THE BEAN/COWPEA COLLABORATIVE RESEARCH SUPPORT PROGRAM (CRSP)

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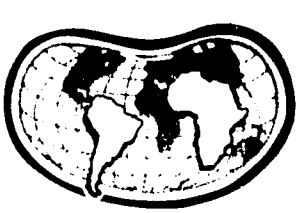

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REPORT OF

THE EXTERNAL EVALUATION PANEL OF

THE BEAN/COWPEA CRSP FOR FY 91

January 1992

Funded through A.I.D. Grant No. DAN-1310-G-SS-6008-00

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TABLE OF ACRONYMS

A.I.D.	Agency for International Development
AGR	Agriculture
ALS	Angular Leaf Spot
APHIS	Animal and Plant Health Inspection Service
BCMV	Bean Common Mosaic Virus
BGMV	Bean Golden Mosaic Virus
BNF	Biological Nitrogen Fixation
BOD	Board of Directors
BRP	Bean Research Program
BTI	Boyce Thompson Institute
CATIE	Centro Agronomico Tropical de Investigacion y Ensenanza (Tropical Agricultural Center for Investigation and Teaching)
CB	Common Blight
CIAT	Centro Internacional de Agricultura Tropical (International Center of Tropical Agriculture)
CITA	Center for Food Technology Investigation, University of Costa Rica
CRSP	Collaborative Research Support Program
DFF	Days to First Flower
DNA	Deoxyribonucleic Acid
DR	Dominican Republic
EAP	Escuela Agricola Panamericana (Pan-American Agricultural School)
EEP	External Evaluation Panel
FY	Fiscal Year
GOS	Government of Senegal
HC	Host Country
IARC	International Agricultural Research Center
IBPGR	International Board of Plant Genetic Resources
ICTA	Instituto de Ciencias y Tecnologia Agricola (Institute of Agricultural Science and Technology)
IITA	International Institute of Tropical Agriculture
INCAP	Instituto de Nutricion de Centroamerica y Panama (Institute of Nutrition of Central America and Panama)
INERA	Institut d'Etudes et de Recherches Agricoles
INRAN	Institut National de Recherches Agronomique du Niger
INIAP	Instituto Nacional de Investigaciones Agropecuarias (National Institute of Agricultural Investigations)
INIFAP	Instituto Nacional de Investigaciones Forestales y Agropecuarias (National Institute of Forestry and Agricultural Investigations)
INTSORMIL	Sorghum/Millet CRSP
IRA	Institut de la Recherche Agronomique (Institute of Agronomic Research)
ISRA	Institut Senegalais de Recherches Agricoles (Senegalese Institute Agricultural Research)
LASPAU	Latin American Scholarship Program for American Universities
MDR	Multiple Disease Resistance
ME	Management Entity
MNR	Ministry of Natural Resources
MO	Management Office
MSU	Michigan State University
NCRE	National Cereals Research and Extension Project
NifTAL	Nitrogen Fixation by Tropical Agricultural Legumes
NSF	National Science Foundation
PI	Principal Investigator
PR	Puerto Rico
PROFRIJOL	Research network of Latin American and Caribbean countries "for beans"
PROFRIZA	CIAT-coordinated regional testing program
PSTC	Program in Science and Technology Cooperation
R&D	Research and Development (formerly Science and Technology)
RIL	Recombinant Inbred Lines
RFLP	Recombinant Fragment Length Polymorphism
SADCC	Southern African Development Coordinating Committee
SAFGRAD	Semiarid Food Grain Research and Development Project
SEA	Secretaria de Estado de Agricultura (Secretary of State for Agriculture)
SODECOTON	Societe de Developpement du Coton (cotton production cooperative in Cameroon)
SUA	Sokoine University of Agriculture
TC	Technical Committee
UCD	University of California-Davis
UCR	University of California-Riverside
UGA	University of Georgia
UMN	University of Minnesota
UMR	University of Minnesota Rhizobia
UNL	University of Nebraska-Lincoln
UPR	University of Puerto Rico
U.S.	United States
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
UWI	University of Wisconsin
WB	Web Blight
WID	Women in Development
WSU	Washington State University

REPORT OF THE EXTERNAL EVALUATION PANEL OF THE BEAN/COWPEA COLLABORATIVE RESEARCH SUPPORT PROGRAM FOR FY 91

I. INTRODUCTION

The Bean/Cowpea CRSP began with funding in September 1980. The original grant came to an end in FY 86. Subsequently, there have been two three-year extensions. The present review covers FY 91 activities, the third year of the second extension.

Evaluations are based mainly on project Annual Reports, project extension documents, discussions with the CRSP MO/ME and the A.I.D. Project Officer and perspectives gained from previous site visits to Host Countries and U.S. lead institutions.

A. The FY 91 External Evaluation Panel

Originally the EEP consisted of seven members, all appointed in 1980-81. During 1986, two members (Drs. Melvin Blase and Luis Camacho) retired from the EEP, reducing the number to five. In 1987, another two of the original seven retired (Drs. Antonio M. Pinchinat and Charlotte E. Roderuck). They were replaced by Drs. Edna McBreen and Kenneth O. Rachie. Two more of the original seven (Drs. Hugh Bunting and Peter E. Hildebrand) retired in 1988. They were replaced by Drs. John S. Robins and Arthur J. Siedler in 1989. The last of the original seven, Dr. Clarence C. Gray, retired in 1990 and has not as yet been replaced. The current members and their affiliations are given in Attachment D.

B. Organization of the Bean/Cowpea CRSP

When it was organized, the Bean/Cowpea CRSP consisted of eighteen projects in thirteen countries of Africa, Central and South America, including the Caribbean area, in collaboration with ten U.S. lead institutions. At the end of FY 91, there were thirteen projects for review (beans--nine; cowpeas--four). The thirteen remaining projects are located in eleven HCs (including INCAP, a regional institution located in Guatemala) and involve twelve U.S. lead institutions.

The Bean/Cowpea CRSP projects are developed and executed by PIs at collaborating U.S. and HC institutions. Oversight and participation in approval of plans and budgets are made by a TC, the MO/ME and the BOD. MSU serves as the MO/ME. As the MO/ME, MSU has overall responsibility for the programs of the Bean/Cowpea CRSP and is accountable for the funds granted by A.I.D. MSU funds CRSP projects through sub-contracts with the lead institutions, who are responsible for their projects and accountable for funds received.

The Bean/Cowpea CRSP is funded through the Office of Agriculture, Bureau for Research and Development, Agency for International Development. The R&D/AGR Project Officer is Dr. Harvey Hortik, Chief, Agricultural Production Division and Senior Horticulturist/Plant Pathologist.

C. FY 91 EEP Review: Sequence of Events

The following are events which comprised the FY 91 EEP review process.

1. Using the *Guidelines for Collaborative Research Support Programs* and inputs from the TC and BOD, the MO/ME developed a Scope of Work (see Attachment A) which was based on the outline distributed to PIs to be used as a format and guide for preparation of Annual Reports due by November 1, 1991 (see Attachment B). The outline for EEP reviews of individual projects was considerably condensed.

2. EEP members were assigned projects for review from which discussion drafts were prepared prior to the annual EEP meeting in Dallas in January 1992.

3. Draft reviews of individual projects and special topics were discussed at the Dallas meeting. Final project and topic evaluations were made during the discussions.

4. The fiscal and administrative review was based on data/information supplied by the MO. Discussions of CRSP operations and procedures, status of activities and related matters were held with MO officials and the A.I.D. Project Officer.

5. The summary, overall evaluation of the Bean/Cowpea CRSP was made on the basis of the results of individual project reviews, discussions of the progress towards amelioration of constraints, estimates of the performances of participating U.S. institutions, evaluation of fiscal and administrative operations, information acquired through conversations and discussions with CRSP officials and perspectives gained through earlier site visits to HCs and U.S. universities.

II. PROGRAM EVALUATION: SUMMARY AND SPECIAL COMMENTS

SUMMARY:

For the FY 91 review, thirteen projects, the WID and training components, and the fiscal and administrative dimensions were evaluated with regard to progress, funding/fiscal management, planning, status and prospects. Nine of the projects were devoted to improvement of beans (seven in Central and South America and the Caribbean; and two in East Africa). The remaining four are concerned with improvement of cowpeas (one in South America and three in West Africa). Four of the projects are in final stages of closure. The Panel's evaluation of these four was limited to a statement about the orderliness of the phaseout and a subjective observation about sustainability of effort in the HC. Each of these projects is to develop a terminal report that we hope will be useful in a retrospective look at "lessons learned." Women in Development is separate from the MO and is funded as a half-time position. The MO itself was evaluated on the basis of its Annual Report and on discussions with MO personnel and the A.I.D. Project Officer.

The EEP finds that the Bean/Cowpea CRSP is being managed and operated in a highly satisfactory manner in full compliance with the *Guidelines for Collaborative Research Support Programs* and the enabling grant document.

Overall Rating of the Bean/Cowpea CRSP: 1--Highly Satisfactory

SPECIAL COMMENTS:

The FY 90 EEP review identified a number of special concerns. The Panel expresses its gratification with the response to these concerns as summarized for us by the MO. We especially applaud the addition of an economics competence to the program. While most of the concerns seem to be adequately addressed, we again suggest attention to some.

Inter-Project Collaboration in Host Countries: We note several examples of intra- and inter-project collaboration and applaud efforts of the CRSP to identify opportunities. We are still concerned at the obvious lack of attention to this matter by Host Country Missions, which in some cases preclude inter-project collaboration and consequent cost-effective sharing of resources.

Baseline Data Collection: We continue to be concerned at the apparent lack of appropriate baseline data in some projects. We encourage projects to call upon the program's social scientists and others experienced in this area to assist in these efforts.

Project Phaseout: As projects are proceeding through orderly phaseout processes, the compilation of final reports becomes an important task to insure a record of CRSP activities and successes. These final reports may be the only record of important measures of success including: a summary of the human resources, research capacity, institutional capacity, infrastructure, etc. that will be left in the Host Country after the phaseout; research efforts related to the CRSP project that will continue after the phaseout in the Host Country and at the U.S. institution; plans to maintain linkages between U.S. and Host Country institutions and researchers; publications resulting from CRSP activities that will serve as a permanent, accessible record of scientific activities and results. We urge the PIs to give this task their best efforts and to complete it in a timely manner. The MO and BOD should monitor these reports to assure their adequacy.

English Language Capability: As noted in last year's review, the EEP is concerned that the lack of English language capabilities of Host Country scientists is a deterrent to their full participation in a global scientific community. We believe that provision of ongoing English language training in the Host Country; intensive English language training for students in preparation for admission to degree programs; and/or intensive English language programs in the U.S. or elsewhere for junior, mid-level, and senior Host Country scientists should be a CRSP priority. Those programs focusing on scientists who may have already completed degree training are/will be especially important to mature CRSP projects and will help to insure the sustainability of Host Country involvement in the interactive world scientific community.

Reporting: There are several parts of the Annual Report format that should be clarified to be more reflective of CRSP problems and/or successes and to more accurately address issues of impact and sustainability. The following reporting areas are of special concern to the EEP:

A. **Specific Research Contributions (item I.A.1 of the Annual Report format)**--In order to better understand individual project priorities and to more accurately evaluate progress toward achieving goals, the EEP would like to see this section broken down into those related to primary project objectives and those which are CRSP funded but address other research issues. This item should address all research activities that are part of the annual plan of work or its revisions.

B. **Other Research-Related Results (item I.A.2 of the Annual Report format)**--If the previous suggestion is adopted, this section could be used to report non-CRSP funded research results as well as ancillary non-research activities and impacts.

C. **Balance Between Research and Training (item III.B of the Annual Report format)**--As noted in the EEP recommendations in the training section of this document, the investment balance between research and training should be reported with much greater specificity and consistency (please refer to pg. 6).

D. **Relative Contributions of Collaborators Towards Accomplishment of Objectives (item III.E of the Annual Report format)**--There is considerable inconsistency in the way this item is reported. The EEP suggests that this item include actual dollar figures broken down to signify U.S. and Host Country cash and in-kind contributions, with the latter given U.S. equivalent cash value. For comparison's sake, we also encourage the inclusion of A.I.D. funding amounts broken down into U.S. and HC categories.

E. **Publications and Presentations (item IV of the Annual Report format)**--To more accurately represent CRSP publications and presentations, we suggest that the publications portion be delineated according to the classifications "refereed" and "not refereed."

F. **Benefits to HC, U.S., and Global Agriculture**--As CRSP reporting is currently organized, there is no place to report benefits to intended beneficiaries. This should be done clearly, concisely, and in terms understandable by an "educated layman." While item I.A.3, "Changes in National Production," attempts to address a part of this issue, it does not, in fact, even accurately represent Host Country situations because of poor statistics.

III. PROGRAM EVALUATION: TRAINING AND WOMEN IN DEVELOPMENT

TRAINING:

The training focus of the CRSP is consistently acknowledged as important to Host Country institutionalization. The essential role of graduate students in university research activities is well accepted. While the rationale for including training as a part of the CRSP is most often professed as the former, the latter inextricably links training with research. The argument that " . . . the CRSP is a research project . . ." and can therefore ignore training responsibilities appears less and less often in CRSP rhetoric--but still appears when projects are questioned for not having training plans or for omitting Host Country participants from training opportunities. It is important to note that while the need to dedicate funding to training will vary over the life of a CRSP project, training needs do not disappear when three or four Host Country scientists have received degree training. Long-term plans for degree training must address such Host Country needs as: depth of expertise in beans/ cowpeas, depth of expertise in agricultural content areas, and at least basic expertise in social science content areas. Plans for short-term training must consider in-service training needs of collaborating scientists, including: research management, English language, computer applications, biotechnology advances, and other technical areas.

