperation. If the Government of Senegal is able to assign an appropriate priority to this activity, as against all the other needs it has for aid, the donors are not likely to refuse. Conversely, there is doubt whether any donor would be supportive if the Government of Senegal itself did not assign sufficient priority to this matter.

D. Problems Regarding Funding, Budgeting, Release of Funds, Procurement and Other--in US and Host Country

Funding reductions absorbed with difficulty

E. Adequacy of Current Policies and Procedures

Funding levels unreliable

III. PLANS FOR 1987

A. Research in Host Country and US

The report proposes to continue along the established lines in Senegal--minikit trials on farms in cooperation with the national research agency; breeding for appropriate durations, resistance to pests and diseases, and effective fixation of nitrogen; trials of improved materials at many locations; methods for field control of insect pests; study of hydrologic balances of sites of minikit trials, and of weather in relation to the population dynamics of Pests; storage methods; and support for national seed production. The seasonal weather of the sites of the multilocational trials should be studied.

In California, the analysis of the effects of heat and drought on reproductive stages in contrasted forms of cowpea will be associated with breeding and screening for adaptation to these factors; studies of the efficiency with which different varieties use stored soil water by both gas exchange and discrimination between carbon-12 and -13; respiration in stored seeds and effects on it of neem materials; partitioning of carbohydrate in different genotypes at different spacings; vegetable cowpeas.

B. Expected Changes/Additions/Deletions

The 1987 program will therefore be much like 1986, but just as it is important to know about the hydrologic balances of the sites of multilocation and minikit trials, it must be important to describe the conditions at UCR and other experimental sites also.

IV. STATUS

A. Appropriateness of Activities to Goals of Global Plan

The program seems to be appropriate to these goals.

B. Balance between Research and Training

Satisfactory

C. Balance of Domestic vs Overseas Activities with Respect to Program Constraints

The two parts are effectively dovetailed together.

D. Level of Collaboration/Cooperation between US and Host Country Institutions and Personnel

Excellent

E. Relative Contributions of Collaborating Institutions and Individuals towards Accomplishment of Objectives

There is more than a division of labour between more basic work in California and application in Senegal: the program is enabling and encouraging the Senegalese participants to make more analytical studies in their own environment.

F. Interest, Involvement and Support of USAID Mission and/or US Embassy

Satisfactory

G. Domestic and International Linkages and Cooperation/Collaboration

Linkages with IITA, with cowpea workers in the US, and with cowpea producers in California are satisfactory.

H. Cost Effectiveness, Especially Regarding Level of Activity vs Funding

In this project it is not unfair to compare the value of the extra output of say 45,000 tons of cowpeas (at about \$1000 per ton, the approximate import price indicated in the FAO Trade Yearbook, or even at the export price of about \$300 per ton) with the cost of the project. If on top we consider the effects of this extra output on human survival, it seems reasonable to suggest that the cost effectiveness, though still not precisely measurable, is very substantial.

I. Institutionalization of Host Country Component

The cooperation with ISRA has the effect of building the work into the structure of government, so that institutionalization is satisfactory and adequate for present purposes.

V. PUBLICATIONS

A. US researchers

Nine publications listed, two of them in refereed journals

B. HC researchers

12 publications listed, none in refereed journals

VI. OVERALL EVALUATION: 1--Highly Satisfactory.

3316C:skb:010887

## 1986 EEP REVIEW

### TANZANIA/WASHINGTON STATE UNIVERSITY BEAN/COWPEA CRSP PROJECT

#### "Breeding Beans for Disease and Insect Resistance and Determination of the Economic Impact on Smallholder Farm Families"

#### I. PROGRESS

##### A. Specific Research Contributions

##### 1. Research in process in Host Country and in US

##### a. Tanzania

Crop science. The search for inherited resistance to bean fly, Oothea, bruchids and flower thrips continued, and some crosses between insect-resistant and disease-resistant material were in F3. Neem extract can lessen feeding by Oothea in the field.

Materials with inherited resistance to bean rust, angular leaf spot, bean common mosaic virus, anthracnose and common blight have been crossed with large-yielding, locally adapted lines. In the improvement of screening methods (in which two contrasted environments are used, high, wet and cool, and low, hot and dry), the Wisconsin dry-inoculum technique has proved useful for rust and angular leaf spot, and methods developed at MSU have been useful in producing spores of the causal organism of angular leaf spot for screening.

