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REPORT ON WORKSHOP

WORKSHOP TO DEVELOP A COLLABORATIVE PROJECT FOR BEAN RESEARCH IN EAST AFRICA

NOVEMBER 16-21, 1983

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Report on Workshop

Workshop to Develop a Collaborative Project For Bean Research in East Africa

November 16-21, 1983
Centro Internacional de Agricultura Tropical
Cali, Colombia

Submitted to: John B. Slattery
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REPORT ON WORKSHOP

I. Introduction

A. Background

Increasing bean production in East Africa is recognized as important to meet food security objectives of the national governments. Beans (Phaseolus vulgaris, L.) are an important source of protein, especially for low-income families, and most are grown by smallholders as a subsistence crop. Recurrent droughts, high population growth rates and urban migration lend greater urgency to the need to increase production and productivity of this popular food. Donor nations, concerned to alleviate world hunger, have given attention to support of agricultural research, especially research that recognizes the resource and other constraints faced by the smallholder farmers, the major producers of food crops.

The Center for Tropical Agriculture (CIAT), based in Cali, Colombia, began in 1969 as an international agricultural research center with a focus on crops that can alleviate the nutritional deficiencies of low-income people: beans, cassava and rice. CIAT attempts to develop a technology which takes smallholder farmer constraints, cropping systems and cultural patterns into account. While CIAT was assigned world responsibility for collection, preservation and improvement of bean germplasm (by the Consultative Group on International Agricultural Research), initially it directed its efforts to Latin America and developed varieties which have increased production and productivity there. This experience, along with their germplasm bank, have been recognized as also valuable for improving bean production in East Africa. Following Dr. O. T. Edje's study at CIAT in 1977/78, a plan was drawn up to hold a workshop in Malawi, co-sponsored by CIAT and the Bunda College of Agriculture of the University of Malawi, to study the feasibility of starting a collborative regional program in Eastern Africa. A Workshop on the Potential of Field Beans in Eastern Africa was held in Lilongwe, Malawi, from March 9-14, 1980.

Subsequent to this Workshop a request was made by CIAT to AID to finance a regional bean research program in East Africa. Since AID also finances the Collaborative Research Support Program (CRSP) activities in this region, it felt a joint research plan should be developed and another workshop held to work out this collaborative effort. This was first referred to as a Workshop on Integration of Research Efforts of Bean/Cowpea CRSP, CIAT and National Bean Programs in Kenya and Uganda. The objectives were to develop a joint research plan, and to draft an improved Project Paper, with discussion among all the interested parties.

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coordinate research activities, and distinguish between emphases in genetic research, was reached between CIAT and CRSP in informal meetings during the workshop. However, because the workshop proposal was to be presented at the December meeting of the Ad Hoc Committee for Agricultural Research of Cooperation for Development in Africa (CDA) by George Dion of CIDA, it was decided that separate draft proposals would be prepared by CIAT and CRSP during the final days of the workshop.

The draft Bean/Cowpea CRSP proposal, "Strengthening the Bean Research Program at the University of Makerere," was presented on Sunday evening (Appendix 5). CIAT presented its draft proposal, "Regional Project to Increase Bean Production and Consumption, and to Strengthen National Bean Research in the CDA Countries of Eastern Africa" at the same time (Appendix 6). The primary project countries in the CIAT proposal were: Uganda, Kenya, Ethiopia, and Somalia. Both proposals were reviewed and discussed in plenary sessions Sunday evening and Monday morning. Suggestions for revision of the two proposals received during and after these sessions would be incorporated into subsequent drafts of the proposals. The CIAT proposal was to be revised and submitted to CIDA, CDA, and AID by the end of the week, while the CRSP proposal was to be submitted to a CRSP review process before being presented to AID later.

II. SUMMARY OF PRESENTATIONS, DISCUSSIONS AND ACTIVITIES

A. Presentations of African Bean Research Programs

1. Kenya

Mr. S. Muigai of the National Horticultural Research Station in Thika presented an overview of Kenya's bean research program. His presentation was accompanied by some slides and was a joint report with the other Kenyans, who submitted two papers (Appendix 7).

After describing Kenya's bean production areas, Mr. Muigai listed the objectives of the bean research program and the major topics being researched. He noted that while dry beans are the most important pulse crop in Kenya, cowpeas and pidgeon peas are also grown and being researched.

The University of Nairobi, which has a Bean/Cowpea CRSP project, works closely with the Ministry of Agriculture. Its bean research will continue to emphasize the development of drought-tolerant varieties suitable for the semi-arid areas of Kenya.

2. Uganda

Mr. Mukasa of the Ministry of Agriculture described the history of bean research of the Ministry in Uganda, characterized by expansion in the sixties and decline during the period of civil strife beginning in the seventies. He stressed the need for rehabilitation of the agricultural research infrastructure and programs by external assistance. He presented an overview of the staffing and work being carried out at the three research stations of the Ministry of Agriculture: at Kawanda, Serere, and Namulongwe (Appendix 8). Sophie Masaana then described the bean research program at Kawanda in more specific detail.

Dr. Mukiibi of the University of Makerere described the developmental stages in agricultural research in Uganda and the University's rise to prominence before 1972. Currently there is a need to reestablish Uganda's germplasm bank, to improve infrastructure and facilities as well as to increase the number of trained staff. The major limiting factor is financial and much needs to be done to strengthen the research program. He described the University's work with the Ministry of Agriculture; its cooperation with the other East African universities, even after the collapse of the East African Community; and its collaboration with the international research centers, IITA and CIAT.

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3. Tanzania

Mr. Koinange, the Head of the Legume Program of the research station at Lyamungu, gave an overview of the four major bean production areas in the highlands of Tanzania, listing the three entities responsible for bean research in these areas. He then described the parastatal Tanzania Agricultural Research Organization (TARO), formerly with the Ministry of Agriculture, responsible for the work in the north. After describing TARO's principal research topics and projects, he identified the major constraints to their work.

A second parastatal entity, Uyole, is responsible for the south western highlands area. Ms. Catherine Madata described the bean research activities and achievements of this station and its six substations.

The third entity responsible for bean research is the Faculty of Agriculture of the University of Dar-es-Salaam. Its research station is based at the Morogoro campus. Dr. Matt Silbernagel, the Principal Investigator for Tanzania of the Bean/Cowpea CRSP, described the University research program. He indicated collaboration with CIAT in that some staff received training from CIAT and the program utilized material from CIAT.

4. Malawi

After presenting some information about Malawi in general utilizing a slide presentation, Dr. Todo Edje gave a comprehensive overview of the history and accomplishments of Malawi's bean improvement program (Appendix 9).

He then described the CRSP project at Bunda College and how it evolved from the Malawi Conference as well as a recent visit to Malawi by Drs. Pat Barnes-McConnell and Wayne Adams. An important orientation of the university's research program concerns socio-economic constraints and cultural practices regarding utilization and consumption of beans.

5. Ethiopia

Imru Assefa began with an overview of Ethiopia's ecological regions and the organizational structure of its agricultural research program, which began in 1966. He described the major reorganizations of the program: in 1977 into 8 research departments, and then to a team research approach, with 15 multidisciplinary teams, beginning in 1980. His research team, the mid and lowland pulse team, utilized CIAT germplasm for haricot beans, which were not well accepted or utilized. He then outlined the available resources and resources needed to improve bean research in Ethiopia.

B. Donor, CRSP, and CIAT Presentations

1. Donor presentations

a. Cooperation for Development in Africa (CDA)

Dr. H. G. Dion, from Canada, stated he was representing Cooperation for Development in Africa, a donor's consortium founded in late 1979, including the United Kingdom, Belgium, France, West Germany, Italy, the United States and Canada. Agricultural research is one of six priority areas. While the United States has overall responsibility for the agricultural research activities of the CDA, Canada has responsibility for Agricultural research in the East Africa region, which includes Kenya, Uganda, Ethiopia, Somalia, Ruwanda and Burundi. Dr. Dion described the long-term research program envisioned, stressing a regional network center based in one nation, with various resources in other locations. He then described the types of assistance CDA would provide, given regional consensus as to what is needed. He stressed that African Ministries of Finance and Economic Planning as well as of agriculture must be supportive of these proposals. While the goal of CDA is for a number of donors to be involved, avoiding overlap and duplication, obviously bilateral programs would continue.

b. Agency for International Development (AID)

Dr. Carv Wiggin, of the Office of Technical Resources of the Africa Bureau of AID/Washington, addressed the issue of AID's funding of the project paper to be developed during the workshop. He outlined the major items that should be included in the final project proposal to be considered for funding by AID--a phased five-year regional project that describes linkages with other work going on in the area, including the collection of baseline data, an economic analysis as well as analysis of expected project outputs and impact, needed for evaluation and monitoring of the project.

2. The Bean/Cowpea Collaborative Research Support Program (CRSP)

Dr. Patricia Barnes-McConnell, Acting Director of the Bean/Cowpea CRSP, conducted an informative slide presentation, noting that CRSP's efforts were currently in Africa and Latin America. She described the organizational structure of the AID-funded, land-grant university-based program which is approximately three years old (Appendix 10).

After reviewing the major constraints to increased bean production identified in the CRSP planning phase, Dr. Barnes-McConnell presented the major features of the CRSP philosophy: mutual collaboration of U.S. and host country colleagues; host country's role in deciding expenditure of 50 percent of program

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funds; multidisciplinary research; maximum use of research in traditional settings;and monitoring impact on women and families, hunger and malnutrition.

3. Centro Internacional de Agricultura Tropical (CIAT)

Since Dr. John Nickel had described CIAT's philosophy of complementarity and regional cooperation in his introductory remarks defining the goals of the workshop, Drs. Aart van Schoonhoven and Jeremy Davis described in detail CIAT's bean research program.

Dr. van Schoonhoven utilized a slide presentation and listed reasons for the disparity between potential bean yields (on research plots) and actual yields with the same varieties. He described how CIAT shares its germplasm and works with host country researchers.

Dr. Jeremy Davis reviewed CIAT's experience breeding beans at various altitudes in Latin America, and outlined some of the special problems encountered in Africa but not Latin America.

C. Small Work Groups

Following these presentations, the workshop participants were divided into three small working groups which met for an afternoon to prioritize areas for bean research in East Africa (Appendix 2). Three groups were formed according to research focus of participants' academic background and work experience: one each for genetic improvement, agronomic improvement and utilization improvment. Where possible each group had participants from various African countries, CRSP, donors and CIAT. Facilitators were provided suggested discussion questions to give direction to the sessions (Appendix 11). Recorders were selected by each group and asked to prepare flipcharts for their presentations to the entire group the following morning. The conclusion of the work groups, together with the list of members of each, are found in Appendix 4.