In almost all cases, the PIs' Annual Reports present excellent summaries of training activities, the rationale for those activities, and summary training plans. On the other hand, the MO's one-page training report is cursory at best, presenting a small dose of Host Country development rhetoric, data on degrees completed in FY 91, and mention of ongoing impact studies and short-term training.

In reviewing those elements of the PIs' Annual Reports that deal with training, the following summary evaluations may be helpful.

Brazil/BTI/Roberts--During this phaseout period for the Brazil project, the returns on what has been a well-planned investment in training should begin to become evident. Project leaders are to be congratulated on how their institutional development and training efforts have enhanced Host Country capabilities. The phaseout of the project leaves the HC with the capability to continue this research and to maintain linkages with U.S. counterparts.

Cameroon/Purdue/Murdock--The Cameroon project's training plans have clearly considered the special needs of a relatively new project. Training plans are clear, concise, and make sense. The inclusion of a focus on training of Host Country technicians is an excellent example of an appropriate training decision to help prepare the Host Country for a truly collaborative role. There is some concern regarding the project's long-term commitment to training. The focus on training only three HC researchers during the total life of the project may prove to be naive, given the trend of turnover of well-qualified HC scientists.

Dominican Republic/UNL/Coyne--This project is an excellent example of a successful training component for an equally successful research program. The project's use of a variety of funding sources to enhance long-term training opportunities has been excellent.

Dominican Republic/UWI/Maxwell--This project is an excellent example of exciting, cutting-edge research attracting large numbers of excellent graduate and under-graduate students. Because of the type of research being done in this project, it is appropriate to view the training efforts as focusing on regional needs. The project has included graduate

students from around the Caribbean region, as well as from the U.S. and other parts of the world. (Funding expenditures for training are not clear in the Annual Report, with the budget including no funds for training while the narrative notes $56,349 for training. Perhaps the narrative item related to the balance between research and training should be clarified as noted in the summary of this section.)

Ecuador/UMN/Graham--The training plans for this relatively new project are excellent and clearly consider long- and short-term Host Country needs.

Guatemala/Cornell/Wallace--Unfortunately, with this project phasing out, the Host Country institution (ICTA) is left with no remaining CRSP-related technical capacity. The three former CRSP scientists left their positions or were transferred within ICTA.

Honduras/UPR/Beaver--This project seems to have accomplished its goals for increasing research capabilities in Honduras. Training efforts are continuing to develop further depth in the HC.

Malawi/UCD/Gepts--CRSP training efforts in Malawi have resulted in the development of a well-prepared Host Country team. Plans to continue training to fill remaining gaps in the Host Country team are excellent, showing both short- and long-term planning for the sustainability of bean research.

Mexico/MSU/Kelly--There appears to be some discrepancy between PI response to EEP training-related recommendations and the Annual Report. On the one hand, it is noted that " . . . the CRSP does not fund training of Mexican nationals because Mexico is a graduate country." On the other hand, in reporting on the balance between research and training, the Annual Report includes the training of Mexican nationals at MSU. It is assumed that these Mexican nationals have been funded with non-CRSP funds but this is not clear. Additionally, while the Annual Report implies project interest in non-CRSP-funded training, responses to EEP recommendations imply a lack of interest in this aspect of the program.

Nigeria/UGA/McWatters--Training efforts on this project have clearly left the Host Country in an excellent position to continue both food science and technology, and nutrition research following the phaseout of the project. The U.S. and HC project leadership should be congratulated on an excellent job in the training area.

Senegal/UCR/Hall--This project is gradually making good progress in the training area. Current problems of lack of depth in Senegal appear to be a function of both Senegal's economic woes and a lack of M.S.- and Ph.D.-trained personnel. The greater source of the problem is probably budgetary, since training within the project appears to have been well planned. However, it would be helpful to specify if project funds are being spent on training of Sudanese students and, if so, why, in light of the personnel gaps in Senegal.

Tanzania/WSU/Silbernagel--Excellent progress in insuring Host Country research capacity has been made through training. Although initial training investments are showing returns, there are still ongoing training activities and long-range plans to fill remaining gaps in the Host Country research capability.

Summary: Overall, training has been quite successful in the CRSP. There are, however, problems related to the reporting of these returns. The item in the Annual Report entitled "Balance Between Research and Training in FY 91" is apparently confusing, since it is rare that any two PIs present the same data in response to this item. We suggest that this item

include the following figures broken out according to funding sources (CRSP/U.S., CRSP/HC, matching contributions/U.S., matching contributions/HC, and other): tuition and fees, student stipends, and other training costs (e.g., dissertation preparation). We request that the names, nationalities and sources of funding (using the categories previously noted) be included and that all students whose training could be classified as enhancing the CRSP research effort and/or increasing research capacity in the U.S. or HC be included. This reporting item should, of course, also note dollar amounts spent on research.

A second reporting concern stems from the training report issued by the MO. It simply does not give the level and quality of information for the total CRSP that is so well presented in the individual Annual Reports (e.g., institutional development and training over the life of the project, training to be completed by the end of this extension, and balance between research and training). The quality and quantity of the MO report imply a lack of interest in training, despite the eloquence of rhetoric.

WOMEN IN DEVELOPMENT:

The Women in Development component of the Bean/Cowpea CRSP has consistently been an important resource to the CRSP. The WID Specialist, Dr. Anne Ferguson, has provided leadership in encouraging researchers to consider women in development and other social science issues. Her efforts have helped the overall CRSP to maintain a stronger linkage to the ultimate consumers of research results: farmers, farm families and consumers. Her ongoing reviews of each of the projects within the CRSP have generally encouraged U.S. and HC PIs to develop greater awareness of relevant WID and social science issues and to begin to include appropriate research efforts in project plans.

The 1991 publication by the WID component, "Farmer Participatory Research Bibliography," and considerable work with PIs on farmer participatory research by Dr. Forguson are particularly important at this stage in the CRSP. Several of the ongoing CRSP projects are at a stage where they should begin incorporating more farmer participatory research in their plans (i.e., Dominican Republic/UNL, Honduras/UPR, and Mexico/MSU). Luckily, the CRSP offers them an excellent resource to assist them in this process.

General Strengths–The WID program's greatest strengths lie in the professional commitment and consistent efforts of Dr. Ferguson; the enlightened interest and involvement of many of the PIs in WID issues related to their research; and the continued support of this component by the MO and the A.I.D. Office of Agriculture.

General Weaknesses–In general, WID and other social science elements still suffer from the low priority given to this focus by some of the PIs.

Recommendations–The successes of the WID program in expanding its influence to more and more of the CRSP projects leads us to again encourage an increase in those efforts. As was noted in last year's review, we still believe that there is a need for a full-time WID person. We are encouraged by the addition of an agricultural economist (Dr. Bernsten) to the overall CRSP team; believe that it is crucial for Dr. Ferguson and Dr. Bernsten to work closely together as a social science team; and support these combined efforts as a socioeconomic/social sciences approach to considering CRSP results, ongoing activities, and proposed activities.

Overall Rating: 1--Highly Satisfactory

IV. PROGRAM EVALUATION: FISCAL AND ADMINISTRATIVE

After more than a decade of operations, the Bean/Cowpea CRSP has settled into a pattern of standard operating procedures that conform to U.S. Government grant guidelines and acceptable accounting practices and facilitate achievement of the CRSP's objectives.

With regard to fiscal matters, a budget process has been developed through trial and adjustment which works well for this CRSP (i.e., the participating U.S. and HC institutions and PIs). The process is now in place and it is routine, efficient and fair. Its notable features include: (1) adjustment and accommodation to the vagaries and unpredictabilities of A.I.D. financing; (2) maximum participation of CRSP entities (i.e., TC, BOD, PIs and MO/ME); (3) timely release of funds and timely receipt of expenditure reports; (4) up-to-date monitoring of the flow of funds; and (5) flexibility to transfer unspent funds to points of need within the system.

On the administrative side, we applaud the decisions of the ME and BOD to augment the overloaded support staff of the MO. However, we remain concerned about the continued overload of the professional staff. The "extras" asked of and delivered by the Director, Deputy Director, and Administrative Officer that we observed in 1990 have continued and, if anything, escalated in 1991. We again urge the BOD, the ME and A.I.D. to take cognizance of the situation and recognize CRSP Council activities and the negotiation of buy-ins as MO responsibilities, thus perhaps legitimizing some level of additional professional staff in the MO.

There continues to be a strong commitment and support for the Bean/Cowpea CRSP at all levels of Michigan State University. This has been, and is being, reflected in MSU's staffing and administrative support for the Management Office and in the overall operation of a highly successful CRSP.

The Panel was pleased to note the very favorable report of the A.I.D. Management Review Team following its review in September 1991. Their observations clearly parallel those of the Panel.

Overall Rating: 1--Highly Satisfactory

V. PROGRAM EVALUATION: PROJECT RATINGS

A. Bases for Evaluation: Rating Categories/Format

Using *Guidelines for Collaborative Research Support Programs* provided by A.I.D., a Scope of Work was prepared which provided for evaluation of progress, funding, plans, and status/prospects for each CRSP project (Attachment A). These criteria were assessed on the basis of reports submitted by the projects' Principal Investigators, earlier site visits to HC institutions and U.S. universities, data provided by the MO, and discussions with MO and A.I.D. officials. Numerical and adjective ratings are based on assessment of the criteria against the plans spelled out for FY 91. Phasing-out projects were not given a specific rating.

Category	Rating
1	Highly Satisfactory
2	Satisfactory
3	Unsatisfactory

B. Summary of Ratings

Category 1: Highly Satisfactory

Bean/Cowpea CRSP
Women in Development
Fiscal and Administrative Dimensions
Cameroon/Purdue
Dominican Republic/UWI
Ecuador/UMN
Honduras/UPR
Senegal/UCR
Tanzania/WSU

Category 2: Satisfactory

Dominican Republic/UNL
Malawi/UCD
Mexico/MSU

Category 3: Unsatisfactory

None

VI. THE FIVE-YEAR EXTENSION PROPOSAL

The Panel commented at some length in the FY 90 report on the five-year extension proposal as it had evolved up to that time. Our views on the nine projects, then proposed for extension, and the WID component have not changed materially as we examine the most current plan. For this reason, the EEP will not comment on planning in this review. Again we applaud the addition of the economics dimension to the "socioeconomics" component in the forward plan, and we note with satisfaction the regionalization of the University of Wisconsin's involvement.

Now that further decisions have been made on inclusion of additional projects, we comment as follows:

COSTA RICA/MSU/HOSFIELD

Improvement of Digestibility and Nutritional Quality of Common Bean (P. vulgaris) Through Traditional Plant Breeding, Molecular Biology and Food Technology

This project is an excellent example of the integration of production and utilization. The Host Country (Costa Rica) has a very good food technology component, Center for Food Technology Investigation (CITA), and the participating U.S. institutions (MSU and Purdue) have excellent food science programs. In addition, this project involves private industry (Gerber Products Company). The breeding component will focus on traditional and biotechnological approaches to improve the nutritional and/or processing quality of beans. The EEP looks forward with enthusiasm to having this project as part of the CRSP.

GHANA/UGA/PHILLIPS

Research Strategies to Increase the Utilization of Cowpeas

This project involves a new Host Country (Ghana) and the phaseout of Nigeria as the Host Country. The Georgia team has developed an outstanding program in cowpea utilization and the University of Ghana-Legon has very good institutional capabilities. The research and training elements include processing, storage, production formulation, microbial safety, acceptability, and nutritional quality of cowpeas. The EEP encourages this project to develop close collaborative ties with the production projects in Senegal and Cameroon. The strong Host Country capability gives this project an excellent potential for rapid development into a comprehensive program.

INTEGRATED PEST MANAGEMENT

We note that there are remaining two competing proposals for this activity. We further note that the MO is currently in negotiations to resolve this matter. Our base of knowledge and information limits our action to that of supporting the inclusion of an IPM component in the forward plan and in supporting the MO in the ongoing negotiation.

FY 91 EXTERNAL EVALUATION PANEL SCOPE OF WORK

Use bolded headings as outline for writing report. In paragraph form, discuss every item listed below based on the information presented in the corresponding section(s) of the Annual Report. If an item does not apply to a particular project, please indicate "Not Applicable."

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

1. **Research results disseminated and currently in use** *Discuss constraints and specific contributions provided, with special regard to improved cultivars; inoculants; tests; methods; systems; and technical papers, reports and bulletins produced and released for public use. Show evidence of extent of use to date.*

2. **Other research-related results** *Give examples of germplasm conservation and use (accessions collected/acquired/in storage and kinds and amounts distributed domestically) and international exchange. Discuss seed or other production and distribution of CRSP-produced cultivars or other materials. What is the impact of other CRSP-produced or -recommended technology, including production inputs such as fertilizers, inoculants, insecticides, equipment and machines What is the project's impact on production and consumption of beans and cowpeas (e.g., on-farm trial results and/or changes in production statistics on development and adoption of new products or processes)? How do research findings address the needs of small-scale farmers and women?*

3. **Changes in national production of beans/cowpeas in Host Country** *Using appropriate indicators, report changes in national production (or consumption) due to project research, i.e., hectares planted, yields per hectare and total production.*

B. Institutional Development and Training

(i.e., strengthening Host Country bean and/or cowpea research and improvement systems) Cite changes since FY 90 and over life of project. Discuss project training to be completed by the end of this extension period (1992).