In surveys at Mbeya in southern Tanzania, bean plants were found that were both abundantly and effectively nodulated with indigenous rhizobia. They also seemed to be healthier than other bean plants. Studies have begun of Rhizobium strains. Trials of promising lines without inputs, and on farms, suggest that some lines are better adapted than others to less-favoured conditions.

Promising lines are screened for adaptation to dry conditions at Morogoro and at Davis, California. The methods are not described, so it is not possible to assess how relevant the two screens will be to each other.

Studies of time of cooking seem to me to be retracing old ground; but no doubt they have been discussed with investigators in other projects in this CRSP. Perhaps not surprisingly, magadi (a naturally-occurring mixture of carbonates which "crystallizes" out, as seasonal alkali pools dry in the arid central regions of Kenya and Tanzania Masailand, and which was, and probably still is, extracted commercially in Kenya) ~~which, formerly at least,~~ lessened cooking time. Variation in time of cooking has been found among otherwise promising lines.

Human science. The work on consumption economics and social-cultural factors, formerly confined to Morogoro and Arusha, was extended to Tanga region, in the north-east of Tanzania, where the structure of the local economy is different and more diverse than in the regions studied earlier. Off-farm income is greater per family than in the other regions and was almost equal to income from crop sales.

The relationships between rural families and beans were explored, in directions similar to those developed earlier in Morogoro and Arusha. More bean lines are used in Tanga region, in different and more complex farming systems. The Training and Visit system of extension (since abandoned because of its cost) was studied in Tanga by a Tanzanian MS Student, who brought to light important differences between male- and female-headed households.

Farmers liked two bean varieties offered (one for higher and the other for lower altitudes) for testing on their farms. The reasons why the low-altitude type, TMO 101, was preferred to customary varieties were explored. Though it was as susceptible to pests and diseases, it was upright and compact, matured evenly, and yielded more in a dry year, but it appeared to be more variable in yield.

b. United States

The work at Prosser developed the established program of breeding and screening for resistances to strains of bean common mosaic virus and halo blight. It included the further development of immunological methods for diagnosis, and crosses between drought-resistant and multiple disease-resistant lines. The report does not specify to what type of dry conditions the drought-resistant parents are adapted or how the adaptation was measured. "Drought" means different things for plants in different environments.

Though the report on these topics is very brief, it seems that the work in the United States is so conducted that it not only supports the work in Tanzania, but also contributes directly and valuably to bean research in the United States.

2. Research results disseminated and in use in Host Country and US

- a. Improved cultivars, inoculants, tests, methods' systems, technical papers, reports, bulletins produced and released for public use

b. Evidence of extent of use

Though promising materials are available and have been tested on farms, no new lines have been made generally available to producers in Tanzania. It may be that in Tanzania, which has the remains at least of a seed industry, it will in fact be possible to "release" new materials effectively. No other product of the program is being promoted on a practical scale either.

The proceedings of successive bean workshops at Morogoro have been widely distributed, and a Tanzanian technical report on farming systems data and trials was made available.

3. Other research-related results

a. Germplasm conservation and use.

- 1) Accessions collected/acquired/in storage and kinds and amounts distributed domestically
- 2) International exchange

The program has assembled more than 1000 entries of bean materials, which are freely exchanged among the three bean programs in Tanzania, and are made available to workers in other countries. Nothing is reported about the documentation or conservation of this material; but it may be that duplicates are held at CIAT.

b. Production and distribution of seed (or other materials) produced by the CRSP

Seed has been produced for research purposes only. No seed has been distributed yet. One can question whether it could have been possible, in the time, not only to identify and screen promising materials, but also to test them in enough locations and seasons, to have the confidence to produce foundation seed and arrange for large-scale multiplication and distribution. There comes a point, even if all else is favorable, when the eager researcher has to face the possible consequences of an unforeseen failure.

c. Impact of other technical methods produced or recommended by the CRSP, including production inputs such as fertilizers, inoculants, insecticides, equipment and machines

Only within the program itself.

d. Contributions to and participation in international bean/cowpea research networks, e.g. IARCs and other

At first on its own, and now in cooperation with CIAT and ICIPE, the program has promoted substantial international cooperation in bean research in East Africa and in the SADC countries. There is much further to go along this road, and CIAT and SADC will have to take the lead, but it may be that USAID and other donors will see the advances made by this CRSP program as yet one more piece of evidence of the value of a specific cooperative link between an overseas institution and a national program.

- e. How the research findings address the needs of small farmers and women

The whole of this program is about beans in the lives of small-scale producers. Many of them are women; and the program has documented the specific difficulties of female-headed households. The work on cooking-time of beans may lessen the needs for time, fuel and water, and so lighten women's work loads. (It may be worth recording that in parts at least of Tanzania men collect fuel also; they are not everywhere the idle hedonistic slobs of mythology.)