D. Field Trips

The group was provided the opportunity to visit the CIAT research facilities at the headquarters located between Cali and Palmira in the tropical Valle de Cauca, and two other research stations based at different altitude and climatic conditions near Popayan and Quilichao. Different bean varieties were tested under no input, low and high input (e.g., of fertilizers) conditions as well as for resistance to a variety of diseases and pests under these input conditions. Both climbing and bush varieties were being tested at the research stations. Other conditions being tested were intercropping in association with maize and how length of light period affects growth rate. Careful, computerized records were kept of the germplasm

developed and of yield results obtained in each section of the experimental plots at the research stations. Participants from Africa observed similarities and differences in comparing the CIAT experiments with theirs in Africa.

E. Review of Draft Proposals

The revisions in the agenda and in projected outcome of the workshop were discussed earlier (Introduction, Appendix 3).

The two major questions presented at the Friday afternoon discussion were: What is CIAT's response to the needs and plans of the African national programs? What is CRSP's response? Representatives of both CRSP and CIAT stressed their history of collaboration and their desire to work together while admitting there were some conflicts, duplications and complications arising in part from funding considerations. Both stressed a desire to work in partnership with the African programs (and their need for African invitations), and noted that while CRSP's primary linkage was with the national universities, CIAT's was with the Ministries of Agriculture. It was agreed that both entities would formulate separate draft proposals for donors, yet the program would be collaborative. A variety of ideas about differentiating CIAT and CRSP areas of research were discussed both in formal, plenary sessions and in informal meetings with various participants, especially of CIAT and CRSP.

There was discussion, too, that while Tanzania and Malawi would not be included in this CIAT proposal, because they are considered by the CDA to be in the Southern Africa region; they would be included indirectly, insofar as other bean research projects in the area could be invited to regional meetings and visited by participants in this project. Other funding restrictions clarified were that AID could not fund the Ethiopian segment at this time and that CDA donors, other than the U.S., would not fund CRSP projects.

In the plenary sessions on Sunday evening and Monday morning, Aart van Schoonhoven and Pat Barnes-McConnell outlined principal features of their proposals (Appendices 5 and 6). Doug Laing, CIAT's Director of Crop Research, presented a chart-schematic of two different manners of relationship with host countries that CIAT has utilized: a regional approach, made more difficult in the case because there is no regional entity formed, and a bilateral approach. He emphasized that the purpose of the workshop was to develop a proposal for funding the former in East Africa.

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Suggestions were accepted for revision of the CIAT proposal. Several Africans voiced their concerns about the need for funds to run their own on-going programs (especially recurrent costs that bilateral donors are generally reluctant to fund), about African input into selection of project staff, etc. Dr. Nickel pledged that the revisions would be made, a budget drafted, and a completed proposal mailed to donors and participants by the end of the week. Dr. Dion said he would present the proposal to the CDA Ad Hoc Committee for Agricultural Research at its mid-December meeting in Paris, and that he estimated a high probability of Canadian funding for the CIAT project in excess of $1 million by Spring or Summer 1984.

III. DEVRES' CONTRIBUTION TO THE WORKSHOP

A. Overview

Devres contributed to the workshop in several significant ways. As the implementor of USAID-funded agricultural research activities in Africa, Devres has been in touch with a number of donors and African researchers during the past year in an effort to assess the status of and needs for agricultural research generally in Africa. Hence, it was in a good position to assist in making plans for the workshop. Devres staff helped to plan the agenda of the workshop in a pre-planning meeting in October 1983 and to carry out the actual workshop at CIAT from November 14 through 23. The staff assisted in logistical arrangements before and during the conference as well as in providing administrative support to workshop participants.

B. Pre-Planning

Devres' President, Jayne Millar Wood, made a trip to CIAT in October to assist with the initial planning of the workshop. Working closely with Dr. van Schoonhoven and Dr. Pat Barnes-McConnell, Ms. Millar Wood helped structure the workshop's agenda, decide on the participants, sort out administrative and financial details, and discussed parameters of the proposal to be developed at the workshop.

C. Administrative Assistance

Devres began the administrative tasks of the workshop in mid-October as the list of participants began to be formulated and the process of contacting those individuals could commence. Five representatives from CRSP were identified: Wayne Adams, and Pat Barnes-McConnell of Michigan State University, Barry Swanson and Matt Silbernagel of Washington State University, and Barbara Webster of the University of California at Davis. Colleen Stapleton made arrangements to procure tickets and visas for them (with the exception of Pat Barnes-McConnell who purchased her ticket herself and Matt Silbernargel who procured his visa through USDA).

The reimbusement of travel expenses for three CRSP representatives was done in Cali, while two of the CRSP's elected to await payment from Devres upon our receipt of bills for expenses incurred.

The Africans' plane travel arrangements were handled by CIAT's travel bureau. However, initial communication with the invitees was handled by Devres once a confirmed list had been drawn up. In order to maximize the chances that the participants were notified in time to make arrangments to attend, a series of three letters were dispatched by Devres in November.

Letters of invitation were mailed directly to participants; letters requesting for permission from supervisors, accompanied by a copy of the letter of invitation, were airmailed to appropriate African Ministry and University heads; letters of invitation for the African participants were also sent to the Agricultural Development Officers in the respective U.S. embassies, with the request that the U.S. Embassy assist in notification. A cable to that effect was also sent to the embassies by USAID. CIAT wired prepaid tickets and ten participants (out of 12 original invitees) from Africa were present at the workshop.

Ms. Stapleton met eight of the Africans at the Miami Skyways Hotel on Monday, November 15, en route to Cali (two of the Kenyans arrived in Cali at later dates on their own). The group dined together and had the opportunity to begin discussion of the topics to be considered at the workshop. The procedures for reimbursement, visas and departure for Cali the next day were explained.

On Tuesday morning the African participants were reimbursed for their en route expenses and completed the paperwork needed to obtain Colombian visas. In some cases, estimated return expenses were higher than actual arrival expenses due to layovers required by flight schedules. While all Africans were able to procure in their country some dollars for travel, the amount and ease in obtaining dollars varied per country. Several could not obtain sufficient dollars to cover en route expenses.

Ms. Stapleton procured Colombian visas for the six Africans who needed them with some difficulty on Tuesday afternoon. Devres had been furnished with a copy of a cable from the U.S. Embassy in Bogota. For future reference, notification of host country authorization (in this case by the Colombia Ministry of of Foreign Affairs) must be received by the host country's US-based consulate in order for the visas to be processed expeditiously. There was also some difficulty at the Miami airport, when Eastern Airlines delayed validating the two Kenyans' plane tickets, requesting additional fotos not normally required.

Financial reimbursements for the five CRSPs and two late-arriving Africans were conducted during the course of the workshop by Devres. Discussions with CIDA, AID and CIAT representatives were held to determine how the expenses should be presented and paid for. On November 23, 1983, Devres staff presented to Andrew Urquhart, CIAT's Director of Finance and Administration, documentation detailing the travel expense/per diems incurred by the ten African participants and paid by Devres. CIAT will reimburse Devres for these expenses and CIAT, in turn, will bill the Canadians for the African's travel. Devres was also clear in stating that Devres/USAID should be billed for accommodation expenses only for the five CRSP and two Devres representatives who attended the workshop. Other Africans, Americans, and Europeans invited by CIAT to attend will be paid

be paid for by their respective agencies or by CIAT. Devres will present expense sheets and air ticket vouchers for the seven Americans listed above to USAID for reimbursement.

Devres also prepared a detailed participants' list (Appendix 1) based on a questionnaire prepared by Colleen Stapleton.

D. Workshop Coordination

Workshop cocordination was provided by Devres' Senior Associate, Kathy Desmond, who arrived in CIAT two days prior to the workshop in order to assist with pre-workshop planning. This included: finalizing the agenda and preliminary participants' list, preparing packets of material (including translating a map of CIAT into English), arranging for bilingual secretaries and inputing the draft project paper into CIAT's IBM word processor. During this phase, the two principal CIAT contact persons were Dr. Jeremy Davis and Ms. Eugenia Cobo, CIAT conference secretary.

During the course of the workshop, Ms. Desmond reported to Dr. Aart van Schoonhoven, and discussed needed agenda revisions and discussion topics with him. She helped prepare and post the revised agenda, prepare the moderators and panel presentors, and arrange for retyping and copying of papers prepared by the Africans. She made sure that audiovisual and other workshop materials were in place in time for advance preparation of each session.

In order to facilitate the work of the small groups, Ms. Desmond met with Dr. van Schoonhoven and Dr. Jeremy Davis to assign participants to work groups. In addition, she prepared the discussion questions, and briefed the facilitators and recorders on their roles and the work to be accomplished. At Dr. van Schoonhoven's request, she outlined a format for discussing resource needs Friday morning and briefed one African representative from each country in preparation for this panel. In order to prepare for the session on collaboration between CIAT and CRSP, she arranged for Aart, Doug Laing, and Pat Barnes-McConnell to meet together at lunch to begin to talk about how their respective institutions could collaborate.

While Devres did not have responsibility for producing the draft project papers, Devres staff did assist with arrangements for two secretaries and the photo copy person to work on Sunday to type and copy the two draft proposals written on Saturday, so they would be ready for the group to review Sunday evening. Minutes of the small work groups and and the detailed participants list were also typed and xeroxed over the weekend. Other logistical support included meeting persons at the airport on their arrival to help them through customs and to get settled at CIAT. Derves staff assisted with needed translation services throughout the workshop. Devres staff also helped coordinate participants' departure to the airport.

After the workshop, Devres staff remained at CIAT for a day to work out remaining financial and administrative details with CIAT. Devres' Senior Associate also discussed billing arrangements with AID and CIDA donor representatives during the workshop, and with Andrew Urquhart and Dr. John Nickel subsequent to it.

Appendix 1: List of Participants

WORKSHOP TO DEVELOP A COLLABORATIVE PROJECT FOR BEAN RESEARCH IN

EAST AFRICA

CIAT, November 16-21, 1983

PARTICIPANTS

IMRU ASSEFA Team Leader, Pulse Research Team Institute of Agricultural Research Nazareth Research Station Box 103 Nazareth, Ethiopia Telephone: (02) 11-21-86	Plant Breeder Responsible for formulation implementation and evaluation of trials; Chair of Annual preview and review meetings of Pulse Research Team
SAMUEL GAITHURU MUIGAI Agricultural Research Officer National Horticultural Research Station P. O. Box 220 Thika, Kenya Telephone: 0151-21281 Thika	Plant Breeder Responsible for designing appropriate methodology of handling various types of bean material in order to incorporate appropriate genetic values into acceptable kbean seed types for Kenyan farmers.
SIMEON K. NJUGUNA Director National Horticultural Research Station P. O. Box 220 Thika, Kenya Telephone: 0151-21281 0151-211334	Plant Breeder Coordinator of Research planning, implementation, monitoring and evaluation at NHRS including determination of human and financial resource needs, and selection of new cultivars; policy advisor to Kenya government on horticultural research development.
DR. DANIEL M. MUKUNYA Associate Director University of Nairobi, Faculty of Agriculture Kabete Campus P. O. Box 30197 Nairobi, Kenya Telephone: 59 22 11	Plant Pathologist Principal Investigator for Kenya/UC Davis-Riverside CRSP project to develop drought and heat resistant beans in semi-arid Kenya.