C. Progress Achieved Regarding Objectives Stated in Workplan

Describe progress made towards U.S. and HC research objectives. How long has project been engaged in the lines of research addressing these objectives? How does the progress relate to the log frame? Is the research on schedule? If not, please explain. How does research relate to research being conducted in the HC, IARCs, and elsewhere? Is it complementary, duplication, unique, etc.? Provide an update on the likely contribution of research towards the amelioration of the global constraint(s) as it relates to the HC and U.S.

D. Evidence of Biological/Social Sciences Integration

Identify attention to relevant WID issues and to other social and/or food science issues (or production issues if not production project).

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

Discuss those not included in C. above.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems *(i.e., regarding funding, budgeting, release of funds, procurement and other--in U.S. and Host Country)*

B. Adequacy of Current Management, Policies and Procedures *Discuss especially follow-up on use of funds and use of equipment.*

C. Activity Towards Buy-ins and/or Other Funding

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

B. Balance Between Research and Training *Relate expenditures for research and training in FY 91 to research and training plans for FY 91, made in FY 90.*

C. Balance Between Domestic vs. Overseas Activities *(with respect to program constraints)*

D. Level of Collaboration/Cooperation Between U.S. and Host Country *Describe the process/procedure for planning research, preparing budgets, and making decisions on training and publications/presentations.*

E. Contributions of Collaborators Towards Accomplishment of Objectives *Give U.S. (U.S. university and A.I.D.) and Host Country contributions to the FY 91 budget. Note whether the HC and U.S. university contributions were in-kind or cash. Include other funding over and above that by A.I.D. and participating U.S. and HC institutions with accompanying comments as to the uses and impact of such additional funding.*

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

G. Evidence of Institutionalization *Note faculty recognition for international activities; integration of domestic and international commodity research programs with CRSP projects; internal project management and institutional management support; and student/professor interactions.*

H. Other Comments

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

V. OVERALL RATING

A. General Strengths

B. General Weaknesses

C. Recommendations

FY 91 ANNUAL REPORT FORMAT
Due November 1, 1991

I. PROGRESS DURING FY 91 (Oct. 1, 1990 Sept. 30, 1991)

A. Specific research contributions in FY 91.

1. Research results from FY 91 disseminated and currently in use in I Country and U.S. Give examples such as:

a. Improved cultivars; inoculants; tests; methods; systems; and papers, reports and bulletins produced and released for public

b. Evidence of extent of use to date.

2. Other research-related results, such as:

a. Germplasm conservation and use.

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

(2) International exchange.

b. Seed production (or other materials) and distribution of CRSP-produced cultivars (or other materials).

c. Impact of other CRSP-produced or -recommended technology, including production inputs such as fertilizers, inoculants, inse equipment and machines.

d. Project impact on production and consumption of beans and c (e.g., on-farm trial results and/or changes in production statist development and adoption of new products or processes).

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

3. Changes in national production (or consumption using appropriate indicators) of beans and cowpeas in Host Country:

a. Hectares planted.

b. Yields per hectare.

c. Total production.

B. Institutional development and training, i.e., strengthening Host Country bean and/or cowpea research and improvement systems.

1. Cite the changes since FY 89.

2. Over life of project (where are we?).

3. Project training to be completed by the end of this extension period (1992).

C. Progress achieved in relation to the objectives stated in your 1991 workplan (attached).

1. List each U.S. research objective and/or activity and then describe the progress made towards the objective. Example:

1. Nonspecific rust resistance-leaf pubescence/adult plant mechanisms and their inheritance.

Ten F_2 families (hairy X non-hairy) were evaluated in the greenhouse. Segregation ratios (Appendix A) show that pubescence is controlled by several genes. Field and greenhouse studies (Appendix B & C) showed a significant correlation between leaf pubescence and rust resistance.

2. List each HC research objective and/or activity and describe the progress made towards the objective.

3. How long has your CRSP project been engaged in the lines of research addressing these objectives? How does progress relate to the log frame? Is research on schedule? If not on schedule, give reasons for delay.

4. How does your research relate to research being conducted in the HC, IARCs, and elsewhere? Is it complementary, duplication, unique, etc.?

5. Provide an update on the likely contribution of research towards the amelioration of the global constraint(s) as it relates to the HC and U.S.

D. Evidence of biological/social sciences integration.

1. Identification of and attention to relevant WID issues.

2. Identification of and attention to other social and/or food science issues (or production issues if not production project).

E. Does your project have baseline data adequate to evaluate the impact of your project? If not, what do you plan to do to obtain this baseline data?

F. Collaboration with other Bean/Cowpea CRSP projects, linkages with other CRSPs, and other external groups not included in C.4. above.

II. <u>FUNDING/FISCAL MANAGEMENT IN FY 91</u>

A. Problems regarding funding, budgeting, release of funds, procurement and other--in U.S. and Host Country.

B. Adequacy of current management, policies and procedures (especially regarding follow-up on use of funds and use of equipment).

C. Activity towards buy-ins and/or other funding.

III. STATUS IN FY 91

A. Appropriateness of activities to goals of Global Plan.

B. Balance between research and training.

1. Give expenditures for research and training in FY 91.

2. Relate these expenditures to research and training plans for FY 91, made in FY 90.

C. Balance of domestic vs overseas activities with respect to program constraints.

D. Describe the level of collaboration/cooperation between U.S. and HC institutions and personnel (research planning, budgets, training, and publications/presentations).

E. Relative contributions of collaborating institutions and individuals towards accomplishment of objectives.

1. Give U.S. (U.S. university and A.I.D.) and HC contributions to the FY 91 budget. Note whether the HC and U.S. university contributions were in-kind or cash.

2. Other funding over and above that by A.I.D. and participating U.S. and HC institutions with accompanying comments as to the uses and impact of such additional funding.

F. Interest, involvement and support of USAID Mission/U.S. Embassy.

G. Evidence of institutionalization in Host Country/in U.S.

1. Faculty recognition for international activities.

2. Integration of domestic and international commodity research programs with CRSP projects.

3. Internal project management and institutional management support.

4. Student/professor interactions.

H. Other comments.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

FY 91 EEP REVIEW

BRAZIL • BOYCE THOMPSON INSTITUTE • ROBERTS

Insect Pathogens in Cowpea Pest Management Systems for Developing Nations

In anticipation of the orderly phaseout of this project, the EEP would like to take this opportunity to compliment Boyce Thompson Institute for its support of, and commitment to, the CRSP.

The FY 91 workplan for this project focused on plans to demonstrate the viability of the basic research results of the project in insect control efforts. Results from the 1991 experiments were mixed, with some results very positive while others were inconclusive. The progress made in a second trial of controlling *Empoasca* leafhoppers with *Zoophthora radicans* exemplifies success in achieving the goal. Additional research, including the determination of the economic damage level of *Empoasca kraemeri* on common beans in central Brazil and control of the whitefly, *Bemisia tabaci*, with *Verticillum lecanii*, are both in the initial stages of development. It is hoped that preliminary work will continue, both in Brazil and BTI, as it has long-range potential for crop production worldwide.

It is clear that the project, as part of its phaseout process, has included efforts to enhance the institutionalization of expertise in insect pathology in the Host Country. The PI and his team are to be congratulated on their institutional development efforts throughout the project, as well as during the phaseout process.

The EEP looks forward to the submission of a final report of this project and hopes that the elements noted in its suggestion relative to final reports (Section II, page 3) are included in the document.

FY 91 EEP REVIEW

CAMEROON • PURDUE UNIVERSITY • MURDOCK

Preservation of Post-Harvest Cowpeas by Subsistence Farmers in Cameroon

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

1. Research results disseminated and currently in use

In this project the following advances were made and/or improved during FY 91: (1) the basis of seed and pod resistance to the cowpea weevil, (2) cowpea storage practices used by low-resource farmers in Northern Cameroon, (3) insect problems of cowpea storage in the region, (4) farmer attitudes and awareness of storage insect problems, (5) farmer systems of post-harvest processing of cowpeas, (6) alleviating technologies including solar heating, ash storage, triple bagging, and in-pod storage, (7) use of insecticides and sprayers to reduce insect damage to cowpeas, (8) refinement of ash storage and understanding how it works, (9) qualitative understanding of gender roles in cowpea production, and (10) development of an effective and efficient entomology laboratory in Cameroon including training of scientists and technicians.

2. Other research-related results

As part of the project's service to IRA, an evaluation of two types of sprayers--conventional micro ULV (1 l/ha) and the new Berthoud low-volume sprayer (10 l/ha)--on cowpeas was carried out.

3. Changes in national production of beans/cowpeas in Host Country

No data are available.

B. Institutional Development and Training

The initial goal of the project was to train a three-scientist team for national cowpea research: entomologist, agronomist and plant breeder. The three candidates have been identified and are being trained as planned. In addition, the project has trained a cadre of capable technicians for laboratory, field and farmer-level research. Moreover, the small cowpea storage laboratory at Djarengal is among the best such facilities in the region.

C. Progress Achieved Regarding Objectives Stated in Workplan

Significant progress has been made on all research objectives. The survey of farmer production and storage practices was completed in 1990 with data analysis and preparation for publication continuing in 1991 and is ongoing.

The use of solar technology to disinfest whole pods has been determined to be impractical; however, studies of heating of cowpea seeds have shown toleration of 60°C for up to 8 hours without loss of germination or seedling vigor. Other work in storage technology has included the continuing development of predictive models of cowpea weevil population growth in unprotected grain and in pod storage. The success of a developing network of cooperating farmers has been especially important in village/field trials of storage technology.

Progress in cowpea breeding initiatives focusing on combined seed and pod resistance to weevils has resulted in the progeny of 27 crosses being grown at Mouda on 3½ ha. Some of these (seven families) were in the F_3 generation, ten families were F_2s, and ten were F_1s.

The project has made substantial progress toward the goal of improving cowpea storage methodologies for subsistence and low-resource farmers in Cameroon. At present--after only four years of field activities--the project is on schedule or ahead of schedule.

D. Evidence of Biological/Social Sciences Integration

Principal responsibility for the identification of and attention to WID issues was carried by Dr. Jane Wolfson, who conducted the early surveys of cowpea storage practices among low-resource farmers in Cameroon. She helped define the roles of both genders in cowpea production, storage and utilization and was particularly sensitive to assuring that the roles of women were given due attention. Unfortunately, Dr. Wolfson has left Purdue.

With regard to nutrition/cultural considerations, it is recognized that any post-harvest treatment (and genetic manipulation) may affect seed qualities such as cooking time, hard-to-cook defect, flavor, germination, and seedling vigor. When resources are available and needs are identified, Dr. Suzanne Nielsen, Associate Professor of Food Science at Purdue, is consulted.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

The Purdue project participated with several other projects and activities relevant to cowpeas and seed storage research including other CRSP cowpea projects; CIAT; IITA; the British Natural Resources Institute; Bush Brothers, Inc. (Arkansas); and in Cameroon, USAID and the University of Florida agricultural education project at Dschang.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

Reimbursements tend to be delayed from one to several months due to a variety of complicating factors. However, the situation has improved somewhat as a consequence of whole-hearted support by concerned parties both at Purdue and in Cameroon (IRA).

B. Adequacy of Current Management, Policies and Procedures

Adequate--Fortunately, A.I.D. approved the procurement of a much-needed new vehicle.

C. Activity Towards Buy-ins and/or Other Funding

USAID/Yaounde has not extended earlier project support in 1991 but will be approached for 1992 and beyond.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

The activities are on target. Very promising technologies have been developed or improved for low-resource farmers to effectively store cowpeas between harvests. These include solar disinfestation, ash storage, triple bagging, and pod and seed resistance to weevils. Except for breeding, these technologies are non-specific to site, culture or commodity and, therefore, could have wide applicability.

B. Balance Between Research and Training

The balance is good for the goals established. Funding is adequate to train one Ph.D. and two Masters candidates and training is on target.

C. Balance Between Domestic vs. Overseas Activities

The balance is about right. However, the necessity of maintaining Dr. L. Kitch in Cameroon for 8-9 months and the national fiscal crisis in Cameroon has temporarily shifted the balance to favor the HC.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

Highly satisfactory--Purdue and IRA scientists plan their research collaboratively in annual two-to-four-week reviews. In addition Purdue and Cameroonian researchers visit each other's institutions on an *ad hoc* basis as the need arises and resources are available.

E. Contributions of Collaborators Towards Accomplishment of Objectives

The Purdue team has contributed project leadership and guidance, particularly to developing the more basic aspects of the work. Cameroonian participation has been largely in providing facilities for testing and in adapting and fine-tuning the technology.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

The USAID Mission at Yaounde has been supportive of the project and made one buy-in for $81,000 in 1990, but new policies may limit future monetary support from them.

G. Evidence of Institutionalization

At present, there is no recognition of faculty for international involvement at Purdue. International project management and institutional management support is good as is student/professor interaction. Frequent contacts occur with the U.S. private sector particularly on incorporating insect resistance into new varieties. Project wide, excellent relationships have been established with IITA and are beginning with CIAT and the British Natural Resources Institute.

H. Other Comments

The project in Cameroon has been particularly fortunate to maintain Dr. L. Kitch in the country for several months each year. This is particularly essential while Georges Ntoukam is working on his Ph.D. at Purdue.

The project is actively seeking collaboration with other countries--particularly in West Africa--to test the new technologies. Toward this end, initial contacts have been made with INERA in Burkina Faso, INRAN in Niger and SAFGRAD for the Sub-Saharan region, which may be followed up by mutual visits.