#### B. Changes in National Production of Beans and Cowpeas in Host Country

1. Hectares planted.
2. Yields per hectare.
3. Total production.

The official statistics show that of 315-360,000 tons of pulses (which does not include soya or peanuts) produced per year in Tanzania between 1979 and 1985, from 250-280,000 tons were beans. In 1982-84, imports of pulses were small--around 1-300 tons only, at \$600-750 per ton. Exports in 1982 were 50,000 tons at about \$200 per ton. In 1983 and 1984 7000 and 6000 tons were exported at about \$550 per ton. There is no reason to ascribe any of these fluctuations to the CRSP.

#### C. Institutional Development

1. Cite changes in 1986.

Nineteen names appear on the list of participants in Tanzania. One is a member of the USAID Mission in Dar es Salaam, and one is an administrator, who must surely be welcome as a team member. Two are from the University of Dar es Salaam. None is listed from Uyole, though workers there certainly cooperate, as do the workers of the Agricultural Research Corporation.

2. Over life of project

The CRSP is well established. The most significant products are a better understanding of how rural life systems work in.

different regions and environments in Tanzania; advances in plant breeding for multiple attributes; and a strong and cohesive collective of bean research workers in Tanzania. It is clear that the CRSP is serving a great deal more than subsistence, it does not yet know enough about the place of beans in the economy of the nation, or of the natures and sizes of the effective demands for beans and bean products in local, regional, national and foreign markets.

The project has suffered from continual changes in HC personnel and may well continue to do so. The senior entomological cooperator, Dr Karel, is expected to leave in 1987; it is most important that his work should be continued.

3. In prospect

Difficult to answer, partly for lack of knowledge about effective demand for beans and bean products. Tanzania may well soon have excellent plant material and production practices, tested at Morogoro and on some farms, but no way of moving these products out to users on a large scale, or even knowledge of the tactically most suitable areas into which to move them.

4. Project training targets during three-year extension period (1986-88)

The report proposes to continue the training of four students for higher degrees, in spite of the cost.

II. FUNDING/FISCAL MANAGEMENT

A. Custody and Maintenance of Vehicles, Equipment and Other Non-Expendable Property Purchased with CRSP Funds

1. Inventory (or records)--Satisfactory
2. Accountable individuals and institutions--Satisfactory

B. Audit/Project Management Reviews

1. Date, by whom, and findings and follow up
2. If no audit, has one been requested?

Audited in 1985 by the Tanzania Audit Corporation, but not by CRSP.

C. Adequacy of Funding by CRSP Participants

1. USAID
2. Host Country
3. US university

This project has used its funds well and has got on doing what it could both economically and uncomplainingly. The local institutions are very short of funds, but it seems certain that they have contributed resources at some real cost as well as the time of staff and the use of existing facilities.

D. Problems Regarding Funding, Budgeting, Release of Funds, Procurement and Other--in US and Host Country

Delays in custom clearing of imports

E. Adequacy of Current Policies and Procedures

Not satisfactory, especially at Sokoine University of Agriculture

III. PLANS FOR 1987

A. Research in Host Country and US

Much as before. In Tanzania, in addition to the existing tests at zero inputs, some studies will be made with more complete inputs to find out what might be possible in commercial farming--which must be expected to become more important as technical methods become available, and will have a legitimate call on research services. Studies of digestibility of bean proteins will be undertaken. Like the work on cooking time, this will no doubt benefit from consultation with other relevant programs in this CRSP.

In the US, the relationship between level of resistance to halo blight and seed transmission will be more closely studied--a potentially very interesting topic. Failure to transmit a virus in seed can be seen as a form of resistance which in many groups is in fact the norm.

B. Expected Changes/Additions/Deletions from 1986

Entomological work is expected to continue somehow until Martha Quentin returns to Tanzania. Sokoine University may not be able to continue the same volume of support as in the past, for lack of funds. Inoculation with Rhizobium is to be tested on farms--but on what hosts and with what sources of inocula is not clear. Dr Due is to undertake some studies of the requirements and constraints in the production, distribution and marketing of improved seeds. More quantitative information about the nature of drought in different regions and at different sites in Tanzania and Washington State, and

of year to year variations would make it easier to interpret the results of experiments. Terry Woodhead's old publication on evaporation rates in Tanzania would help (Woodhead, T. 1968. Studies of potential evaporation in Tanzania. Nairobi: East African Agriculture and Forestry Research Organization). It is probably in libraries in Dar es Salaam, Arusha or SUA.