DR. DAVID N. NGUGI Dean, Faculty of Agriculture University of Nairobi Kabete Campus P. O. Box 30197 Nairobi, Kenya Telephone: 59 22 11	Crop Physiolkogist Primarily involved in administrative and liaison of the Bean/Cowpea CRSP project as head of the Faculty of Agriculture hosting the project.
ROBERT MISANGU Lecturer/Researcher University of Dar es Salaam Faculty of Agriculture, Forestry, Veterinary Medicine Crop Science Department Sub Post Office Chuo Kikuu Morogoro, Tanzania Telephone:	Plant Breeder Involved directly with WSU/ Tanzania CRSP project designing and conducting research on bean breeding for disease and pest resistance.
PROF.OGHENETSAVBUKO TODO EDJE Director of Bean Research Bunda College of Agriculture collection/evaluation; Lilongwe, Malawi Telephone: 721-455	Agronomist and Seed Physiologist Germplasm P. O. Box 219 yield stability and stress studies; seed/seedling rigours; mixed cropping trials; preparation of document paper for the implementation of Bean/ Cowpea CRSP project in Malawi.
EPIMAKI K. M. KOINANGE Agricultural Research Officer Head, Legume Program TARO-Lyamungu P. O. Box 3004 Moshi, Tanzania (55) 4411	Crop Scientist; Plant Breeder Conduct of field trials for cowpeas beans and soybeans; planning and conduct of bean breeding trials; design and conduct of all bean Telephone: research trials at Lyamungu and other legumes (cowpeas, green grains, soybeans) from other stations.
ABERI AUGUSTINE MUKASA-KIGGUNDU Director of Research Kawanda Research Station P. O. Box 7065 Kampala, Uganda Telephone: 67621	Soil Scientist Responsible for project funding and execution, staff recruitment and training. Development and distribution of acceptable varieties to farmers.

DR.JOSEPH K. MUKIIBI
Dean, Faculty of Agriculture and Forestry
Makerere University
P. O. Box 7062
Kampala, Uganda
Telephone: 56931

Plant Pathologist
Disease identification and crop/yield loss assessment for beans and cowpeas in Uganda; studies of chemical disease control, effect of inter-cropping on bean diseases; preparing monograph on tropical legume disease.

MRS. MASITUULAR S. MUSAANA
Scientific Officer
Kawanda Research Station
P. O. Box 7065
Kampala, Uganda
Telephone: 67621

Plant Breeder
Passion fruit and solanaceous vegetables; bean breeding and trial implementation to develop new and improve other varieties (including K_{130} and K_{20}) for local consumption and export market.

CRSP -- COLLABORATIVE RESEARCH SUPPORT PROJECT

DR. PAT BARNES-McCONNELL Director, Bean/Cowpea CRSP 200 International Center Michigan State University East Lansing, Michigan 48824 Telephone: 517/355-4693	Social Scientist As Director of the Bean/Cowpea CRSP since 1978, has done extensive work in West and East Africa, especially Malawi.
DR. MAURICE WAYNE ADAMS Professor - Plant Breeding and Genetics Michigan State University, College of Agriculture Crop/Soil Sciences Department Michigan State University East Lansing, Michigan 48824 Telephone: 517/355-2234	Agronomist/Plant Breeder/ Geneticist U.S. Principal investigator for MSU/Malawi and MSU/Mexico CRSP projects. Responsible for research design, data analysis and evaluation of project design and review with particular emphasis on mid-term evaluation and adjustments.
DR. MATHIAS J. SILBERNAGEL USDA Agricultural Research Service -Vegetable Crops Production Unit WSU Irrigated Agriculture Research and Extension Center (IAREC) P. O. Box 30 Prosser, Washington 99350 Telephone: 509/786-3454	Plant Pathologist; Plant Breeder U.S. Principal Investigator on WSU/Tanzania CRSP project to breed beans for disease, insect and drought resistance and nutritive value and to evaluate socio-economic impact on small holders. Chairman of B/C CRSP Technical Committee.
DR. BARRY G. SWANSON Professor, Food Science and Human Nutrition Washington State University 375 Clark Hall Pullman, Washington 99164-6330 Telephone: 509/335-4015; 335-1702	Food Scientist/Nutritionist/ Horticulturalist U.S. Principal investigator, INCAP. Assessment of quality and utilization of dry beans in Central America and East Africa, including: effects of anti-nutritional factors, storage techniques, cooking methods and training in assessment techniques.

DR. BARBARA D. WEBSTER
Professor of Agronomy/Associate
Dean of Research
Hunt Hall
University of California-Davis
Davis, California 95616
Telephone: 916/752-2468; 752-2075

Plant Biologist
U.S. Principal Investigator for UCD/Kenya CRSP project involved in project design, implementation, integration and assessment determination of research priorities. Overall B/C CRSP formulation, identification of technical issues and constraints.
Former Chair of B/C Technical Committee.

CIAT (CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL)

JOHN L. NICKEL	Director General
DOUGLAS R. LAING	Director, Crops Research
AART VAN SCHOONHOVEN	Coordinator, Bean Program
FERNANDO FERNANDEZ	Coordinator, Scientific Training and Conferences
JEREMY DAVIS	Bean Plant Breeder
DOUGLAS PACHICO	Bean Economist
FRANCISCO J. MORALES	Bean Virologist
SHREE P. SINGH	Bean Plant Breeder
JONATHAN WOOLLEY	Bean Agronomist

CIAT (Centro Internacional de Agricultura Tropical)
Address: Apartado Aereo 6713 Cali, Colombia
Telephone: 68 01 11
Telex: 05769 CIAT CO.

OBSERVERS

COY HIBWAANGA HACIWA Msekera Research Station P. O. Box 89 Chipata, Zambia Telephone: (062) 21725	Pathologist (currently in training) Breeding for disease resistance
MRS. CATHERINE S. MADATA Breeder Uyole Agricultural Centre P. O. Box 400 Tanzania Telephone: 26117	Coordination of Bean bean Bean Improvement Project in the Southern Highlands of Tanzania, breeding for high-yield Mbeye, varieties acceptable to growers and consumers and addressing problems of disease, pests, agronomic practices and gap between research and extension.
GEORGE ODHIAMBO Agricultural Research Officer Ministry of Agriculture P. O. Box 30028 Nairobi, Kenya	Plant Pathologist Evaluation and screening for disease resistant beans
DR. DAVID J. ALLEN 2, The Arch Bottisham, Cambridge, England Telephone: 0223-811253	Breeding for disease resistance in beans and cowpeas in national and international programs in Africa. Recently Leader, Grain Legume Research Team for the Ministry of Agriculture and Water Development in Zambia.
SIGURD BJORTUFT Agricultural Supervisor Agricultural Project Norwegian Church Aid/Sudan Programme P. O. Box 52802 Nairobi, Kenya	Testing materials from CIAT, IITA, Katumani under conditions in Southern Sudan and testing of tepary beans under dry conditions with aim to find suitable varieties for small holder.

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University of Nebraska
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Agronomist
Cropping systems methodology and interactions between on farm resource utilization constraints and efficiency.

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Telephone: 810-1747 (Melbourne)

Plant Pathologist
Disease identification and control, particularly white mould on *Phaseolus vulgaris*; conduct of field trials to determine efficacy of integrated methods of treatment.

REPRESENTATIVES OF DONOR NATIONS

DR. H. GEORGE DION Agricultural Consultant Canadian International Development Agency (CIDA) Natural Resource Section Promenade du Portage Hull, P. Quebec, Canada K1A064 Telephone: 819/771-7030	Soil Scientist, formerly Senior Agricultural Advisor to CIDA. Coordination of CIDA's role in identifying agricultural research possibilities in 200 Eastern Africa for possible support by the donor consortium of Cooperation for Development in Africa (CDA).
DR. GUNTER K. F. JOHN German Agency for Technical Cooperation (c/o CIAT, Cali, Colombia) P. O. Box 5280 6236 Eschborn, West Germany	Experience in Agronomy and project evaluation in North, West and East Africa and Latin America
W. FRED JOHNSON Internarional Research Programs Officer International Food and Agricultural (BIFAD) USAID - Department of State Room 5316 Telephone: 202/632-9050 Washington, D. C. 20523	Assist in identifying the science and technology in U.S. agricultural Board for universities for research and development programs to increase production and improve utilization of food in developing countries and to develop and strengthen linkages between U.S. and developing country institutions.
VERNON C. JOHNSON Africa Bureau U.S. Agency for International Development Department of State Washington, D.C. 20523 Telephone: 202/632-2040	Agricultural Economist Associated with the development in Africa (CDA), especially programs in agricultural research. Assess country programs and advise on development issues in the Agricultural Office of the AID Africa Bureau.
DR. HENRY C. WIGGIN Agricultural Research Systems Advisor U.S. Agency for International Development AFR/TR/ARD Department of State Room 2941 Washington, D. C. 20523 Telephone: 202/632-2040	Design, technical assessment and approval of research U.S. projects in connection with the Coopeation for Development in Africa (CDA) initiative.

DEVRES, Inc.