Experiments were initiated late in 1991 to search for host plant resistance to the common bean weevil, *Acanthoscelides obtectus*. The project is particularly well situated to look at various bruchid pests of the pulses.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

Six research papers were presented or published in 1991. In addition, three technical bulletins on the new technologies (solar disinfestation, ash storage, and triple bagging) were prepared for extension/farmer use in both French and English.

V. OVERALL RATING: 1—Highly Satisfactory

A. General Strengths

This project has made excellent progress in its four-year duration, producing concrete results and technology to be disseminated to limited-resource farmers. It has done an excellent job of baseline social science research, incorporating an understanding of social science elements into overall research planning. There is an excellent U.S./HC relationship with well-developed and logical long- and short-term planning. The project has been able to have a significant impact in the storage area in a short period of time.

B. General Weaknesses

No general weaknesses have been identified. However, as noted in the EEP review of CRSP training, we have some concern regarding the lack of a long-term training perspective that would consider needs beyond the training of three agricultural scientists.

C. Recommendations

Implement the approved five-year extension plan

FY 91 EEP REVIEW

DOMINICAN REPUBLIC • UNIVERSITY OF NEBRASKA • COYNE

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

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

Diseases of beans, particularly common blight, rust, web blight, and bean golden mosaic virus are major constraints to bean yields and seed quality in the Dominican Republic. The objectives of this project are to identify resistant germplasm, to determine pathogenic variation, to conduct epidemiological and genetic studies, to develop resistant cultivars, to improve research facilities and capabilities, to train personnel and educate students.

1. Research results disseminated and currently in use

The recently released PC-50 is now the predominant red-mottled variety in the DR. In addition, the new black-seeded line H-270 and the white-seeded line L-86020 were released to the SEA Seed Department for seed increase. The SEA selected 139 seed producers to grow 5,000 ha of seed of PC-50 for sale to commercial growers in 1991. Basic seeds of the two new lines--white L-86020 (1400 pounds) and the black H-270 (270 pounds) were produced in the DR. The new production system--a fallow period for beans followed by near-synchronous planting of beans in December--greatly reduced losses from BGMV in the DR and enhanced yields in 1991.

In Nebraska foundation and certified seed of the new Great Northern Starlight was produced in 1991, with favorable grower response. Also, the first Pinto lines with multiple disease resistance to common blight, rust, white mold, and bean common mosaic virus were developed. Some of these may be released in 1993.

Advances in cell culture has demonstrated bean plant regeneration from embryonic axis and cotyledonary explants. These techniques have been described and are in use.

Genetic information on non-specific resistance to rust, BGMV, common blight, and white mold was disseminated and is in use.

Information on germplasm resistance to rust, CB, and on seed quality has been published and is in widespread use in the Caribbean, Central America, Africa, and the U.S.

2. Other research-related results

Fifty-eight new lines of Pompadour landraces were collected and evaluated at two locations in the DR. These materials are used for resistance to BGMV and non-specific resistance to rust in the DR. Germplasm will be distributed to neighboring states, CIAT, and other germplasm banks.

The Caribbean Adaptation Nursery was grown in Panama, Guatemala, DR, and Puerto Rico. Bean lines from DR and PR were also evaluated for rust resistance in Nebraska in 1991.

3. Changes in national production of beans/cowpeas in Host Country

Government statistics on bean production in the DR are unrealistic, but it is estimated that about 60 percent of the crop was planted to PC-50.

B. Institutional Development and Training

The USAID Mission in the DR is requiring the CRSP to seek a new administrative agency for its project. Several agencies are under consideration. Future success of the project depends on a successful resolution of this problem.

Staff changes in the DR include: Graciela Godoy, Ph.D., became Co-PI in October 1990 and E. Arnaud-Santana, DR student, returned to the DR in September 1991 to complete his Ph.D. thesis. Two students completed M.S. degrees and three others are progressing toward completion and working in the project. Three staff members participated in short-term training in 1991. Two visiting scientists and one Post-Doctoral Fellow are participating in the project.

A CRSP short-term training course was also conducted for 25 Ministry of Agriculture technicians in 1991.

At the project's outset (1981-82) the DR program lacked trained personnel, facilities, vehicles, equipment, and financial support to conduct a bean research program. At present (1991), ten students have received M.S. and Ph.D. degrees, and a strong bean research program has been established in the DR. Facilities have greatly improved and basic laboratory equipment, computers, and vehicles have been provided. The EEP believes that progress in this area has been excellent.

C. Progress Achieved Regarding Objectives Stated in Workplan

Some of the more important practical outputs of the project are reported in I.A.1 and 2. Details of activity under each objective were reported and the EEP feels progress in most to be excellent. Unfortunately, progress in baseline data acquisition and in socioeconomic impact evaluation has been limited.

D. Evidence of Biological/Social Sciences Integration

Women have an important role in the project. The current Head of the Department of Plant Pathology at UNL is Dr. Anne Vidaver, who is also an investigator on this project. Other women at UNL include Lisa Sutton (M.S.), a half-time research assistant; Dr. Margaret Mmbaga, a visiting scientist at UNL from Tanzania; and several technicians.

In the DR and PR, Dr. Graciela Godoy received her Ph.D. at UNL in 1990 and is now a Co-PI, and some technicians working in the project are women.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

There has been a long-standing and intimate working relationship between this project and the Honduras/UPR/Beaver project. More recently, a similarly close tie has developed with the Dominican Republic/UWI/Maxwell project and with CIAT and others through the Latin American regional testing program (PROFRIJOL). Within the U.S., UNL scientists participate in various regional inter-institutional programs.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

A major problem is transportation, as only one dilapidated vehicle is available. The project has budgeted for two new vehicles in 1992, but A.I.D. has yet to approve this request.

A second problem is low salaries paid to professionals in the DR on account of the deteriorating economy. Attempts are being made to adjust for inflation and to keep the "bean team" together.

B. Adequacy of Current Management, Policies and Procedures

Advance funding and reimbursement on the basis of receipts is a workable system. A grant proposal system is in the second year in the DR. The proposals containing objectives, procedures, and budget are submitted by investigators and reviewed by the DR, PR, and UNL personnel before approval and implementation. This ensures that only HC scientists with approved proposals remain with the project.

C. Activity Towards Buy-ins and/or Other Funding

The research program at UNL has utilized a USDA competitive grant, industry grants, USAID scholarships, private foundation, Rotary International, and regional research funds to offset losses in state support to maintain bean research. The UPR has utilized local industry support and other USAID-funded legume project resources for bean research. In the DR and PR, support from PROFRIJOL (funded by the UN, USAID and Swiss Bank) also contributes to bean research.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

The DR project is the only Bean/Cowpea CRSP project addressing the improvement of beans for elevations less than 1,000m where diseases such as CB, BGMV, and WB can be severely limiting. However, continuous bean cultivation in mountainous regions may have deleterious consequences for the ecologies of those regions. One alternative is bean production in the coastal plains during the cool season--an option that may serve other similar regions. In this respect, the project can prove useful throughout the Caribbean.

Resistance strategies, race-nonspecific rust resistance, CB and BGMV resistance sources, and general disease management strategies, as well as germplasm, will be available for the bean community in Africa, Central and South America as well as in North America.

B. Balance Between Research and Training

Training costs were only $12,268 compared with research costs of $187,534 in 1991, but other sources of funding also support training. These include three LASPAU scholars, two departmental assistantships (UNL and UPR), shared assistantship with a BNF project, UN Foundation, CIAT training grants, USAID Morocco project assistantship, Rotary International, and visiting scientists. Short-term training programs at CIAT, UNL, and UPR for breeding and pathology were conducted. Therefore, training plans were on schedule.

C. Balance Between Domestic vs. Overseas Activities

Most of the basic research is carried out at UNL and UPR, while applied research is carried out at all three institutions. The level of basic studies in the DR will increase as Dr. G. Godoy (Co-PI) has initiated fundamental studies on WB epidemiology and as Mr. Arnaud-Santana completes his Ph.D. and returns to the DR program. The balance seems appropriate.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

Research planning and budget development for FY 92 were done jointly with Co-PIs Godoy and E. Arnaud-Santana at Lincoln, Nebraska in July 1991. Input was also received from F. Saladin (HC PI), J. Beaver (Co-PI/UPR), and D. Maxwell (UWI). Areas covered included research proposals (modified as necessary), training needs in the DR, international travel, and publication projections. Travel is so planned as to have UNL, UPR, DR, UWI and CIAT representatives participating in each trip.

E. Contributions of Collaborators Towards Accomplishment of Objectives

Estimated budget projections for FY 91 were almost equally split between U.S. ($105,570) and HC ($104,430) for a total of $210,000. The U.S. contributions were based on percent of time of PI, Co-PIs, investigators, and

technicians devoted to the project, plus their benefits and overhead. HC contributions were derived from salary and benefits of PI and investigators paid by SEA. As in most projects, there are contributions such as laboratory and greenhouse supplies, secretarial assistance, labor and other miscellaneous costs that cannot be easily documented.

The A.I.D. funding is particularly useful in that it allows the bean/legume programs in the DR, UPR and UNL to interact collaboratively on objectives that have local, regional, and international impact. This is particularly important since the institutional bean programs have highly qualified personnel and facilities but lack adequate operating expenses and technical support personnel to assist in the research. The A.I.D. funding is not adequate to carry a fully staffed bean improvement program *per se*, but it does provide critical resources, allowing the active participation of three institutions to focus on urgent problems and needs of the DR. In practical terms, this means "bigger bang for the buck" (i.e., highly cost effective).

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

The USAID Mission is interested but provides only token support. The Mission has requested the project to change the administrative arrangement from the Ministry of Agriculture/SEA to a private entity. This is currently being studied. Other problems arise from procurement--especially vehicles--and permission for UNL staff to travel to the DR.

G. Evidence of Institutionalization

The UNL, UPR and DR breeding programs are closely involved with the Honduras/UPR and DR/UWI CRSP projects. There are also connections with USDA, Tanzania/WSU and Mexico/MSU CRSP projects. Some examples include integration of rust resistance from Pompadour (DR) landraces into U.S. and Honduran materials and UNL-derived CB resistance into Honduran and DR breeding lines. Disease management strategies have been devised in the DR based on information from both the DR and the U.S. Also, graduate students from HCs have furthered basic research while in the U.S. but have taken the knowledge back to the DR and are using it to advance HC research.

Both UPR and UNL administrative support has been excellent. Both Grants and Contracts Offices have given support to the project. The DR administrative support has also been good despite severe economic difficulties.

Student/professor interactions are excellent. Contacts have continued after the HC students returned to the DR.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

Project publications for FY 91 include twelve refereed articles, two theses, eighteen non-refereed research papers and abstracts, and one non-refereed report. Ten presentations were made at various meetings. By any criteria, this is an excellent output.

V. OVERALL RATING: 2--Satisfactory

A. General Strengths

Major strengths are the enthusiastic and aggressive display of fundamental and applied research aimed at major diseases of beans in Latin America, and the close and effective collaboration and cooperation among the scientists and institutions involved.

B. General Weaknesses

The general lack of attention to socioeconomic concerns has been cited in the FY 89 and FY 90 EEP Reports. These concerns continue in FY 91 and simply will not go away until they are addressed. These include, most importantly, production and production economics, and consumption patterns and preferences. Also, attention needs to be given to a more participatory approach in the research.

A second concern relates to the project's ability to resolve the host institution and related travel, procurement and USAID relations problem. The lack of a stable national institutional umbrella has probably also constrained attention to the socioeconomic concerns expressed earlier.

C. Recommendations

Implement the approved five-year extension plan with early and aggressive attention to the matters presented in V.B.

FY 91 EEP REVIEW

DOMINICAN REPUBLIC • UNIVERSITY OF WISCONSIN • MAXWELL

Molecular Approaches for Control of Bean Golden Mosaic Virus

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

Increased effort was directed in FY 91 to two emerging areas of exciting scientific breakthrough: the engineering of transgenic beans with the coat protein gene of the BGMV, and the development of a polymerase chain reaction technique for detection of unknown geminiviruses. Some decrease in effort on other objectives and lines of work was required to accommodate the increases on the above. Nonetheless, interesting and useful information on other elements was obtained and a wide array of collaborative efforts have emerged involving institutions throughout the world. Dr. Maxwell's research is clearly at the cutting edge of the new biotechnology!

1. Research results disseminated and currently in use

Six separate aspects of this research have been disseminated and are in use:

a. Geminivirus DNA probes from cloned DNAs of bean-infecting geminiviruses were distributed to scientists in Arizona, Costa Rica, and Nigeria;

b. Full-length infectious clones of DNA-A and DNA-B of BGMV were supplied to a scientist in North Carolina for host range determinant studies;

c. Technology for inoculating plants with cloned viral nucleic acid, first demonstrated in this project, is now being used in laboratories in Colombia, Brazil, North Carolina, and Arizona;

d. Unpublished geminivirus sequence data for bean-infecting geminiviruses was sent to laboratories in Florida and North Carolina;

e. A diagnostic service adjunct to Dr. Maxwell's lab has processed samples for geminiviruses from three states and fourteen countries;

f. Vector and virus source studies in the DR resulted in a government-imposed fallow period prior to the main bean growing season. This reduced incidence of BGMV and yields were generally higher in 1991 than in 1990 when a serious incidence of BGMV occurred.

2. **Other research-related results**

More than 50 landraces of beans were collected in the DR and evaluated for reaction to BGMV. Seed was sent to Puerto Rico for storage and preservation.