#### IV. STATUS

- A. Appropriateness of Activities to Goals of Global Plan
- B. Balance between Research and Training
- C. Balance of Domestic vs Overseas Activities with Respect to Program Constraints

All seem satisfactory as reported, except that graduate training is consuming about three-quarters of the remaining budget for Tanzania--a burden the Sokoine University is willing to bear. The studies at Prosser of resistance and breeding in relation to disease are so conducted that they could benefit the US producer as well as lead to materials useful in Tanzania and in CIAT's programs. Work on the main constraints is well distributed between the US and HC groups.

- D. Level of Collaboration/Cooperation between US and Host Country Institutions and Personnel
- E. Relative Contributions of Collaborating Institutions and Individuals towards Accomplishment of Objectives

These matters are considered in careful detail in the report. The EEP commends the way in which this program has used and extended its direct and cooperative resources for the tasks in hand.

- F. Interest, Involvement and Support of USAID Mission and/or US Embassy  
Appears to be satisfactory

- G. Domestic and International Linkages and Cooperation/Collaboration

Comments earlier in this review have referred to the cooperation among research organizations in Tanzania, with bean researchers in other African nations, with CIAT, and with the developing cooperative research activities of SADCC. The research director of SADCC, Dr Martin Kyomo, is a former Dean at Morogoro, and Dr David Allen, now at Arusha for CIAT/SSDCC, is an old friend of the CRSP.

- H. Cost Effectiveness, Especially Regarding Level of Activity vs Funding

This program gets value for money but it would be difficult to put even a shadow value on the uncompleted and unmarketed products or on the institutional development and international cooperation.

### **Institutionalization of Host Country Component**

In addition to Sokoine University, Uyoie and the Agricultural Research Corporation feel themselves to be involved, even though none of their staff members are listed in the team. But the next stages will need more than this. In Tanzania, there is a Ministry of Agriculture, without which no development (as distinct from research) is possible beyond the gate of the research station, and there may still be a Ministry of Rural Development. There is certainly a Planning Ministry and a Natural Resources Institute. The Extension Service was, and may still be, attached to the provincial and district administrations and so attached to the Office of the Prime Minister.

All this makes Sokoine University of Agriculture a very different place from a state agricultural university in the United States, which, through its unified management of research, education and extension and its links with USDA is able to play a leading part, alongside the farmers themselves, in generating agricultural progress. No doubt the studies Dr. Due is to undertake in relation to seeds will bring her into touch with the complexities that need to be taken into consideration.

### **V. PUBLICATIONS**

#### **A. US Researchers**

Four publications listed, three in refereed journals.

#### **B. HC Researchers**

Thirteen publications listed, five (all bearing Dr Karel's name) in refereed journals.

### **VI. OVERALL RATING: 1--Highly Satisfactory**

3319C:skb:010887

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November 17, 1986

Mr. James Mrowka  
 Arthur Young and Company  
 100 Renaissance Center  
 Detroit, Michigan 48243

Subject: Audit of Michigan State University  
 Bean/Cowpea Overseas Projects

Dear Mr. Mrowka:

I am enclosing the information received from the U. S. Institutions in connection with the audit through May 6, 1986 for the following six locations:

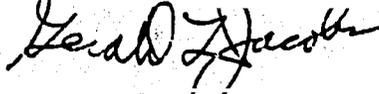
<u>Location</u>	<u>U. S. Subgrantor</u>
1. Centro Sur de Desarrollo Agropecuario San Christobal Dominican Republic	Univ. of Puerto Rico
2. Centro Sur de Desarrollo Agropecuario San Christobal Dominican Republic	Univ. of Nebraska
3. Instituto de Nutricion de Centroamerica y Panama Guatemala City, Guatemala	Washington St. Univ.
4. Univ. of Nairobi Kabete, Kenya	Univ. of Calif. (Davis)
5. Sokoine Univ. of Agr. Morogora, Tanzania	Washington St. Univ.
6. Centre National de Recherches Agronomiques Bambey, Senegal	Univ. of Calif. (Riverside)

Page 2

Mr. James Mrowka  
Arthur Young and Company  
100 Renaissance Center  
Detroit, Michigan 48243

Please refer to our previous correspondence. If you need any additional information, please call the undersigned at (517) 355-4476.

Sincerely,



Gerald L. Jacobs  
Contract and Grant Administration

GLJ/sh

Enclosure

cc: Carolyn Snow

127