KATHY DESMOND	Senior Associate Workshop Coordinator
COLLEEN STAPLETON	Executive Assistant Workshop Coordinator

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Appendix 2: Program: Workshop to Develop a Collaborative Project for Bean Research in East Africa

Friday 18th

Room E

Moderator: A.v. Schoonhoven

8:30-12:00	Presentation and discussion of conclusions of working groups.
8:30- 9:15	A. Genetic improvement
9:15-10:00	B. Agronomic Improvement
10:00-10:30	Coffee
10:30-11:15	C. Utilization
11:15-12:15	Discussion of resource requirements

Moderator: H. G. Dion

1:30- 3:30	Strategy for collaboration and coordination of existing resources, linkages: CIAT and CRSP roles
3:30- 4:00	Coffee
4:00- 6:00	Field Nursery Tour in Palmira — J. Davis
8:00- 9:30	Discussion of project outline — **Moderator: H.C. Wiggin**

Saturday 19th

8:00	Field tour to CIAT-Popayan	J. Davis

Sunday 20th

Social Program

Monday 21st

Room E

Moderator: D. R. Laing

8:30-12:00	Discussion of first draft of project
12:00	Closure
2:30- 6:00	Visit Quilichao (optional)

Tuesday 22nd

8:00	Departure

PROGRAM

Workshop to develop a collaborative project for bean research in East Africa

November 16-21, 1983

Wednesday 16th

Room E

8:30	Inscription/registration	
9:00- 9:30	Welcome and scope of workshop	
	Orientation and goals	J. L. Nickel
	Moderator:	**M. Silbernagel**
9.30-10.00	Introduction, logistics	A.v. Schoonhoven
10:00-10:30	Coffee	
10:30-12:00	Presentation of bean program of Kenya,	
	1) Ministry of Agriculture	S. Mugai
	2) University of Nairobi	D. Mukunya
	Moderator:	**B. Webster**
1:30- 3:00	Presentation of bean program of Uganda,	
	1) Ministry of Agriculture	A. Mukasa-Kiggundu
	2) University of Makere	M. Musana
3:00 3:30	Coffee	
3:30- 4:30	Presentation of bean program of Tanzania,	
	1) University	B. Ndunguru
	2) Ministry	E. Koinange
4:30- 5:00	Malawi: Bunda College	O.T. Edje
5.00- 5:30	Ethiopia: Institute Agricultural Research	I. Assefa
6.00- 7:00	Cocktail	

Thursday 17th

Room E

	Moderator:	**O.T. Edje**
8:30- 9:00	Presentation by donor agencies	H.C. Wiggin (AID) H.G. Dion (CIDA)
9:00-10:00	Objectives and strategies of Bean Cowpea CRSP.	P. Barnes-McConnell
10:00-10:30	Coffee	
10:30-11:30	Objectives and strategies of CIAT Bean Program	A.v. Schoonho· en
11:30-12:00	Organization of 3 discussion groups	
1:30- 3:00	Work sessions of discussion groups Topic 1: Identification of regional research priorities. A. Identify genetic improvement (Room E) priorities for: -disease resistance -insect resistance -N-fixation -low soil fertility tolerance -quality improvement -others B. Agronomic management (Room B) -intercropping -weed control -soil fertility -on farm research -others C. Utilization and/human nutrition (Room C) -storage -food preparation -fodder	
3:00- 3:30	Coffee	
3:30- 5:00	Work sessions of discussion groups Topic 2: Discussion of socio economic context for baseline data and identification of training requirements.	
5:15- 6:15	Field tour of CIAT facilities	D.R. Laing

Appendix 3: Revised Program

Revised Program
(This is what actually occurred)

Workshop to develop a collaborative project for bean research in East Africa

Wednesday, November 16th

9:30 - 10:00	Welcome, orientation and goals of workshop	J. L. Nickel
10:00 - 10:30	Coffee	
10:30 - 12:00	Moderator	M. Silbernagel
	Presentation of Bean Program of Kenya: Ministry of Agriculture	S. Muigai
	Presentation of Bean Program of Uganda: Ministry of Agriculture	A. Mukasa - Kiggundu, M. Musaana
1:30 - 2:15	Moderator	W. Adams
	Presentation of Bean Program of Uganda: University of Makerere	J. K. Mukiibi
2:15 - 3:00	Presentation of Bean Program of Tanzania: Ministry of Agriculture	E. Koinange
	University	C. Madata M. Silbernagel
3:00 - 3:30	Coffee	
3:30 - 4:30	Malawi: Bunda College	O. T. Edje
4:30 - 5:30	Ethiopia: Institute of Agricultural Research	I. Assefa
6:00 - 7:00	Cocktail	

Thursday, November 17th

8:30 - 9:00	Moderator Presentation by donor agencies: CDA/CIDA AID	O. T. Edje H. G. Dion C. H. Wiggin
9:00 - 10:15	Objectives and strategies of Bean/ Cowpea CRSP	P. Barnes-McConnel
10:15 - 10:30	Coffee	
10:30 - 11:30	Objectives and strategies of CIAT Bean Program	A. v. Schoonhoven J. Davis
11:30 - 12:00	Presentation of Bean Program of Kenya: University of Nairobi	D. Mukunya
12:00 - 12:10	Organization of three work groups	K. Desmond
	Work sessions of discussion groups	
1:30 - 3:00	Topic I: Identification of regional research priorities	
3:00 - 3:30	Coffee	
3:30 - 5:00	Topic II: Discussion of socio-economic context, base line data needs, and identification of training requirements.	
5:30 - 6:30	Field tour of CIAT facilities	J. Davis

Friday, November 18

	Moderator Presentation and discussion of conclusions of working groups:	A. v. Schoonhoven
8:30 - 9:15	A. Genetic Improvement	D. Allen
9:15 - 10:00	B. Agronomic Improvement	J. Woolley
10:00 - 10:30	Coffee	
10:30 - 11:15	C. Utilization	B. Swanson

11:15 - 12:15	Discussion of Resource Requirements: Kenya Uganda Ethiopia Malawi	 S. Muigai A. Mukasa I. Assefa O. T. Edje
1:30 - 3:30	Moderator Strategy for collaboration and coordination of existing resources, linkages: CIAT and CRSP roles	D. R. Laing
3:30 - 4:00	Coffee	
4:00 - 6:00	Field Nursery Tour in Palmira	J. Davis

Saturday, November 19th

8:00 - 8:00	Field tour to CIAT - Popayan and visit to Popayan	J. Davis

Sunday, November 20th

10:30 - 4:30	Social Program Dinner at A. van Schoonhoven's home	
8:00 - 10:30	Presentation and discussion of drafts of CIAT and CRSP proposals	A. v. Schoonhoven P. Barnes-McConnell

Monday, November 21st

8:30 - 12:00	Moderator Discussion of drafts of proposals, cont.	D. R. Laing
12:00	Closure	J. L. Nickel
2:00 - 7:00	Visit to Cali (optional)	

Appendix 4: Conclusions of Work Groups

November 17, 1983

GROUP A:

GENETIC IMPROVEMENT

J.Davis,Facilitator

D.Allen,Reporter

Imru Assefa

S.Muigai

C.Madata

M.Musaana

C.Haciwa

W.Adams

M.Silbernagel

C.H.Wiggin

P.Trutmann

WORKING GROUP A: GENETIC IMPROVEMENT

TOPIC 1: REGIONAL RESEARCH PRIORITIES

A. Sub-Topics : To increase

(i)	Productivity	without lost stability nor acceptability
(ii)	Disease Resistance	
(iii)	Pest Resistance	
(iv)	Tolerance of soil infertility	
(v)	Tolerance of drought	

Long-term objective:

To increase productivity in locally acceptable material, and to select for tolerance to stress to achieve a yield stability in food beans in small scale farming throughout the region.

B. Research priorities and logistics:

1. To establish a network of trial sites across the region, initially on research stations chosen to represent specific ecological zones, then on-farm.

2. To test improved lines in, and against, mixtures and local land-races, and to examine population breeding methods to produce stable improved mixtures.

3. To develop and utilize resistance to disease (Anth, BCMV, ALS, CBB; HB, Rust, Asco....), pests (bean fly, bruchids, aphids, nematodes) and non-parasitic stresses (soil infertility, drought).

4. To investigate the biology (specially suitable for thesis topics), and to monitor distribution and importance, of pests and diseases (specially those absent from Latin America, principally bean fly but also scab) so as to better assign research priority, to detect shifts in relative importance, and to enable the development of reliable screening methods.

5. To develop a system of seed movement, both within the region and between Africa and CIAT, to ensure that standars of seed health are maintained. This is of particular significance in relation to seed-borne pathogens absent from E.Africa (e.g. BMMV, CpMV, SBMV, CMV, *Cercospora vanderysti*, *Pseudocercosporella albida*).

6. To develop a system of seed multiplication of improved materials in collaboration with national seed companies, to investigate means of the seeds' distribution and subsequent maintenance on farms.

TOPIC 2: SOCIO-ECONOMIC CONTEXT, BASELINE DATA AND TRAINING

A. Socio-economic constraints in plant breeding

i. The need to avoid risk

ii. Cooking time

iii. The availability of chemical inputs, esp. fertilizer and access to credit.

iv. Cost benefit inputs.

v. The importance of associated cropping relative to inputs.

vi. The importance of leaf plucking

vii. The availability of labour with regard to women workforce

viii. The need for an organized extension service

B. Baseline data

i. Edaphic	
ii. Climatic	Ecological
iii. Physiographic	
iv. Production regions	
v. Production systems	Agronomic
vi. Production constraints incl. parasites (crop loss profile)	
vii. Consumption patterns	Socio-economic

C. Training Requirements

i. Non-degree related

- Annual workshop at regional centre
- Annual courses (national?) in plant breeding and in farming systems agronomy.

ii. Post-graduate

	PhD	Ms
Breeders	4	4
Pathology	4	4
Entomology	4	4
Farming systems agronomy	0	3
Crop physiology	0	3
Microbiology	0	3
Food Science	0	3

GROUP B:

AGRONOMIC IMPROVEMENT

J.K.Mukiibi,Facilitator

J.Woolley,Reporter

G.W.Odhiambo

S.K.Njuguna

O.T.Edje

E.K.Koinange

B.Webster

H.G.Dion

V.Johnson

D.Carter

CONCLUSIONS OF DISCUSSION GROUP ON AGRONOMIC MANAGEMENT

1. Identification of regional research priorities

The group based its recommendations on the research needs for Kenya and Uganda and also noted that the research priorities for Tanzania and Malawi were similar, although it was understood that the project developed will not include these countries.

Soil fertility was considered the first priority. It was considered premature to specify the order of priority of sub-projects, but these were in approximate order:

- Use of organic fertilizers (including animal manure, green manure and crop residues)
- Management of native *Rhizobium* strains (including genetic selection of plants for optimum response to these). Management of inoculated strains
- Inorganic fertilizers
- Rotations

In general, attention should be paid to phosphorus availability.

Cropping Systems, understood to include monoculture and multiple cropping should be studied as second priority. The emphasis should in the initial stages of the project be on understanding and improving farmers' existing cropping systems rather than research on novel cropping systems. A proper understanding of farmers' cropping systems, problems and practice should orientate other work conducted under the regional project.

Labour is limiting at land preparation, planting and weeding and delays in planting may cause considerable yield losses if the rainy season is short. Research on tillage (including hand tool improvement, animal or mechanical technology and chemical inputs) was therefore considered the third priority. Soil and water conservation is important and directly

linked to the study of tillage, as is weed control during the crop cycle.

On-farm research was seen, in conjunction with station research, as an important technique for achieving all three objectives. In addition it provides, through varietal testing in farmers' fields, the link with genetic improvement.