3. **Changes in national production of beans/cowpeas in Host Country**

Not applicable

B. Institutional Development and Training

There is little doubt that this project is helping to build and sustain a highly sophisticated and successful institutional capacity for geminivirus and related research at the University of Wisconsin. This institution is a major force internationally in its scientific specialty.

Although no training funds are provided by the CRSP, the project has attracted funds from a variety of other sources and an impressive record has been achieved, i.e., thirteen women and six men have received training since 1989. Students have come from the DR, Puerto Rico, Brazil, Egypt, Costa Rica, and Mexico as well as the U.S. As this project broadens its involvement in Latin America and the Caribbean, training funds are critical to build a base of expertise for this region.

C. Progress Achieved Regarding Objectives Stated in Workplan

Progress has been excellent on all objectives of the workplan and, as indicated in I.A, outstanding on two of them.

D. Evidence of Biological/Social Sciences Integration

The release of transgenic plants in the developing world has major social implications. These are being addressed through detailed planning among the Universities of Wisconsin and Puerto Rico, APHIS/USDA and the government of Puerto Rico for initial tests in Puerto Rico during 1992.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

As noted in I.A.1, this project has collaborative involvement with scientists in numerous countries and several states in the U.S. Of particular note is the close working relationship with the DR and Honduras CRSP projects, with CIAT in Colombia, and with Agracetus, Inc. As the extended program is framed, there will be enhanced collaboration in Brazil, Costa Rica, Jamaica, Nicaragua, and Guatemala.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

None reported.

B. Adequacy of Current Management, Policies and Procedures

The EEP is aware of the concerns of the DR USAID Mission relative to continuation of CRSP activities under Secretaria de Estado de Agricultura. It is hoped that this can be resolved without loss of valuable resources that have been developed and/or of the valuable environment offered by the current site for the CRSP projects.

Dr. Maxwell rightfully identifies several policy concerns relating to transformation technology that need attention. The bio-safety and political implications of the transfer of genetically engineered germplasm need to be considered as does the "ownership" question. We are aware that these are receiving attention and can only encourage orderly resolution.

C. Activity Towards Buy-Ins and/or Other Funding

Dr. Maxwell has been quite successful in garnering support for this program. Sources other than the CRSP and University of Wisconsin include the World Bank, PSTC/A.I.D., USAID Costa Rica, a Costa Rica Foundation, the Brazilian government, and Agracetus, Inc. which total approximately $150,000. In addition, about $55,000 was provided for geminivirus work on tomatoes.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

As they address a complex disease that threatens bean production throughout Latin America, the project's activities clearly are appropriate to the CRSP Global Plan's goals. The project further aims to help build an institutional base to address this particular disease and which will be able to deal with virus diseases in general.

B. Balance Between Research and Training

Although the original CRSP budget did not provide funds for HC personnel, Dr. Maxwell has been able to garner both university and outside funds to sustain a major training component. The outcome has been quite a good balance between research and training (see II.C).

C. Balance Between Domestic vs. Overseas Activities

The nature of this research up to now has necessitated that it be heavily concentrated in the U.S. where sophisticated equipment and appropriately trained personnel are available. There has been increasing activity in the DR and a beginning of collaboration in Costa Rica and Jamaica. These will increase in the future as will collaboration with Puerto Rico and CIAT.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

See III.C.

E. Contributions of Collaborators Towards Accomplishment of Objectives

As indicated in III.C, HC collaboration has been limited but is increasing both in the DR and with newer interactions in Costa Rica and Jamaica. The DR/UNL project has provided significant assistance through their field resources in the DR. Agracetus, Inc. has been a major contributor in the bio-engineering work and in developing transgenic materials. Several other U.S. universities have provided and/or evaluated materials, notably the Universities of California, Florida, Arizona, North Carolina, and Puerto Rico. Finally, CIAT in Colombia has completed ovipositional preference studies on two landraces from the DR.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

As noted earlier, support of the DR Mission has been limited and, on some counts, negative. On the contrary, the Costa Rican, Honduran, and Jamaican Missions have been quite supportive. The Costa Rican Mission is supporting a Costa Rican graduate student working in the project.

G. Evidence of Institutionalization

There is no doubt that this line of research is well institutionalized at Wisconsin and that a network of U.S. universities and CIAT are in the bean virus business to stay. The process of development in the several host institutions is just beginning, but at least two (Costa Rica and Jamaica) seem to be sufficiently committed that the process will succeed. The outcome in the DR is less clear but, with recently trained personnel, it has at least a chance.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

Four technical publications, three Bean Improvement Cooperative technical reports, and one M.S. thesis are recorded for FY 91. Eleven technical presentations further document the productivity of this team.

V. OVERALL RATING: 1--Highly Satisfactory

A. General Strengths

The greatest strength of this project is the highly sophisticated technical facilities and personnel available to it, including the network linkages to technical resources outside the University of Wisconsin. A major reason for this is the unswerving support of the university administration as evidenced by the strong and steady financial and other support provided.

B. General Weaknesses

A weakness has been lack of a stable fund base for building HC collaboration. Hopefully, this will be helped in the FY 92-97 extension.

C. Recommendations

Implement the approved five-year extension plan

FY 91 EEP REVIEW

ECUADOR • UNIVERSITY OF MINNESOTA • GRAHAM

Improving the Productivity of Phaseolus Beans Under Conditions of Low-Input Agriculture Through Genetic Selection of Host Cultivars and Rhizobium Strains for Enhanced Symbiotic Efficiency

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

1. Research results disseminated and currently in use

This project is just in its third year so generally applicable results are not yet available to impact production agriculture. Additionally, the nature of the research is such that its utility, aside from use by other scientists, is limited to the long term. While practical applications to date have been limited, extensive exchange of materials and information has occurred, especially with CIAT, Colombia.

Significant progress was made during FY 91 in elucidating differential *Phaseolus* cultivar/*Rhizobium* strain responses. These studies are beginning to sort out groups of bean gene pools and *Rhizobium* strains that can ultimately guide breeding programs.

Work of others has suggested likelihood that there is host specificity in nodulation of this crop. This opens the possibility of restriction as a mechanism for enhancing benefits of introduced inoculum. Preliminary studies indicate that the line Puebla 152 displays restriction to indigenous Ecuadorian and to introduced Argentinian strains while displaying excellent nodulation with Type I strain of UMR 1632.

Significant progress was made in identifying genes responsible for acid and for salt tolerance in *Rhizobium* strains. Acid tolerance is one of the traits that can be used to distinguish two of the *Rhizobia* groups able to effectively nodulate common beans.

Baseline studies have continued on rhizobial, mycorrhizal, and root disease organism levels in Ecuadorian soils. Most soils showed rhizobial populations adequate to ensure competition with inoculant rhizobia. Initial data show very low mycorrhizal fungi levels associated with field plantings of beans. About 60 percent of 600 bean root samples from farmers' fields showed significant infection by *Fusarium* root rot organisms. The baseline studies also include nutrient level analyses in soils and plants for N, P, K, Ca, Mg, Zn, Mn, B, and Fe. It is evident that micro-nutrient deficiencies and possibly boron toxicity are probable yield-limiting factors in most bean-producing areas in Ecuador.

2. **Other research-related results**

Initial results of socioeconomic and gender studies identified principal crops, pest control methods, storage, and consumption problems, women's roles in agriculture and related information in seven communities in the Imbabura region.

A collaborative study with Peace Corps volunteers was undertaken to test solar, oil, and ash disinfestation methods developed in the Cameroon project. Both solar and wood ash treatments were quite effective but even the two-hour solar treatment elevated temperatures to the point of possible damage to seed viability.

3. **Changes in national production of beans/cowpeas in Host Country**

No data are available.

B. Institutional Development and Training

Since the host institution in Ecuador, INIAP, is in the process of achieving independence from the Ministry of Agriculture, it has recognized the need for trained personnel to serve the institution. The project has thus emphasized training at both the *egresado* and graduate level. Six *egresados* received support for their thesis work. Ing. Consuelo Estevez completed her M.S. and returned as HC PI. Gustavo Bernal has entered the M.S. program at Minnesota. Discussion with INIAP management has resulted in prioritization of future needs for graduate study in the U.S.

One would have to agree with the U.S. PI's conclusion that the project "has achieved a level of institutional development and integration that would have seemed impossible only one year ago," thanks to the work of the HC PI and INIAP management. He continues, "Much work remains to be done in this area, but we are clearly ahead of schedule. . . ."

C. Progress Achieved Regarding Objectives Stated in Workplan

Some of the more important findings were reported in I.A.1 and 2. Activity was reported and the EEP judges the output as satisfactory or better in all but two of the eleven objectives of the workplan. Overall, the progress is surely highly satisfactory.

D. Evidence of Biological/Social Sciences Integration

As outlined in I.A.2, a significant socioeconomic study was initiated in FY 91, a somewhat expanded activity, albeit fortuitously, than that originally planned. INIAP has expressed interest in expanding its capacity in this area and proposes training of an *egresado* and one graduate-level person in this area. It is also noted that the HC PI, one of the U.S. Co-PIs and six of the eight graduate students involved to date are female.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

As noted in I.A.2, the project is testing methodology developed by the Cameroon project. As to other linkages, close collaboration with CIAT and Mexican scientists is ongoing and the project participates in the CIAT-coordinated regional testing program, PROFRIZA.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

Current financial reporting in Ecuador continues to limit turnover of receipts and availability of funds for HC use. Hopefully, independence of INIAP will permit a more professional approach to fiscal management.

B. Adequacy of Current Management, Policies and Procedures

Aside from that noted in II.A, there seem to be no particular problems.

C. Activity Towards Buy-Ins and/or Other Funding

A buy-in for bean research in Egypt has been negotiated but has been disrupted by the unrest in the Middle East. Results of the work appears to be quite complementary to the work in Ecuador.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

Since nitrogen stress is an important production constraint to bean production in the developing world, improved efficacy in nitrogen fixation by the crop would seem highly appropriate to the Plan's goal of improving productivity and availability of this protein source to people. Specific activities of the project clearly bear on the question of improved nitrogen fixation.

B. Balance Between Research and Training

While no quantitative data are presented, it seems to the EEP that the balance might be improved if the training of Ecuadorian students were increased as proposed in the plan. This of course requires both qualified candidates and funds to support them but, in the long term, such a move would be of great benefit to the institutionalization of bean and other research capacity in Ecuador.

C. Balance Between Domestic vs. Overseas Activities

The balance as well as the division of labor seems appropriate, given current capacities and funding limitations. As HC capacity increases, more of the work relating specifically to Ecuador can and will shift to INIAP.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

The U.S./HC collaboration is excellent.

E. Contributions of Collaborators Towards Accomplishment of Objectives

As noted elsewhere, the contributions of the collaborators seem fully consonant with their individual capabilities.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

The USAID project officer has shown interest in the project but the Mission has not "bought in." The wife of a USAID officer in Quito was instrumental in bringing to fruition the collaborative work with the Peace Corps, and the EEP is of the belief that the USAID Mission lent support to the move for independence of INIAP.

G. Evidence of Institutionalization

As noted elsewhere, great strides toward institutionalization in Ecuador were made in FY 91. In the U.S., the support of the university has been strong and steady. There is no doubt that this activity is institutionalized.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

One book chapter, three technical publications, and one Bean Improvement Cooperative technical report are documented for FY 91. These, along with eleven technical presentations, indicate substantial documentation of progress.

V. OVERALL RATING: 1--Highly Satisfactory

A. General Strengths

The highly sophisticated facilities, cutting edge personnel and institutional support at the university, and the close and effective collaboration among UMN, INIAP, and CIAT are major strengths. From all reports, the performance of Ms. Estevez is a newly found strength at the helm of the Ecuador activity.

B. General Weaknesses

None

C. Recommendations

Implement the approved five-year extension plan

FY 91 EEP REVIEW

GUATEMALA • CORNELL UNIVERSITY • WALLACE

Agronomic, Sociological and Genetic Aspects of Bean Yield and Adaptation

The FY 91 Annual Report for this project focused mainly on discussions of the "Yield System Analysis" and "Additive Main-effects Multiplicative Interaction" effects analysis. Both of these processes have been considered at considerable length in previous reviews.

However, at this stage of the project, it is important to consider the long-term impacts of project activities, especially in the Host Country. The training efforts of the project have produced highly qualified scientists for the Host Country, and ICTA credits the CRSP research and procedures for recent success in breeding for improved adaptation and high yield. These accomplishments have been achieved through close, successful student/professor interaction. Dr. Wallace is to be complimented on his work with students from Guatemala as well as those from other developing countries and the U.S.

Unfortunately, the strength of personnel in the bean program at ICTA has been severely damaged by personnel turnover and the departure of three former CRSP scientists. It is therefore unclear what long-term impact will be sustained within the ICTA system.

As with all of the phasing out projects, the EEP is particularly interested in reviewing project final reports. We hope that the elements noted in our suggestions relative to final reports (Section II, page 3) are included in the document.

FY 91 EEP REVIEW

HONDURAS • UNIVERSITY OF PUERTO RICO • BEAVER

Improvement of Bean Production in Honduras Through Breeding for Multiple Disease Resistance

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

1. Research results disseminated and currently in use

The new small red breeding line DOR364 carrying BGMV resistance was released as "Dorado." The release was based on field trials carried out collaboratively by the Bean Research Program of the Ministry of Natural Resources, the Rural Development Program at EAP, and the University of Puerto Rico. EAP and the BRP/MNR also collaborated on holding field days and preparing bulletins to promote the new variety. About 4,000 pounds of basic seeds of Dorado was produced and distributed to seed growers. Approximately 40,000 pounds was multiplied by EAP over the past year.