It must not be expected that progress would necessarily be made on all three areas of agronomic research in the first phase of the project.

2. Socio-economic factors important to the priorities discussed

It was found difficult to discuss these constraints in isolation from the socioeconomic factors affecting bean production as a whole in the region. For soil fertility and tillage the following constraints were mentioned:

- Labour shortage at planting and weeding time.
- Marketing, transport and distribution of inputs in a timely manner.
- Cost of purchased inputs, especially imported ones.
- Initial cost of tools.
- Cost and difficulty of preparation and preservation of *Rhizobium* inoculum.

For Cropping Systems study, the major constraints discussed included the diversity of farmer goals which may include, in different areas or seasons:

- provision of food for the family
- monetary return per unit area
- monetary return per unit of labour
- monetary return per unit of investment
- reduction of risk

There was some discussion on the way the benefit of components with a

long term effect, such as soil conservation, are or can be assessed by the farmer and researchers.

3. Description of Farmers' Present Situation

This terminology was preferred to "Baseline Data Requirement", and was taken to include the basic information on farmers' practices and problems in cropping systems which include Beans, in order to carry out relevant research on farm or on station.

The availability of this information varies from country to country. For Kenya, detailed information was reported available, for Uganda and Tanzania, partial information which needs updating, while the information is not available yet in Malawi. Soil survey information was reported as available in all countries.

4. Training

These needs were established for those working in agronomic management, without implying an order of priority:

- Short courses in on-farm research in the region
- Regional workshops both on farm and on station
- Short courses outside the region
- M.S. studies in the region's universities
- M.S. and Ph.D. studies outside the region, with the field work conducted in the region
- Training for those who train farmers in farmers' training schools.

GROUP C:

UTILIZATION

P.Barnes-McConnell,Facilitator

B.Swanson,Reporter

A.A.Mukasa-Kiggundu

W.F.Johnson

G.John

D.Pachico

S.Bjortuft

D.Mukunya

WORKING GROUP C:UTILIZATION AND HUMAN NUTRITION

TOPIC 1: IDENTIFICATION OF REGIONAL RESEARCH PRIORITIES IN EAST AFRICA

Research Issue # 1. Consumption patterns:Acceptability and Food Preparation

A. Objective:

Identify patterns of bean consumption and utilization to provide significant useful information for bean improvement programs.

1. Traditional preferences - color,size,shape,taste, consistency,keeping quality and plant use (leaves, residue)

2. Ratios of complementary proteins- seasonality, income groups

3. Urban/rural,ethnic considerations

4. Cooking time/fuel consumption

5. Recipes - traditional use,methods:fermentation,germination,soaking,grinding,cooking

6. Quality- digestibility after preparation,nutrient quality

7. Consumptive patterns by:age,gender,health.

B. Research Methods

1. Socio-Economic Baseline Data (short term)

Surveys and observations of existing consumption patterns, traditional preferences and preparation methods.

2. On-going Socio-Economic Research (long term)

Consumer evaluation of promising lines.

3. Utilization Research (Laboratory Research)

a) Assess cooking time, digestibility and nutrient quality of traditional and advances lines.

b) Developing and testing new bean products.

Research Issue # 2. Comparative national policies: production and marketing

A. Objective:

Compare national policies in the region and farm economic behavior, analysing their impact on each other and compare recommendations for national policy development that address food availability.

1. Pricing
2. Subsidies
3. Import tariffs and restrictions
4. Credit
5. Research/extension, farming systems

6. Infrastructure

para/statal v. private

distribution mechanisms

cooperatives

7. Taxes

8. Import/foreign exchange regulation

9. Import substitution

10. Labour issues

11. Seed program

B. Research Methods

1. Socio-Economic Baseline Data(short term)

Assessment of existing economic conditions

a) National policy

b) Farm level

2. On-going Socio-Economic Research(long term)

a) Consumer evaluation of promising lines

b) Periodic update of national policy

c) On-going monitoring on farm

d) Study impact of alternative policies on farm

Research Issue # 3. Storage

A. Objective:

Assess and compare the efficacy of traditional and new storage practices, and evolve tested storage methods.

1. Farm level

a) Traditional practices - ash,banana leaves,

cassava seed oil, tobacco dust, neem,fruit juices,moisture (germination,fungi growth) neem,vessels/structures,oils.

b) Alternative practices - pesticides

2. National level

a) types

b) systems

c) canning

3. Effects on quality

a) color

b) seed coat and/or cotyledon hardness

c) viability (germination)

d) disease/pest control

e) taste and texture

B. Research Methods

1. Socio-Economic Baseline Data (short term)

Identify traditional storage practices

2. On-going Socio-Economic Research (long term)

On farm evaluations of effectiveness and safety of storage techniques (user,economic,physical)

3. Utilization Research (laboratory research)

a) Testing effectiveness of traditional and and new storage techniques

b) Testing promising lines performance in storage.

TOPIC 2: TRAINING

Identification of preliminary personnel needs.

A. Long-term training needs

1. Master's and above

a) For Research Issue # 1
rural sociology
food science
home economics

b) For Research Issue # 2

agricultural economics
development economic
rural sociology

c) For Research Issue # 3

food science
entomology
home economic
plant pathology

2. National training priorities

a) Kenya: food science
development economics
rural sociology

b) Uganda: food science
rural sociology
development economics

B. Short-term training needs

For existing personnel in Ministry of Agriculture

Workshops

Seminars

Short courses

Appendix 5: Strengthening the Bean Research Program at the University of Makerere: CRSP Draft Proposal

(Draft proposal not included here because subsequent proposal has been submitted to AID.)

Appendix 6: Regional Project to Increase Bean Production and Consumption and to Strengthen National Bean Research in the CDA Countries of Eastern Africa: CIAT Draft Proposal

(Draft proposal not included here because subsequent proposal has been submitted to AID.)

Appendix 7: Current Bean Research Programmes in Kenya

CURRENT BEAN RESEARCH PROGRAMMES IN KENYA

Paper presented at the Workshop on Bean Research in Eastern Africa held at CIAT, Cali, Colombia, November 16-21, 1983.

by

S.G.S. Muigai, S.K. Njuguna,
D.M. Mukunya and D.N. Ngugi.

CURRENT BEAN RESEARCH PROGRAMME IN KENYA

By: S.G.S.Muigai , S.K. Njuguna *
D.M. Mukunya and D.M. Ngugi **

INTRODUCTION

Kenya is one of the five major bean producing countries in Eastern Africa. The other four countries include Tanzania, Uganda, Rwanda and Burundi. Beans are produced in Kenya at altitudes of between 1.000 and 2.000 meters. These food bean production areas are representative of a wide range of environmental conditions such as many different soil types; low, medium to high and the varying production problems e.g. inadequate moisture and subsequent crop failures, disease and insect pest problems that concur with the respective environmental conditions.

The major production areas (Table 1) include the Eastern and Central Provinces which are of low to medium rainfall. Food beans are also produced in higher rainfall areas of Western Kenya, however, the production here is considerably less but still important. The majority of beans are grown in association with other crops but maize is by far the predominant association crop.

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* Plant Breeders - Ministry of Agriculture
National Horticultural Research Station-Thika.

** Pathologist and Agronomist - Department of Crop Science
University of Nairobi.

TABLE 1. Estimated areas under grain legumes in Kenya by Province in 1974/75 crop year (10^3 ha) *

Province	Common beans	Pigeon peas	Cowpeas	Field peas	Other	Total
Eastern	284.6	104.5	208.4	2.8	30.2	630.5
Central	232.4	4.2	7.8	13.6	0.0	258.0
Nyanza	73.6	0.0	2.9	0.0	1.7	78.2
Western	148.4	0.0	13.2	0.4	1.4	163.4
Rift Valley	7.0	0.0	0.0	0.0	0.0	7.0
Coast	17.5	6.5	38.9	9.1	4.1	67.1
Total	763.5	115.2	271.2	25.9	37.4	1.204.2

Source: Thairu, 1979

Bean Research Objectives

The broad objective in bean research is commensurate with the country's Development Plan and Food Policy i.e. increased total food production to enhance self sufficiency. The Kenya Development Plan has identified the need to increase protein production and consumption via improved production of pulses.

Plant protein as opposed to animal protein would in terms of costs, be more readily available to the majority of the Kenyan population.

Dry beans (Phaseolus vulgaris L.) are the most important pulse crop (Table 1). Other pulses include cowpeas (Vigna unguiculata) and pigeon peas (Cajanus cajan) which are mainly grown in the lower potential areas. Improvement programmes for cowpea and pigeon peas are being conducted by the Ministry of Agriculture as well as the University of Nairobi.

Directed research on beans started in 1971 at the National Horticultural Research Station under a bilateral cooperation between the Dutch and Kenya Governments. Initially, research was carried out on white canning beans but the emphasis shifted to the improvement of food beans in 1974. Bean trials similar to those at the Thika station are also carried out on other national research stations which are representative of the major agroecological environments of dry bean growing areas.

Current research has had emphasis on researchable topics whereby research activities are likely to yield results of practical application in a short time.

Bean Research in Kenya is being conducted with the following objectives under the following disciplines:

AGRONOMY

The major objective has been to develop highly productive crop husbandry techniques that are acceptable and beneficial to bean farmers in their

respective environmental conditions. This objective has been addressed through identification of the fundamental production constraints in the traditional farming systems and the subsequent derivation of appropriate agronomic recommendations that can be inmediately adapted by the farmers to intensify the production of the crop. More recently, the bean agronomists have started to co-operate with a farming systems/agricultural economics section of the bean research programme to analyse the monetary implications of the crop husbandry recommendations.

Research on bean population densities and weed control under both mono - culture and mixed cropping has near' been concluded. Currently research topics include : Soil fertility; d nitrogen fixation and croppin systems research.

SOIL FERTILITY:

Fertilizer trials are now being carried out as farmer's field trials in all main bean growing areas of Kenya. Their aim is to establish specific fertilizer needs of bean grown under different climatic conditions and in different types fo soils. In a large number of these small-scale trials single nitrogen (CAN or urea), single phosporus (triple superphosphate) and combined NP fertilizer (DAP or N:P:K/20:20:0) are compared as to their effect on yield of bean cultivars specifically recommended for the region. Chemical analysis of plants and soils is carried out and root nodulation is assessed to explain plant responses to available nutrients.

Studies are also being conducted on bean nutrition alternatives other than

chemical fertilizers. Sources being experimented on include the use of cheap waste products and manure-fertilizer mixtures to improve soil fertility.

SYMBIOTIC DINITROGEN FIXATION

Atmospheric nitrogen fixation through Rhizobium- legume symbiosis is being studied in the Department of Soil Science of the Faculty of Agriculture, University of Nairobi, where a Microbiological Resources Centre (MIRCEN) was established in 1977. Its activities include surveys, isolations, screening, maintenance and supply of Rhizobium strains for different leguminous crops including Phaseolus vulgaris (L) . Although bean roots are found to be nodulated in most of the bean growing areas of Kenya, the nodule numbers are generally low. MIRCEN maintains a collection of more than 40 beans strains of Rhizobium most of them of local origin, while others were introduced from other countries. Three strains, one introduced and two local isolates, are used for inoculant production. Field trials were conducted to evaluate the best Rhizobium strains for beans in Embu, Kabete, Homa Bay and Mtwapa with variable results (Omar & Keya, 1980). Ssali and Keya (1982) found that dinitrogen fixation as measured by the ^{15}N technique was related to the amount of available phosphorus. Without P-fertilizer or in soils with a high phosphorus sorption,phosphorus may become a limiting factor. Some soils in Kenya, specially in the Western Districts, are rich in nitrogen, but poor in available phosphorus. In Eastern Kenya the situation is often reversed, so that there, Rhizobium inoculation might give better results.

In pot experiments carried out at Thika, unsterilized soil from farmers's field collected in different regions of Kenya were used and kept daily at

60% of the maximum water- holding capacity. The different treatments included inoculation with Rhizobium strain 406 from the University of Nairobi and application of three different fertilizers (CAN,TSUP, and DAP) at optimal levels. The P- containing fertilizers increased the water use efficiency and very much stimulated root nodulation of the bean plants growing in the pots in both inoculated and non-inoculated soils (Floor, 1982). In a planned new series of pot experiments soils with a known poor chemical status will be used, with and without inoculation to assess whether previous results are also valid for poorer soils. In another pot experiment, three different moisture regimes will be maintained in the soil at 40, 60 and 80% of the maximum water holding capacity of the pot to asses the influence of available water on nodulation and plant growth, in three different soils .

FARMING SYSTEMS ECONOMY/EXTENSION:

A new research programme has recently started on: labour requirements in bean cultivation, survey of traditional and improved agricultural methods in bean production, and marketing of bean surpluses; publications for extension purposes aimed at small-scale farmers growing beans for food (e.g. Kenya Farmer, 1983, Special Bean Issue).

DROUGHT RESISTANCE:

As the Kenyan population has continued to increase, it has become necessary to settle families in the marginal rainfall areas. Subsequently, the need to develop drought resistant crop cultivars has become necessary as this character is of paramount importance for a successful crop in these areas.

These are UNDP/FAO Dryland Farming and Development Programme based at the National Dryland Farming Research Station at Katumani, the USAID Cropping Systems Programme, based at the Kenya Agricultural Research Institute (KARI) in Muguga near Nairobi, and the Bean Collaborative Research Support Programme (CRSP) on "Improvement on Drought and Heat Tolerance of disease resistant beans in semi-arid regions of Kenya" between the Universities of Nairobi and California.
This cooperation has produced new crosses of teparies with Kenyan adapted beans and are currently being evaluated in the marginal areas in Kenya.

BEAN DISEASES AND PESTS

A major constraint in the production of beans in Kenya is the disease and pest problem,which contribute to low yields and poor quality of seed. It is obvious that the incidence of the various diseases is as variable as the ecological conditions under which beans are grown in Kenya.
The severity of the diseases and pests varies from one season to the other and is also dependent on year and location. Therefore it is rather difficult to give an order of importance of all the diseases, which will match each season or year or area.
In general, in Kenya the pests on beans are considered less important than the diseases.

DISEASE RESISTANCE

Chemical control of bean diseases received little attention as it was considered less relevant to small holders' conditions.

These are UNDP/FAO Dryland Farming and Development Programme based at the National Dryland Farming Research Station at Katumani, the USAID Cropping Systems Programme, based at the Kenya Agricultural Research Institute (KARI) in Muguga near Nairobi, and the Bean Collaborative Research Support Programme (CRSP) on "Improvement on Drought and Heat Tolerance of disease resistant beans in semi-arid regions of Kenya" between the Universities of Nairobi and California.
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BEAN DISEASES AND PESTS

A major constraint in the production of beans in Kenya is the disease and pest problem,which contribute to low yields and poor quality of seed. It is obvious that the incidence of the various diseases is as variable as the ecological conditions under which beans are grown in Kenya.
The severity of the diseases and pests varies from one season to the other and is also dependent on year and location. Therefore it is rather difficult to give an order of importance of all the diseases, which will match each season or year or area.
In general, in Kenya the pests on beans are considered less important than the diseases.

DISEASE RESISTANCE

Chemical control of bean diseases received little attention as it was considered less relevant to small holders' conditions.

Therefore, more emphasis has been given to breeding for disease resistance, the production of disease free seed and seed dressings.

The screenings for disease resistance and the breeding programme are aimed at resistance to the five major diseases in Kenya:BCM, halo blight, anthracnose, rust and angular leaf spot, preferable a combined resistance with good agronomic characters and attractive seed types.

The first cultivars released during the period 1976 - 1978 originated from bean germplasm collections: GLP-2 (Roko), a Rose coco type, originally from Uganda, with a reasonable level of resistance to mostdiseases,GLP-24, a Canadian wonder type with a good level of resistance to rust and angular leaf spot; GLP-1004 a Mwezi moja type without good resistance to diseases as it is intended for the drier areas where diseases are less important. The last two cultivars originated from Kenya.

The other cultivars have been identified during the period 1978-1981 for possible release. Both originated from Kenya: GLP-X.92, a Mwitemania bean with a wide adaptation and resistance to halo blight, and GLP-X.806, a Zebra type with a good yield potential,mildly susceptible to angular leaf spot and fairly resistant to rust. All five mentioned cultivars are susceptible to BCM, although GLP-X.92 appears somewhat tolerant.

The three other research projects operating in the dryland areas are selecting for drought resistance in combination with diseases and pest resistance. The results from these projects are in an early stage , as they started rather recently. The CPSP project has identified a Mwezi moja bean (NB-518) as a possible candidate for the marginal areas.

The promising cultivars from the breeding programme are being tested in the National Bean Performance Trials at six locations in Kenya, since 1981. Most entries have a combined resistance to more than one disease. The disease in questions and some of the relevant results obtained in Kenya are:

Bean Common Mosaic

The resistance to BCM by the GLP in the cross breeding programme comes from the necrosis gene I present in GLP-16 (Kaw panmix x Confinel) a small-medium sized Rose coco bean from Uganda, with the dominant I gene, and also resistant to anthracnose and halo blight was used as a parent. In the early segregating generations the resistance tests were carried out at the Institute for Phytopathological Research (IPO) and the Institute for Horticultural Plant Breeding (IVT), both at Wageningen, the Netherlands.

Some strains of BCMV present in Kenya are for the necrosis inducing type, others of the non-necrosis inducing type. Certain isolates resembles very closely strain NL3 (Omunyin, 1979: 1983).

The usefulness of the dominant I gene has been tested since 1979. Only in a few cases the number of plant affected by black root was over 10% and the yield in those plots was favourably affected by the dominant resistance factor (Van Rheenen and Muigai, 1983). As BCM is more important in the pure stand of beans (Van Rheenen et al., 1981), the effect of the dominant I gene in the control of this disease is greater in a mono-crop of beans compared to the beans grown in association with maize (Van Rheenen and Muigai, 1983).

A number of cultivars with the dominant I gene are being tested in the National Bean Performance Trials. The cultivar Linea 24 from CIAT did not succeed to enter this trial; although it resembles the popular Roko cultivar (GLP-2) and has the dominant I gene, it appeared to be more susceptible to angular leaf spot and rust, while its yield potential is lower that that of the Roko under Kenyan conditions (Van Rheenen, 1982) Although BCM is not considered to be an important disease in the dryland areas of Kenya (Stoetzer et al., 1983b), the CRSP investigators in Kenya are screening bean germplasm for resistance to six isolates of BCM (Mukunya et al., 1982).

Anthracnose

In Kenya the following pathotypes have been reported: alpha, beta, gamma, delta and epsilon (Grain Legume Project, 1976a; Mukunya, 1975; Kinyua 1979). Currently more research on the pathotypes of anthracnose is carried out at the Faculty of Agriculture of the University of Nairobi.
The obvious resistante to be used in a breeding programme is the "Are" gene for which the French cultivar Confinel was used by Leaky in Uganda.
In 1976, GLP-18 (S40 x Confine) and GLP-20 (Confinel x S153) were used by GLP as resistant parents, and four food bean types as recurrent parents.
The screening for resistance were carried out at the Research Institute for Phytopathological Research, (IPO) Wageningen, The Netherlands.

Lines from this breeding programme with resistance to anthracnose are being tested in the National Bean Performance Trials. A number of these entries have combined resistance to anthracnose and BCM.

Recently,some field screening for disease resistance to anthracnose were executed by the Bean/CRSP in the dryland areas (Mukunya et al., 1982).

Halo blight

In Kenya, race 1 and race 2 of halo blight were found and identified as such (Grain Legume Project, 1976b; Kinyua et al., 1981), although it should be noted that the race-concept is not generally accepted. It would seem quite possible that a more virulent pathotype of the bacterium occurs in the Kisii area of Kenya (Stoetzer et al., 1983a).

In the breeding programme of the GLP, initially PI 150414 and GLP-16 (Kaw panmix x Confinel) were used as sources of resistance (Grain Legume Pro - ject, 1976b; 1977a; 1978a). However, the resistance to halo blight in the breeding material proved not to be satisfactory (Grain Legume Project, 1980b). Therefore, a new cross breeding programme was initiated in 1980 in which GLP-X.92 was used as the halo blight resistant parent, combined with lines resistant to anthracnose and BCM from the 1976 crosses. GLP-X.92 is a local Mwitemania type with resistance to race 1 and 2 of the pathogen (Kinyua et al. 1981) and the cultivar is also resistant to the virulent pathotype from Kisii (Stoetzer et al., 1983a). As mentioned before , this cultivar is considered for release. The breeding programme has about reached the F_6 generation while a rotation technique between locations is used.

Angular Leaf Spot

The extent of pathogenic variability of this disease in Kenya is not yet known, although there are indications that varability exists.
Before entering the National Bean Performance Trials the breeding material from the GLP has been screened under field conditions for its resistance to angular leaf spot. Although not fully resitant, material with a good 'field resistance' to angular leaf spot, combined with the "Are" gene and dominant I gene is currently under advanced testing in the National Bean Performance Trial.