In indeterminate dry beans, narrow-sense heritabilities for days to first flower (DFF) were large, indicating that early generation selection for DFF would be effective. However, narrow-sense heritabilities for days to physiological maturity were somewhat variable, ranging from intermediate to large, depending on planting dates. Some F_3 lines had reproductive periods more than ten days longer than their parents; but genotypes with reproductive periods from 39 to 41 days tended to produce the greatest yields.

An integrated approach to control BGMV and CB including the use of resistant varieties, clean seeds, crop rotation, and management of weeds has been developed. Project personnel have participated in preparing bean disease bulletins for training courses and extension and have contributed to developing a document on recommended bean production practices for school children.

A concerted effort is underway in several areas (including UPR, the DR, Honduras and others) to transfer leaf pubescence from Andean strains to Mesoamerican varieties. Small red and pinto beans with dense abaxial leaf pubescence have been developed.

2. Other research-related results

Nearly 600 accessions of bean germplasm have been collected in Honduras and are maintained at the EAP. More than 500 of these have been evaluated for disease resistance and agronomic traits. An additional

100 collections were made in 1991 with a grant from IBPGR and will be duplicated at CIAT and CATIE (Costa Rica).

3. **Changes in national production of beans/cowpeas in Host Country**

The project has conducted several studies to determine yield losses from diseases in Honduras. Studies are also underway to determine the potential impact of cultural practices and biological control of whiteflies for managing BGMV.

Bean production appears to have increased in areas like Arauli and Moroceli where seeds of Dorado have been distributed. However, a widespread impact will not occur until seeds can be distributed in the country. Recent privatization of certified seed production should increase the rate at which improved varieties are distributed in the future.

B. Institutional Development and Training

This component is proceeding very well. One student completed the M.S. degree and two EAP staff members initiated studies toward M.S. degrees at UPR. One is supported by the project; the other by a PROFRIJOL scholarship.

The project also supports a portion of the thesis research of five fourth-year students at the EAP. These studies include interspecific hybridization of *Phaseolus* spp., small-scale farmer acceptance of bean technology, and management factors affecting BGMV control.

Future training objectives are to support a HC Ph.D. candidate in plant breeding at MSU and his replacement will receive bean research techniques training at CIAT. An EAP staff member spent a month on bean rust research training at UNL and in 1992 plans to begin studies there for an M.S. degree.

A new faculty member has recently been recruited to work on bean rust. Bean research capability in Honduras has increased considerably through the project. As a consequence, the EAP has enjoyed greater success in attracting new donors. The project also contributed to the development and release of two new varieties: Catrachita (1990) and Dorado (1991), both small red beans. These represent the first new bean releases in 25 years.

Although the Ministry of Natural Resources has decreased its emphasis on bean research, the overall commitment and increased capabilities of the EAP imparts a great stability as well as regional impact to this project.

C. Progress Achieved Regarding Objectives Stated in Workplan

Progress has been very good. In addition to the release of Dorado, several CB, rust, web blight and BCMV resistant, as well as heat tolerant, lines have been selected for further evaluation. Other efforts have involved optimization of the reproductive period and yield, maintenance of heterogeneity, and strategies for bean rust management. A selection program for multiple disease resistance is being developed.

D. Evidence of Biological/Social Sciences Integration

The project continues to collaborate with social scientists at the National University of Honduras. The project supports the M.S. thesis of David Erazo which deals with the agricultural and social science factors that affect the adoption and transfer of common bean technology. Two fourth-year students at EAP have thesis projects studying the adoption of bean technology in the Moroceli and San Matias areas. Dr. Anne Ferguson, CRSP WID Specialist, will be consulting with project staff regarding farmer participatory research.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

There is excellent cross-linkage with other Bean/Cowpea CRSP projects, especially with the DR. The DR screened small red beans for resistance to BGMV. Dr. Kelly at MSU provided the "bc_3" gene for BCMV resistance in small reds, and Dr. Silbernagel will conduct the final screening for BCMV resistance in small reds.

Many bean projects in the U.S. (Nebraska, Michigan, North Dakota, California, Florida, and USDA) utilized the PR winter nursery. The project has also exchanged germplasm with several other CRSP projects; and a Honduran graduate student will screen the transgenic lines from the UWI CRSP project for susceptibility to BGMV and other traits.

Meetings were held in Honduras to explore possibilities for further cross-CRSP collaboration. Southern Honduras was selected as a region for initiating collaboration.

Collaboration with Dr. Maxwell's project at Wisconsin has required the UPR to establish a biosafety committee. This will allow the UPR to collaborate with biotechnologists in several areas. At UNL the greenhouse facilities for Dr. Steadman's rust research have been upgraded during 1991.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

Fiscal reports for the first half of FY 91 were delayed owing to adoption of a new computerized accounting procedure at EAP. However, the new procedures will facilitate management of funds at EAP. Another problem is delay in approving purchase of equipment, e.g., more than a year in the case of vehicles. New requests for equipment have been submitted to the MO.

B. Adequacy of Current Management, Policies and Procedures

Current policies and procedures for managing funds are satisfactory. Fiscal officers at both U.S. and HC institutions are familiar with CRSP policies and procedures and fiscal reports are arriving on a timely basis.

C. Activity Towards Buy-ins and/or Other Funding

Honduras was selected as one of four sites for possible cross-CRSP activities. Dr. Rosas (EAP) served as the Bean/Cowpea CRSP representative in a 1991 cross-CRSP planning meeting. There now appear to be opportunities for the project to collaborate with the Sorghum/Millet CRSP in the region. Cowpea lines from Dr. Hall's program (UCR) will be tried in the drier regions of Honduras. Drs. D. Cummins, Director, and Dr. O. Smith, TC Chairman, of the Peanut CRSP recently visited Honduras to plan activities for involvement there.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

The project's strategy to manage bean diseases through incorporating multiple disease resistance and alleviating production management practices will result in increased and more stable production of beans worldwide. The development of germplasm and technologies that help control major diseases of beans such as rust, BGMV, CB and WB will have wide research application. Similarly, the development of bean germplasm with greater heat and drought tolerance will allow the expansion of bean production into new regions and growing seasons.

B. Balance Between Research and Training

The balance between research and training was appropriate to address the objectives of the workplan. Estimated expenditures in FY 91 were $112,000 for research and $26,000 for training. However, the training budget does not include all of the expenditures for the EAP fourth-year students who work with the project and carried out thesis problems on program objectives. Other training support came from CIAT and from UNL (via a visiting scientist). Participation of project personnel in preparing bulletins and attending workshops are also considered training functions.

C. Balance Between Domestic vs. Overseas Activities

The balance is appropriate to address program constraints. Researchers at UNL provide the expertise to carry out basic research on pathogens; the UPR researchers develop bean populations with MDR and heat tolerance and study the inheritance of useful traits, while most of the applied plant breeding is done at EAP.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

Collaboration/cooperation is excellent. Researchers from the U.S. and HC meet frequently and trips are timed to maximize opportunities to review results in field and laboratory. Workplans, budgets, report, training, and travel activities are planned after thorough consultation among HC and U.S. personnel. The project is particularly well situated in the HC under the auspices of the EAP.

E. Contributions of Collaborators Towards Accomplishment of Objectives

HC in-kind contributions to the project were estimated to be more than $46,000. The time that Dr. Rosas dedicates to the project is contributed by the EAP. In addition, the EAP provides land, field machinery/irrigation equipment, laboratory, and germplasm storage facilities. Transportation, communications, publications, and administrative services are also provided by the EAP. In addition, the EAP provides the cooperation of and support services by the Germplasm and Seed Production Units.

The U.S. institutions (UPR and UNL) donate the times devoted to the project by Drs. Beaver and Steadman, respectively. Both institutions provide good facilities for carrying out bean research. The UPR charges the project a reduced rate for indirect costs at a savings of $7,500/year; but both institutions provide services worth considerably more than the CRSP-required 25 percent minimum.

The BRP/MNR has in recent years provided significant support to the project in terms of personnel assigned to EAP and farmer testing. Unfortunately, the national economic stress and other factors have essentially eliminated this support. At present, it is not clear what role, if any, the BRP/MNR will have in future bean research.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

USAID (Craig Anderson) is very interested in the project and has indicated possibilities of support. The Mission may also support some training activities through existing projects.

G. Evidence of Institutionalization

The bean research program at EAP has gained international recognition for its outstanding efforts. It has been highly successful in obtaining funding from several donors including PROFRIJOL, CIAT, USDA, NSF, IBPGR, NifTAL, and others. EAP administrators have given strong support to the project. The Seed Production Unit at EAP assumes responsibility for increasing seeds of newly released varieties. Collaboration with PROFRIJOL and CIAT ensures that project-developed genetic materials and technologies can be tested in Central America and the Caribbean region.

H. Other Comments

This project is proceeding in excellent fashion.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

Output has been very good. They include nine research articles (including theses), eight presentations in 1991 as well as four articles that were published late in 1990 in the Annual Research Report of the EAP Agronomy Department.

V. OVERALL RATING: 1--Highly Satisfactory

A. General Strengths

The collaboration and cross-CRSP activities are exceptional. The strength of the EAP and its regional dimensions are excellent.

B. General Weaknesses

None are apparent.

C. Recommendations

Implement the approved five-year extension plan

FY 91 EEP REVIEW

INCAP • WASHINGTON STATE UNIVERSITY • SWANSON

Improvement of Dry Bean Nutritional Quality and Acceptability

This project will be phased out during FY 92. A no-cost extension was granted until March 1992 in order to develop a final report and finalize the phaseout, including publication of a methods manual.

The overall objectives of this project were to: Develop storage methods to improve bean quality; determine the factors which affect the nutritional quality and acceptability of beans and to utilize this information and processing techniques to increase the consumption of beans by rural populations of developing Central American countries. Participants in this project also included Michigan State University and Kansas State University.

This project has had an excellent training record, having trained twenty Guatemalans, eighteen other foreign and twenty-two U.S. students.

Its publication record was impressive with 118 publications, a number of which were in Spanish and authored by INCAP personnel, plus 94 presentations, proceedings and workshops.

INCAP is a well-established research entity with an apparent long-term commitment to bean research. With the additional trainees and their long-term interest in bean research, this organization is well-equipped to continue contributing to the overall goals of this CRSP after the phaseout.

The EEP looks forward to the submission of a final report of this project and hopes that the elements noted in its suggestion relative to final reports (Section II, page 3) are included in the document.

FY 91 EEP REVIEW

MALAWI • UNIVERSITY OF CALIFORNIA-DAVIS • GEPTS

Improvement and Host Pathogen Co-Adaptation in Malawi, A Secondary Center of Diversity

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

1. Research results disseminated and currently in use

At the beginning of FY 90, this project was transferred to a new lead U.S. institution with a new PI (P. Gepts). However, the social science component remained under the direction of A. Ferguson (MSU). The transition appears to have gone smoothly.

At Bunda, trials have identified two Mesoamerican bean types with better overall performance than local germplasm. Pre-release testing is being initiated and subsequent release is expected. Crossing with higher yielding Malawi germplasm has been attempted.

UCD continues to generate gene pool origin information as a tool to select for crossing experiments.

Bulletins giving recommendations for bean production have been distributed to Extension workers. A technical paper on component breeding, which includes social aspects, has recently been published. Local accession seeds have been supplied to some Agricultural Development Divisions for multiplication by local farms.

2. Other research-related results

Promising bean accessions are being supplied for the Maize Improvement Program and the Adoptive Research Section for On-Farm Research. A mineral uptake experiment in an intercrop maize system indicated fertilization would further improve maize yields. A weeding experiment on monoculture or intercropping of beans and maize was also conducted. Pest and drought resistant bean accessions are being evaluated.

3. Changes in national production of beans/cowpeas in Host Country

The Seed Multiplication Program using farmer fields has some impact on increasing bean production. Data on changes in national production have not been obtained.

B. Institutional Development and Training

A change in the HC PI occurred in 1989. The prior PI remained on the bean team as a plant pathologist. A change in the Principal of Bunda College has occurred.

Dr. Mercy Mafuleka Ngwira completed her Food Science Ph.D. dissertation on Malawian bean seed coat quality characteristics and has returned to Malawi. Bunda is currently housing two M.S. degree students, one of whom is planning to pursue the Ph.D. at a U.S. institution. Two more M.S. candidates are expected to enroll at Bunda in 1992. Two Ph.D. candidates (one non-HC and one U.S.) are studying at UCD.

Plant pathology facilities at Bunda are being improved via equipment purchases.

Overall, the institutional development and training program at Bunda is proceeding very well with the development of a strong interdisciplinary team including biological, social and food technology components.

C. Progress Achieved Regarding Objectives Stated in Workplan

The progress achieved with respect to the FY 91 workplan appears satisfactory. Dr. Gepts has "taken hold" as PI and Dr. Ferguson (the Co-PI) continues her efforts in determining the socioeconomic constraints to bean production and utilization. Bean breeding programs are underway in Malawi, and the genetic research continues in the U.S. institution with considerable cooperative work with other institutions and Bean/Cowpea CRSP projects.

D. Evidence of Biological/Social Sciences Integration

This project has had a strong socioeconomic component since its inception with both HC and U.S. leadership. A recent Ph.D. has been trained in utilization (food science/technology) which should further strengthen this component. The three-region survey to identify socioeconomic constraints to bean production is near completion and a publication on component breeding strategies includes socioeconomic and economic benefit assessment.