Rust

The GLP breeding material is screened for rust resistance under field conditions. Howland and Macartney (1966) identified eight pathotypes of bean rust in Africa. At present no further research is done in the pathotype identifications, as other work is more relevant, e.g.research on partial resistance to rust (van Breukelen, 1979).
As for angular leaf spot, a cultivar can only enter the National Bean Performance Trial when it has a good 'field resistance' to rust.
GLP-X.92 however, has shown in mos locations and in most seasons, a fairly good resistance to rust, but in some seasons, especially at Katumani Station, it appears to be susceptible.

Resitance to Pests

Varietal resistance to beanfly has been observed by Kibata (van Rheenen, 1982), Mukunya et al. (1982) and the GLP staff but the resistance character has not been used in a breeding programme. Some of the generations of the GLP breeding programmes have been under a very heavy selection pressure for beanfly, therefore some resistance may be expected to be present in that material.

Disease Free Seed and Seed Treatments

The influence of seed-borne diseases on the disease development and the yield of beans was shown by Mukunya and Keya (1979) while Hasselbach (1979) showed the influence of the multiplication location.
The seed inspection and certification of the National Seed Quality Control Service, Nakuru, Kenya and the seed production by Kenya Seed Company Ltd. are described by Cullen (1981) and Njugunah et al, (1981).
Currently, trials are executed to find the best area for disease-free seed multiplication, the most effective seed dressing and the influence of the cropping system on the severity of seed-borne diseases.

Future outlook on bean research in Kenya

1. Research activities shall be continued to review current bean husbandry recommendations tomake them more pertinent to the financial scope of the target group i.e. the small scale farmer.

2. Breeding and selection programmes aimed at multiple disease and pest resistance is the ultimate aim. First emphasis is on the major seed borne pathogens.

3. Assistance from colaborators in the Bean/Cowpea CRSP Programmes is and will continue to be appreciated.

4. Cooperation with CIAT and other bean research organisations from where suitable breeding lines can be obtained is viewed as a facet whereby prolonged and expensive breeding programmmes can be avoided or shortened.

5. Continued assitance in training of local scientist shall continue to be considered as invaluable.

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MORE INFORMATION ON CURRENT RESEARCH PROGRAMMES IN KENYA*

DANIEL M. MUKUNYA.

University of Nairobi Grain Legume Projects

The University of Nairobi has recognized the need for improved yields in grain legumes and to date there are four programs concentrating on different aspects of yield improvement.

1. The Bean/Cowpea CRSP
2. Rhizobium MIRCEN (Microbial Resources Center) Project
3. Cowpea Improvement Program
4. Pigeon Pea Project

These programs employ an interdisciplinary approach and the staff involved work hand-in-hand in cooperation with the Kenya Ministry of Agriculture toward the common objective of increasing yields of leguminous crops and optimizing their role in the improvement of soil fertility, cultural practices and information dissemination. The major grain legumes grown in Kenya are beans, cowpeas and pigeon peas. Their provincial distribution indicates that beans are by far the most important covering more than 700 thousand ha.in 1974/75 and total production approximately .5 million tons. It should also be noted that the bulk of bean production is in Eastern and Central Provinces.

* Workshop on Bean Research in Eastern Africa held at CIAT, Cali, Colombia November 16-21, 1983

With increasing population (17 million) and land pressure due to competition from cash crops in high potential areas in Central Province bean production is becoming increasingly higher in Eastern Province. However, in Eastern Province rainfall is limiting as most areas are classified as semi-arid and the probability of growing a successful crop is less than 30%.

The national average bean yield is estimated at 500 kg/ha (750 kg/ha pure crop; 375 kg/ha mixed crop, Njuguna et al, 1980) which is miserably low. For an endeavor to improve this situation, the University of Nairobi under the auspices of the Grain Legume Programs, Rhizobium MIRCEN and in cooperation with the Ministry of Agriculture, has begun research on beans. About 2.500 lines of beans have been collected within and outside the country. These lines have been evaluated for disease and pest resistance, yield and nitrogen fixation capabilities.

THE BEAN/COWPEA CRSP

In 1981, the University initiated the Bean/Cowpea CRSP entitled "Improvement of drought and heat tolerant disease resistant beans in the semi-arid regions of Kenya".

This project was mounted at the request of the Government of Kenya within a framework of the University of Nairobi/Ministry of Agriculture/University of California Collaborative Research Support Program.

The main objectives are:

(a) Evaluation of the country bean germplasm, with particular reference to its usefulness in development of cultivars suited to the marginal rainfall semi-arid areas of Kenya.

(b) Definition of physiologic characteristics associated with drought and heat tolerance in beans in order to develope practical methods for selection of drought tolerant bean varieties.

(c) Screening for resistance to common bean mosaic virus, macrophomia root rot and any other potentially important bean disease in semi-arid areas.

(d) Expansion of the bean germplasm collection at Kabete to allow for broader genetic variability for selection of drought tolerant cultivars and specifically incorporation of tepary bean drought tolerance to common beans

(e) Training of Kenyans in the relevant disciplines of crop physiology, breeding and pathology.

ACHIEVEMENTS

Under the University bean program main constraints in bean production h. been identified especially seed borne pathogens e.g. anthracnose, .terial blights and common bean mosaic.

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Other diseases include rust, angular leaf spot and root rots. Merely by using clean seed, "Canadian Wonder" yields of 1500-2000 kg/ha have been realized.

In collaboration with the Grain Legume Project of the Ministry of Agriculture, Thika, high yielding varieties of beans identified before 1976 have been released and have gained wide acceptance. The main problem has been production of clean certified seed cheap enough for the farmer who mainly depends on his own seed for planting.

Notable among selections emanating from our germplasm trials are:

1. Canadian wonder type (NB 26) which is medium maturing with medium resistance to halo blight and anthracnose.
2. Red harricot (NB 86) which is resistant to halo blight and bean rust.
*3. Rose coco (NB 510) which is very tolerant tc anthracnose and bacteria blights.
*4. Canadian wonder type (NB 532) which is high yielding rust tolerant, and adapted to the higher rainfall areas.
5. Mwezi moja (NB 518) which is susceptible to both halo blight and anthracnose, but can survive because it is early maturing. This is well adapted for marginal rainfall areas.
6. Small Rose coco (NB 1122) which although susceptible to both halo blight and anthracnose, is early maturing and can escape diseases specially in drier areas.

7. Black bean (NB 127) which is resistant to halo blight anthracnose and bean rust. It is late and high yielding.

Both Small rose-coco and Mwezi moja selections have been found to perform exceptionally well at Katumani where the rainy season is relatively short.

With cooperation of the University of California, new crosses of teparies with Kenyan adapted beans have been successfully developed and are currently being tested in the dry areas in Kenya.

Several students have been identified for training in our collaborating institutions in the University of California at Davis and Riverside.

OUTLOOK FOR THE FUTURE

It is hoped that further intensification of bean research will be done particularly in the development of drought tolerant varieties suitable for the semi-arid areas of Kenya. This will be possible as our scientists are fully committed to the fulfilment of this goal.

Assistance from our collaborators in the Bean/Cowpea CRSP is and will continue to be appreciated.

The role of CIAT in this respect will be very important as we look forward to their collaboration particularly in providing us with germplasm, especially advanced lines which we could test in the Kenyan environment for quicker development of suitable cultivars for release to farmers. Also training and exchange of research personnel with CIAT is of great importance .

* These were passed on to the Ministry of Agriculture and have been since released as GLP2 and GLP24.

Baseline studies on socio-economic factors pertaining to bean production should be initiated to supplement those already underway by our sociologists in Kenya.

Appendix 8: Workplan Integrating Research and Training of the Bean/Cowpea CRSP, CIAT and the National Bean Program in Uganda

WORKPLAN INTERGRATING RESEARCH AND TRAINING OF THE BEAN/COWPEA CRSP, CIAT AND THE NATIONAL BEAN PROGRAME IN UGANDA

INTRODUCTION:

The beans programme, which started in 1960, progressed so rapidly that by the early 1970 Uganda's research on beans was ahead of any of the East African countries. When the programme started there were about 50 landraces at Serere Research Station. Mukasa (1970) added more to the existing collections by making more collections in Uganda, through introductions and by addition of improved varieties from the hybridisation programme.

However, there has not been a coherant research programme involving all disciplines, e.g. agronomy, pests etc. Thus the breeder has mainly worked with the pathologist, leaving other disciplines to work independently. Any variety released would be better appreciated if complete results, backed by all displines are presented at the time of release. Lack of manpower, economic constraints, especially the current inflation has placed limitations on improving facilities and therefore techniques on our programme. We have had a decrease in output since the beginning of 1972 and the programme, instead of expanding and progressing, as was the trend of the 1960's has been forced to cut down on many of its activities. Presently, the possibility to regain the former position on our own is rather remote, in which case, we have to rely largely on international organisations in order to be able to use our meagre resources profitably.

Cowpeas are on the otherhand the second most important grain legume after beans in Eastern Uganda and third in importance after beans and pigeon peas (Cajanus cajan (L) Millsp.) in Northern Uganda. Elsewhere in the country the leaves are more popular than the grain. But there has been scanty research work carried out, on the crop and the farmers are presently using disease and pest susceptible, low yielding and indeterminate plant varieties that need to be improved.

a) RESEARCH NEEDS

Beans

(i) Breeding:

Evaluate and document the bean collection for all its major characters to improve yield, disease and pest resistance, nutritional value and other agronomic characteristics of the dry and haricot beans.

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Selection of seed with acceptable seed type (e.g. large red mottled) for commercial purposes. Colour, size of seed and cookability are important. The canning industry requirments for the white hariocts are also to be considered.

(ii) Agronomy:

Fertilizers - In Uganda beans are low yielding partly due to low fertility, so fertilizer requirement have to be up-dated for each variety.

Population and spartial arrangments of the hariost and dry beans. Intercropping - a popular practice in the country - finding its effects on yields.

(iii) Pathology and Entomology:

Documentation of pests and diseases and control measures to be devised. - through chemicals and breeding for resistance.

(iv) Nutrition:

Peas Nutritive value of seed.

Similar research needs as for beans but nutritive value of the popularly eaten leaf needs to be included plus the stage and number of pickings required for optimum production of the crop.

b) INVENTORY OF PREVIOUS AND EXISTING RESEARCH

(1) Previous work:-

Concentrated on developing the large red-mottled bush types. Ephasized screening, hybridisation and selection of materials resistant to Anthracnose, Bacterial blights, Rust and Angular leaf spot. No artificial innoculation was made but selection was done for resistant types when a particular disease was preponderate. Resistance and high yield was in some instances obtained. Varieties obtained in this way include these shown in the table belewp

..../3.