A farmer participatory research program is under development which will strengthen the biological/social sciences integration. The EEP encourages continuing development of this area.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

This project has had excellent collaborative efforts in the socioeconomic component via the Tanzania/Butler-Malawi/Ferguson axis. In addition, a number of interactions with CIAT (Arusha, Tanzania) and SADCC have and are occurring. Germplasm from the Bunda seed store has been sent to five African countries plus Israel. Collaboration with the DR/UWI/Maxwell project continues, and is developing with the DR/UNL/Coyne and Mexico/MSU/Kelly CRSP projects, other universities, and a biotechnology company with an interest in bean genetics and BCMV.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

The fiscal management problems appear to be minimal.

B. Adequacy of Current Management, Policies and Procedures

Current practices appear satisfactory.

C. Activity Towards Buy-ins and/or Other Funding

Considerable activity is occurring. A buy-in by the USAID Mission is being pursued. World Bank funding is being sought to improve the bean research facilities at Bunda. A joint proposal from UCD and Bunda has been submitted to A.I.D./PSTC.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

The bean genome research has broad global impact, particularly with regard to the focus on BCMV. The identification of traits in Malawian accessions will increase the gene pool information.

B. Balance Between Research and Training

Expenditure and budget information indicates that there is approximately an 8:3 ratio between research and training, a satisfactory ratio.

C. Balance Between Domestic vs. Overseas Activities

The balance is satisfactory. Much of the basic research in biotechnology is being done at UCD. Breeding work has been jointly done at UCD and Malawi. The social science studies (surveys) were done in Malawi with the data analysis done in Malawi and Michigan State University.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

The collaboration in the social sciences area between the U.S. and HC has been and continues to be excellent. However, the interaction between the UCD biology component and the social science component at MSU suffers somewhat from the geographical separation of the two institutions. Interaction between the U.S. and HC institutions has been very good.

E. Contributions of Collaborators Towards Accomplishment of Objectives

This appears satisfactory as noted in III.C.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

Contacts with the Mission are continuing. No Mission support (buy-in) has been obtained to date.

G. Evidence of Institutionalization

Personnel with excellent capabilities for social science and biology (breeding, screening) are at Bunda. Training programs are augmenting the capability at Bunda including a food technology capability. The overall research program at Bunda is developing nicely. UCD has a long-term commitment to the genome research, and UCD has received alternate funding to support genetic research and some breeding studies are being conducted.

Overall, institutionalization is proceeding at a satisfactory rate.

H. Other Comments

Interaction between the Malawi and Tanzania projects continues to be a strength.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

The output has been satisfactory with eight presentations and eleven articles. Social science subjects contributed seven to this output.

V. OVERALL RATING: 2--Satisfactory

A. General Strengths

The biotechnology and social science components are strong. Care should be taken to maintain the balance and foster integration of the biological and social sciences.

B. General Weaknesses

Breeding research needs to be further emphasized.

C. Recommendations

Implement the approved five-year extension plan and continue development of breeding program

FY 91 EEP REVIEW

MEXICO • MICHIGAN STATE UNIVERSITY • KELLY

Improving Resistance to Environmental Stress in Beans Through Genetic Selection for Carbohydrate Partitioning and Efficiency of Biological Nitrogen Fixation

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

1. Research results disseminated and currently in use

The project focuses on the broad area of breeding and selection for drought tolerance.

In Mexico, research has focused on continued testing of the three cultivars previously released, as well as on work with new breeding materials.

U.S.-based research is focusing on activities that will allow research using molecular markers to map the trait of drought tolerance. These activities have included successful efforts to develop recombinant inbred lines from crosses between selected parents, and identification of restrictive fragment length polymorphism between parental lines used to generate RILs. Additional U.S. work on the physiological mechanisms of drought resistance was expanded during FY 91 to include: "(a) documenting susceptible and resistant bean genotypes and determining the physiological parameters for which they differ, (b) determining which physiological parameters appear to be related to drought resistance, and (c) identifying physiological parameters which may serve as tools for rapid screening of germplasm into drought resistant and drought susceptible categories."

During FY 91, progress was made on seed multiplication and semi-commercial evaluation of the three recently released cultivars: Pinto Villa, Bayo Victoria, and Negro Durango.

2. Other research-related results

Related ongoing research being conducted in Mexico includes implementation of a " . . . 'prebreeding' program to incorporate randomly the wild traits in cultivated species" and further collection of local wild *Phaseolus*. Research also continues on genotype and environmental effects on required cooking time of beans.

3. Changes in national production of beans/cowpeas in Host Country

These data were not reported in the Annual Report.

B. Institutional Development and Training

It is not reported whether the Mexican government's investments in training have helped build a nationwide bean program. It is unclear which of those people who have been trained will work on CRSP-related research. However, the return of Ing. A. Pajarito-Ravelero to the Durango station to work on breeding for drought tolerance will add depth to that program.

Several concerns remain from last year's review. Last year's EEP review raised concerns regarding the training needs of two junior researchers employed by the CRSP at the Durango station. Apparently they are not eligible for further training through INIFAP programs because they are CRSP employees. Last year's EEP review suggested that project funds be used to assist these individuals as a priority over assistance to new students from other countries. Since Mexican nationals have been provided training in the past, there is certainly a precedent for doing so again, especially for these researchers who have been so important for CRSP successes in Mexico.

Also in last year's EEP review, concern was expressed over the limiting factor of low levels of English language expertise among scientists in Mexico's legume research program. Unfortunately, this was interpreted as a concern only for HC students. In fact, the issue is one that would limit collaboration of even senior Mexican scientists and their entrance into a world scientific community which primarily communicates in English.

C. Progress Achieved Regarding Objectives Stated in Workplan

Although the Annual Report professes that satisfactory progress has been made in attaining the objectives of the workplan, the organization of this part of the Annual Report is such that it is difficult to determine whether or not progress has been made in some areas or to what extent there has been progress in other areas.

Apparently, progress has been made in the greater understanding of the types of root rot pathogens that are affecting bean crops in Mexico, with the most widespread and damaging diseases being *Fusarium* wilt and *Rhizoctonia* root rot. In the project's focus on biochemical markers, progress has been, as noted in the Annual Report, in the expansion of the program to include a focus on DNA molecular markers.

Through a general review of the total Annual Report, it appears that, while progress may be being made in all areas, FY 91 produced no specific results or new products/technologies.

D. Evidence of Biological/Social Sciences Integration

Although the Annual Report failed to address the integration of biological and social sciences, a piece of social science research was reported. Research on technology adoption by farmers in the Guadalupe Victoria district of Durango produced results that may help researchers overcome limitations on the

diffusion of new technology. This information should be helpful to the overall bean program in Mexico however, it is not clear how or why it will fit into the CRSP program. The rationale for its inclusion should be noted.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

None reported in the Annual Report

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

None reported in the Annual Report

B. Adequacy of Current Management, Policies and Procedures

No problems reported in the Annual Report

C. Activity Towards Buy-ins and/or Other Funding

Not reported in the Annual Report

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

The importance of drought as a limiting factor in bean production is evidenced in parts of all regions of the world where beans are grown. A focus on this problem (or its elements) is certainly appropriate to the Global Plan.

B. Balance Between Research and Training

While it appears that there has been a good balance between research and training, expenditures are not noted in the Annual Report nor are they related to training plans. There are also some concerns regarding current training plans noted in section I.B of this evaluation report.

C. Balance Between Domestic vs. Overseas Activities

There appears to be an appropriate balance, however, this was not actually reported in the Annual Report.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

This project has suffered in the last few years from turnover of U.S. PIs. It appears from the Annual Report that the current U.S. PI is finally on board and participated in the annual planning process in Mexico during FY 91. It is hoped that this business-as-usual approach to collaboration has been sufficient to bring the new U.S. PI into what has been a successful project in the past as a full collaborator.

As this project grows in both the more traditional program in Mexico and the high technology genetic engineering focus, it will be more and more difficult to maintain a collaborative program unless concrete efforts are made to incorporate Mexican scientists into U.S.-based activities, and vice versa.

E. Contributions of Collaborators Towards Accomplishment of Objectives

Not reported in the Annual Report

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

Not reported in Annual Report

G. Evidence of Institutionalization

Not reported in the Annual Report

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

The relatively small number of publications may be reflective of the current stage of each of the research activities in the project.

V. OVERALL RATING: 2–Satisfactory

A. General Strengths

The strength of the HC PI as well as the Mexico research program has sustained this project through a series of turnovers of the U.S. PI. Skills, expertise and commitment on the part of the Host Country have obviously been well institutionalized. It is hoped that, as the priorities of the project grow to embrace its new high technology genetic engineering, Host Country involvement can be maintained and further strengthened along with strong collaboration with the new U.S. PI.

B. General Weaknesses

It is difficult to determine whether the project merely suffers from poor report writing or from more serious problems, because of the omission of important information from the Annual Report. A review of Annual Report guidelines by the U.S. PI may be helpful.

As noted in last year's EEP review, the project is in need of a social science component to consider acceptance of new technology and its impact on farmers, farm families, and consumers.

C. Recommendations

The EEP, once again, suggests that the training status of the two junior scientists working in the project in Durango be considered. It also suggests that greater care be given to the preparation of Annual Reports.

The approved five-year extension plan should be implemented.

FY 91 EEP REVIEW

NIGERIA • UNIVERSITY OF GEORGIA • McWATTERS

Appropriate Technology for Cowpea Preservation and Processing and a Study of Its Socioeconomic Impact on Rural Populations in Nigeria

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

This project was scheduled to be phased out on September 30, 1991. A comprehensive phaseout plan for FY 91 was developed. An extension to March 25, 1992 has been granted including $27,500 in funding to finalize data acquisition. A new project on cowpea utilization was initiated in October 1991 with the University of Ghana-Legon and this U.S. team.

1. Research results disseminated and currently in use

A survey conducted in four communities in Anambra and Imo State indicated that suppliers of cowpea flour have increased over the baseline study of 1981-82 primarily in urban areas. The dry milling technology developed in this CRSP project is currently being used. Introduction of cowpea into the diets of children appears to be occurring at an earlier age than before and, in instances where cowpea-containing products were fed to malnourished children, the resulting recoveries were similar to those observed using milk/meat-containing diets. Two workshops were conducted in Nigeria on *moin-moin* preparation from cowpea.

2. Other research-related results

Basic information on the role of protein, starch and cell organelles on *akara* has been obtained in this project. Cowpea flour was found to decrease the time required for preparation of *akara* and *moin-moin* when compared to traditional methods.

Information regarding the cause and alleviation of the hard-to-cook defect in cowpeas has been developed as well as the effects of storage and drying conditions on cowpea flour preparation. Product development concepts were tested using cowpea flour in composite flour mixtures. An *akara*-acceptance study of U.S. teenage consumers indicated some degree of acceptance by this population group.

3. Changes in national production of beans/cowpeas in Host Country

The survey conducted on the impact of the availability of cowpea flour and its use indicated that: (1) cowpea consumption increased in frequency and quantity despite increases in market price; (2) marketing channels were not changed; (3) local cowpea production was not increased (probably owing

to soil limitations); (4) higher-income populations stored cowpea flour while low-income populations did not; and (5) milling and storage improvements lessened weevil losses and time and fuel required for preparation.

B. Institutional Development and Training

This project has been quite successful in enhancing the capabilities of the Host Country to continue development of cowpea utilization programs to train personnel and to hold workshops.

C. Progress Achieved Regarding Objectives Stated in Workplan

This project has made excellent progress in achieving its goals regarding utilization of cowpeas in Nigeria.

D. Evidence of Biological/Social Sciences Integration

As the thrust of this project has been utilization, it has involved women and children issues since its inception. Social scientists have participated in this project.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

This project has established linkages with a number of international organizations including AFRICARE, IITA and some private firms, as well as informal interactions with investigators of the Cameroon/Purdue/Murdock and Malawi/UCD/Gepts projects.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

None are apparent.

B. Adequacy of Current Management, Policies and Procedures

Appear to be satisfactory for the phaseout

C. Activity Towards Buy-ins and/or Other Funding

Not applicable

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

Technologies developed in this project have application worldwide, and many of the processing principles developed are applicable for processing beans as well as cowpeas and, in some instances, other commodities. Product development research also included utilization of a number of agricultural commodities.

B. Balance Between Research and Training

The expenditure data presented indicates that research costs comprised most of the FY 91 budget. However, this was owing to the phaseout. Overall, this project has had a history of a strong training component.

C. Balance Between Domestic vs. Overseas Activities

This balance has been highly satisfactory.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

There has been an excellent record over the life of this project.

E. Contributions of Collaborators Towards Accomplishment of Objectives

The University of Nigeria was a strong contributor to this project. The University of Georgia had and continues to have a commitment to cowpea research.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

The U.S. Embassy has a program of support for small-scale food enterprises in villages via supplying processing equipment. This opportunity is being looked into by the Nigerians.

G. Evidence of Institutionalization

The CRSP project team was recognized for its contributions by being awarded the Institute of Food Technologists International Award in June 1991.

H. Other Comments

The Georgia team has indicated it will continue relationships with the HC team and encourage the Nigerians to continue their cowpea program. The EEP is looking forward to receipt of the final report and to the new project involving the University of Georgia and the University of Ghana-Legon.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

Over forty were listed in the Annual Report, a number of which were authored or co-authored by Nigerians.

FY 91 EEP REVIEW

SENEGAL • UNIVERSITY OF CALIFORNIA-DAVIS • HALL

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

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

1. Research results disseminated and currently in use

Cowpea line IS 86-275 developed and extensively tested by the ISRA CRSP team has been named "Mouride" and is now an officially released variety. It promises to contribute to both level and sustainability of production due to multiple disease and striga resistance and adaptability to drier environments. Two other lines, IS 86-283 and B 89-504, are in advanced evaluation and may ultimately fill niches in the production spectrum.

Cultural research has shown that alternate row planting of early erect and medium-cycle spreading cowpea varieties increases average yields and yield stability under moisture and nutritional stress conditions.

Several recent findings are now providing guidance to breeding and production programs both in Africa and elsewhere. Collaborative research among ISRA, UCR and Oregon State University has shown the presence of cowpea severe mosaic virus in Senegal, the first such finding in Africa. It has been determined that genotypes with delayed leaf senescence have greater mid-season drought resistance than typical senescent genotypes. Carbon isotype discrimination in cowpea has been shown to be correlated with water use efficiency and appears to be a heritable character.

A bulletin on cowpea production in Senegal and a set of leaflets on production techniques and varieties are in the process of publication by the GOS. The mini-kit or farm experiments have resulted in substantial spread of both improved seed and production and storage technologies.

2. Other research-related results

Germplasm collection characterization has continued. Present UCR collection totals about 3,000. Materials have been provided to the USDA, the Cameroon/Purdue and Honduras/UPR projects, the Peoples Republic of China, and the Space Biospheres Project in Arizona.

In addition to seed production by mini-kit farmers, the ISRA team has collaborated with World Vision International to assist in seed production by farmers. This collaboration is being expanded.

3. Changes in national production of beans/cowpeas in Host Country

Data on production and consumption is very soft, as is the case in most developing countries. There does appear to be an increasing trend in fresh pod consumption with the introduction of early maturing varieties. Data on total plantings and production are quite variable and no clear recent trends are evident. As an aside, it appears that there is opportunity and interest in fresh pod marketing by women, a hopeful sign.

B. Institutional Development and Training

The project continues to make progress in building institutional capacity for cowpea (and other) research. Return of an M.S. scientist in January 1991 has permitted departures of the former project coordinator to pursue a Ph.D. in plant breeding. The plant pathologist participated in a short course on cowpea research at IITA and a junior person has joined the project at UCR to pursue an M.S. degree in breeding for drought tolerance. Unfortunately, the social scientist who worked with the ISRA staff during the past year has left the project for a position with the Canadian Embassy in Dakar. Recruitment has begun for a replacement.

With the above changes in personnel, the ISRA team remains very thin and fragile. As is the case of social sciences, there is a continuing threat to the viability of the team when even one person is lost. The hope is, of course, that stability can be achieved over time. It will, however, require continued CRSP presence for perhaps another five to ten years for this to happen. Also, this assumes that other assistance programs will give adequate attention to training to raise the technical capacity across the board.

It is noted that the UCR team is losing the plant pathologist who has served so effectively as Dr. Hall's associate. Recruitment is underway for a replacement, but there is no guarantee that Dr. Patel's shoes will be completely filled.

Finally, the UCR is to be commended for the excellent support provided to this project. It has fostered through provision of facilities, financial and human resources, the maintenance of a stable and effective institutional framework for this program.

C. Progress Achieved Regarding Objectives Stated in Workplan

It is abundantly clear from study of the project's Annual Report that the objectives have been aggressively pursued and that a very great deal has been accomplished, both in the U.S. and in Senegal. As noted in I.A, a number of significant findings have emerged.

As in any agricultural commodity research program, progress in understanding opportunities and constraints is slow and difficult and only comes incrementally over time. This project is a very good example of how a total objective can be addressed by partitioning into discrete increments and assigning them as to potential impact and technical feasibility. This has resulted in steady progress on several fronts, the aggregate of which constitutes substantial progress.

D. Evidence of Biological/Social Sciences Integration

As a result of surveys by the social scientist, there has emerged a better appreciation of gender roles and attitudes among team members and a clear willingness to accommodate participation in both production ("mini-kit") and storage, marketing, and consumption aspects of the total cowpea program. This will surely be fostered as the ISRA team engages in expanded collaboration with World Vision International in seed production, storage, and marketing and with WVI and the Food Technology Institute in Dakar in research and education efforts on utilization of cowpea in cereal-based diets.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

As indicated earlier, seeds have been supplied to the Cameroon and Honduras projects and to USDA. Collaboration has also occurred with the University of Georgia and with the INTSORMIL team at Purdue. Tho project continues to maintain close liaison and exchanges information and materials with the cowpea team at IITA. The collaboration with Oregon State University has begun to bear fruit with identification of a previously undetected virus in material from Senegal. It is also an important training resource. The recently initiated collaboration with World Vision International is most promising and, hopefully, can be expanded in future years. Finally, the strength and effectiveness of this program is further documented by its designation by SAFGRAD as lead center for cowpea breeding in Africa.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

The continued budget shortfalls by the GOS and the California Agricultural Experiment Station may generate a need for supplemental funding for the January-June period.

B. Adequacy of Current Management, Policies and Procedures

The project leader has done an admirable job of managing resources to maximize research and training activities under difficult circumstances. Aside from funding problems, the only problem mentioned was restriction on vehicle imports by the GOS. Hopefully, the USAID Mission will assist in facilitating registration of the new vehicle required by the project.

C. Activity Towards Buy-Ins and/or Other Funding

Previous A.I.D. support for cowpea research in ISRA and in the Food Technology Institute is to be or has been terminated. The "Strategic Plan" of the Mission essentially excludes support for programs in the drier areas where cowpeas are grown. Hopefully, the Mission will be able to support the proposed collaborative efforts with World Vision International, ISRA and the Food Technology Institute.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

The range of scientific activities related to cowpea production encompassed in this project (breeding, physiology, agronomy, pathology, and entomology) are clearly appropriate. Similarly, those activities and collaborative efforts related to conservation and utilization (storage, nutritional qualities, and consumption) relate directly to goals of the plan.

B. Balance Between Research and Training

The EEP feels the balance between research and training is proper. It would be hoped that qualified students from Senegal could be approved for training rather than such heavy involvement of Sudanese. This would help in building a Senegalese capacity to reduce the likelihood of damaging personnel attrition in the cowpea program.

C. Balance Between Domestic vs. Overseas Activities

The EEP feels the balance over the past three to five years has been appropriate. Concern over budgetary problems of the GOS along with at least temporary loss of the social scientist and both the field and storage entomologists from the ISRA team raises at least short term concern for the ISRA component of the total program.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

Collaboration in this project has been exemplary. It has encompassed the full spectrum of activities and has even extended to inter-CRSP and other institutional collaboration.

E. Contributions of Collaborators Towards Accomplishment of Objectives

As indicated elsewhere, this is a fully "shared" program with well-conceived division of labor. Although funding has not always been optimally divided, the research collaboration has been exemplary.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

The interest and support of the USAID Mission is appreciated.

G. Evidence of Institutionalization

It is quite clear that the administrations of both UCR and ISRA are fully supportive. Funding constraints sometimes limit the enthusiasm with which that support is exercised but, thus far, the outcome has been quite positive.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

One Ph.D. and one M.S. dissertation, one book chapter, two poster and three oral presentations, and the several required Annual Reports indicate substantial documentation of progress.

V. OVERALL RATING: 1--Highly Satisfactory

A. General Strengths

Comprehensiveness, both in planning and execution, and collaboration, both internal and external to the project

B. General Weaknesses

Insecurity of funding and personnel availability by the GOS is a potential problem.

C. Recommendations

Implement the approved five-year extension plan

FY 91 EEP REVIEW

TANZANIA • WASHINGTON STATE UNIVERSITY • SILBERNAGEL

Breeding Beans (Phaseolus vulgaris L.) for Disease, Insect and Stress Resistance and Determination of Socioeconomic Impact on Smallholder Farm Families

I. PROGRESS DURING FY 91

A. Specific Research Contributions in FY 91

A bean line (designated SUA90), which is high yielding, resistant to BCMV, rust, ALS, drought tolerant and with good sensory attributes, was officially released in 1991. SUA90 seed multiplication is underway. Excellent results have been obtained by farmers who have used SUA90. However, official seed multiplication systems are very slow, and a private Dutch company has been contracted to supply seed. SUA will also participate in seed multiplication. Several additional promising bean lines are in final stages of testing prior to release. Breeding studies have also emphasized pathogen and stemfly resistance and early maturity to decrease the need for drought resistance.

Because of the appearance of BCMV in Idaho seed fields, genetic aspects of BCMV resistance and efforts to develop resistant U.S. varieties are underway.

Short-term storage studies have indicated that high-temperature/high-humidity storage conditions may decrease cooking time, but additional storage after exposure to this environment increases the hard-to-cook phenomenon.

1. Research results disseminated and currently in use

SUA90 seed is being multiplied and, in limited farm use, has had excellent results. The impact of this release is expected to be highly significant. The farmer participation research is a mechanism for enhancing impact of new varieties and technologies. A paper entitled "Improving Farmer Selection for Participatory Research" was developed for the 1991 Bean Research Workshop.

2. Other research-related results

Bruchid incidence and the effects of various procedures to prevent bruchid damage, such as coconut oil coating, wood ash treatment and commercial insecticides, are being determined. The relationship of stem rot and *Fusarium* infection is being determined. The role of intercropping with maize on stem maggot damage is also being evaluated. A study on the use of various nitrogen sources has indicated that organic fertilizer and inoculum is preferable to high cost commercial fertilizers.

3. Changes in national production of beans/cowpeas in Host Country

Impact studies have not been initiated; however, a major impact of the release of SUA90 is expected. Baseline data had been obtained previously facilitating impact studies.

B. Institutional Development and Training

Institutional development and training efforts have been very good. Two Ph.D. candidates have completed their degrees, two others are currently enrolled in U.S. institutions, and three are pursuing Ph.D. degrees at SUA.

A video on participating farmer research is being developed and a training program initiated at SUA. Four prior trainees are now working with this project. Overall, the SUA has developed a very good and comprehensive institutional capacity to support bean research.

C. Progress Achieved Regarding Objectives Stated in Workplan

This project, although broad in scope appears to be meeting its workplan objectives. The release of SUA90 looks very promising. Farmers are now participating in the research. Other bean lines are in the pipelines for future release. Plant pathology and entomological research is underway in support of the bean breeding program. Methods have been developed to detect BCMV in the U.S.

D. Evidence of Biological/Social Sciences Integration

The farmer participation efforts will be important in assessing the socioeconomic constraints associated with the release of new bean varieties. In addition, the proposed PI (Dr. Butler) is a social scientist, and strong collaborative efforts are being developed with the Malawi project (Dr. Ferguson). Attention is being given to screening bean cultures for protein, anti-nutritional factors, cookability and use in various products. The Food Technology Department at Sokoine University has collaborated with this project.

E. Collaboration with Other Bean/Cowpea CRSP Projects and Other Linkages

This project has had a long history of collaborative efforts. Bean lines developed by this project have been tested by CIAT/SADCC. Other collaborative interactions are underway with a number of Tanzanian agencies and organizations in the Netherlands. U.S. collaborative efforts, particularly on BCMV, have been ongoing with Washington State University, the University of Idaho, Clemson University, and researchers in Australia, Germany and Canada.

II. FUNDING/FISCAL MANAGEMENT IN FY 91

A. Problems

HC expenditure statements remain slow as is the case in many of the projects, but corrective measures are being pursued. No major problems are apparent. The HC has a strong institutional commitment to this project.

B. Adequacy of Current Management, Policies and Procedures

The current procedures, policies and management appear satisfactory.

C. Activity Towards Buy-ins and/or Other Funding

A USAID Mission buy-in attempt was not fruitful. Funding for one of the SUA participants was obtained from the International Foundation of Science to support utilization (cookability) research. A grant was awarded from CIAT/SADCC to establish BCMV nurseries in East and Southern Africa.

III. STATUS IN FY 91

A. Appropriateness of Activities to Goals of Global Plan

The breeding program has global application. In addition, this project has developed a comprehensive program involving social science and utilization components which have global and regional impacts.

B. Balance Between Research and Training

This project has had an excellent record in training. The research component continues to be strong.

C. Balance Between Domestic vs. Overseas Activities

This appears satisfactory. The basic studies on BCMV diagnosis are primarily centered in the U.S., and the breeding and social sciences studies are centered in the HC.

D. Level of Collaboration/Cooperation Between U.S. and Host Country

This continues to be excellent.

E. Contributions of Collaborators Towards Accomplishment of Objectives

Satisfactory--Personnel have had a long history of close collaboration to achieve the objectives.

F. Interest, Involvement and Support of USAID Mission/U.S. Embassy

Not commented on in the Annual Report, but support from the Mission continues to be pursued.

G. Evidence of Institutionalization

This project has developed a strong interdisciplinary capability at SUA which indicates a long-term institutional commitment.

H. Other Comments

This project has developed a strong regional capability in production/utilization. Coupled with the development of the Malawian capability, this constitutes an exceptional capacity to address bean research in the East and South African region. Attention should be given to developing a total capability in bean research without duplicative efforts between these projects.

IV. PUBLICATIONS AND PRESENTATIONS IN FY 91

Highly satisfactory--Over 30 publications are listed. The EEP looks forward to the developing publications in the social sciences.

V. OVERALL RATING: 1--Highly Satisfactory

A. General Strengths

Development of HC institutional capability

B. General Weaknesses

No significant weaknesses are apparent.

C. Recommendations

Implement the approved five-year extension plan

BEAN/COWPEA CRSP FY 92 EXTERNAL EVALUATION PANEL (EEP)

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