Table:

Yield, maturity periods and disease reaction of some bean varieties

Variety	No. of days to maturity	Grain Yield in Kg/ha	Diseases recorded
K_{130}	-	-	-
K_{113}	85	2150	-
K_{112}	85	2075	virus
K_{119}	90	2067	virus
K_{121}	85	1892	virus
K_{116}	85	1750	
K_{20}	80	1575	heavy rust mild bacterial blightsand Angular leaf spot.
Banja 2	75	1008	

Spacings of 10 x 60 cm have been used without applications of lime, phosphate and nitrogenous fertilizers.

(2) Existing research programmes:-

Breeding:

Breeding haricot and dry beans for resistance to *Urohyces phaseoli* (Bean rust)

Bean germplasm development, maintainance and evaluation.

This programme is being carried out by:

(i) multiplying available local genotypes and introductions for distribution after preliminary evaluation.

(ii) Selecting from accessions, good lines for a crossing programme with an aim of getting new and useful recombinations.

(iii) Maintaining all promising lines previously developed by breeders. White haricot beans are being screened and selected for adaptation to a wide range of climates, resistances to diseases, high yield and suitable seed size for canning.

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Agronomy

Fertilizers - research is being directed at finding out whether nitrogenous, phosphatic fertilizers and lime are beneficial to bean growth and intercopping m beans with maize and cotton is being studied to find out the effect on the yields of both crops and see if it increases total economic returns to the farmer.

Pathology:

(i) Studies on artificial innoculation techniques, control and host range of Pseudomonas solanacearum - a bacterial wilt affecting a wide range of crops in Uganda.

(ii) Study on the Bean common mosacie virus; through artificial innoculation.

Nutrition

Nutrition qualities of beans in Uganda need further study.

Peas

Improvement through breeding.
To screen and select pea varieties for high yield, disease and pest resistance and plant type.

c) EXISTING RESOURCES

1. Personnel	Available Beans	Available Peas	Total needed
Breeders	2	1	3
Pathologist	1	-	2
Entomologist	1	-	2
Agronomist	1	-	3
Weed scientist	-	-	1
Nutritionist	-	-	1
Agric. Economist	-	-	1
Extension worker and Rural sociologist	-	-	2

2. Infrastructure

Testing centres (District Variety Trial Centres, (60 in number) need rehabilitation:

Transport, for research workers to go to trial centres is not available.

d) RESEARCH NEEDS IN RELATION TO RESOURCES

Breeding.

Up to 6 breeders are required to handle the urgent problems found on dry and haricot beans and pear (2 for each area). But personal and financial limitations makes employment of such a big number of research workers impossible.

Agronomy etc.

Although breeding is the backbone of any crop improvement programme, other displines should be integrated in the programme for meaningful and reliable results. Hence the need for Agronomists, Entomologists, Pathologist, a Weed scientist, a Food quality scientist, Economist and Extension work and Rural Sociologist.

8. TRAINING REQUIREMENTS

a) short term: - (at CIAT)

2 Breeders (present breeders are new in the job)
1 Pathologist
1 Entomologist
1 Agronomist

b) Undergraduate.

None

c) Graduate

Msc. / Ph.D.

1 Breeder of pigeon peas
1 Pathologist
1 Entomologist
2 Agronomist
1 Weed Scientist
1 Extension/Economist

3. Regional Centre:-

We suggest formation of a Regional Centre for beans/cowpeas, based in Uganda to monitor the progress and archivements of national research programs in comparision with International Research centres like CIAT.

Reasons for suggesting Uganda.

1. a) Though the yield of beans are low the crop is produced all over the country.

b) The crop is very well-known and consumed by all the people in the country.

2. i) Uganda has got a variable ecosystem:

Appendix 9: Workshop to Develop Workplan for Bean Production in Eastern Africa: Country Presentation for Malawi

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WORKSHOP TO DEVELOP WORKPLAN FOR BEAN PRODUCTION IN EASTERN AFRICA: COUNTRY PRESENTATION FOR MALAWI[1]

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[1]Paper presented at a Workshop on Workplan for Bean Production in Eastern Africa. Cali, Colombia. 16 - 22 November 1983.

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WORKSHOP TO DEVELOP WORKPLAN FOR BEAN PRODUCTION IN EASTERN AFRICA:
COUNTRY PRESENTATION FOR MALAWI

BACKGROUND INFORMATION ON MALAWI

Geography and population

Malawi is in East Central Africa. It is bounded on the north and north east by Tanzania, on the east, south and southwest by Mozambique and in the west by Zambia. The main access to the Indian Ocean is through Mozambique. The country extends for about 900 km from the north to the south and about 200 km from east to west.

The country which occupies part of the Great Rift Valley system has an area of 11.8 million hectares. Of the total area, 79.7% is land and the remainder is essentially lakes with Lake Malawi being the largest body of water in the country.

Malawi has two main distinct seasons, the dry and the wet. The dry season lasts for about seven months. May to August are cool and dry while September to October are hot and dry. The rainy season stretches from November to March generally. Rainfall is about 1,600mm in the Lakeshore and high altitude areas such as Mulanje. The plateau areas of the Shire Highlands and the Central Region receive about 875mm of rain. The Lower Shire (South), Mzimba West, and parts of Rumphi (in the north) receive less than 750mm. The Lower Shire in the South is also characterized by erratic rains.

The annual range of temperature is about 12°C in most meteorological stations increasing to about 15°C in the extreme South. The lowest

temperatures occur in June and July and the highest, in October and November. Temperatures in the Lakeshore and the Shire Valley average 24°C.

Population

According to the 1977 census, Malawi had a population of 5.55 million people. The growht rate was 2.9. It is estimated that the population in 1983 is 6.83 million people. The population density in 1977 was 59 persons per Km^2. Of the 5.55 million people in 1977, only 8.5% lived in urban areas of Blantyre, Lilongwe, Mzuzu and Zomba. The remainder were in the rural areas where their main occupation is aagriculture.

Agriculture in Malawi

Agriculture is the main industry in Malawi where about 90% of the population are engaged in farming and agriculture related profession. In 1980, agriculture contributed 42.6% of the gross domestic product with a rise of 9% (Anonymous 1981a). In 1977, of the 9.4 million hectares, 36% was under cultivation with 31 and 5% being under customary land (Smallholders) and estates, respectively (Table 1).

Table 1. Estimated land usage in Malawi

Parameter	Land Use (%)
Customary land under cultivation	31
Area under estate	5
Land not arable	33
National parks	11
Forest reserves	9
Urban area and infrastructure	11

The smallholder sub-sector produces the bulk of the staple foods such as maize, beans, groundnuts, rice, cassava, potatoes, etc. The export surplus from the smallholders accounted foraabout 32% of the gross domestic product in 1981 (Anonymous 1982).

IMPORTANCE AND UTILIZATION OF BEANS IN MALAWI

The common beans, Phaseolus bvulgaris L (Savi) also known by various names as dry beans, kidney beans, ration beans, sugar beans, french beans, garden beans, or simple nyemba or nchunga in Malawi, are one of the most important grain legumes. As food, beans provide high percentage of protein (20 - 25%) compared with maize, cassava and rice. Green pods and green shelled seeds are also good sources of vitamins A and C. Beans are also good sources of energy providing comparable calories as maize

flour (ufa), milled rice or cassava flour (Platt, 1962). Beans provide about two and five times more energy than bread and potatoe (Solanum tuberosum), respectively.

The beans commonly eaten in Malawi are the dry beans. These are usually red, white, speckled or tan; larged seeded (40 - 50g/100 seeds); kidney shaped seeds, which after cooking look like chunks of meat, are preferred. There are several ways of preparing bean dishes in Malawi. The commonest one in homes, boarding schools, colleges, farming estates and in most institutions where a large number of people are fed communally, is to soak the seeds in water for a few hours and discarding the water afterwards. The purpose of soaking is to accelerate cooking and also to reduce flatulence (generation of gas in the digestive system). Salt, cooking oil, tomato and other ingredients may be added according to taste and cooked as a mixture. The cooked beans (ndiwo) is served with rice or nsima. The seedcoat is sometimes removed after soaking, and the beans are cooked until soft. The beans may be mashed with a special laddle to form chipere. Beans may also be boiled with maize, after the pericarp has been removed, to produce a popular food called ngata. Beans are sometimes cooked with banana or plantain to produce a dish known as mbaraga. Beans may also be cooked in the pod and eaten as such, makata. Bean flour can also be mixed with maize flour and ground groundnuts to produce Likuni phala which is used for weaning children and for children under five years old.

The green immature pods, zitheba, are sometimes eaten as relish. Young and tender leaves are sometimes boiled and cooked with groundnut flour to produce khwanya. Surplus leaves are dried and stored for future use as mfutso. In areas where bean production is low, or at a time of the year when supply is low, beans, cowpeas (Vigna unguiculata) and pigeon peas (Cajanus cajan) can be cooked together either for the bean flavour and/or to stretch the bean supply. Other bean dishes are: baked brown beans, bean fritters, fried bean balls or mock meat loaf.

MALAWI'S GERMPLASM COLLECTION

Because of the importance of beans in the diet, a bean research programme was initiated in the early 1940's. The work was concentrated on only one variety. Because of the low genetic base, the programme was [illegible]mped in 1969 at Bunda College of Agriculture. Using extension workers, a large collection of about 4,000 lines were made from all over Malawi to form the basis for the bean improvement work. Out of the total sample, 11,285 lines were selected for evaluation (Table 2). The predominant growth habit of lines in the collection was climbing (75.4%), emphasizing the importance of maize and beans being grown in association in Malawi as compared to the dwarf which are mostly planted as pure stand on residual moisture. The main colour was solid and hardly any black seeds.

Table 2. Growth habit and seedcoat colour of beans lines in Malawi.

Growth habit	Accessions Total		Seed coat colour Solid (%)	Speckled (%)
Climbing	8486	75.4	70.4	29.6
Dwarf	2769	24.6	88.1	11.9
TOTAL	11,255	100.00	74.8	25.2

The germplasm material are in a "cold" room. They are rejuvenated periodically as well as collecting growth data such as emergence date, flowering date, date of fruitification, number of pods/plant, number of seeds/pod and yield as well as information on diseases and pests. It is hoped that the information would be useful in the preparation of a catalogue so as to facilitate the exchange of genetic materials among scientists. However, this aspect of our programme has been slow because of lack of facilities and staff.

OBJECTIVES OF THE BEAN IMPROVEMENT PROGRAMME

The objectives of the Malawi Bean Improvement Programme are:

1. To produce high yielding and commercially acceptable bean cultivars.
2. To provide recommendation for the production of beans both under rain-fed and irrigated condition on residual moisture as a short-seasoned rotational crop.

RESEARCH COMPLETED AND IN PROGRESS

GERMPLASM EVALUATION

Only a few of the germplasm materials bhave been evaluated at catalogued. The results obtained so far indicate that the yield potential of the collection is high with about 13% of the bush lines evaluated yielding more than 1500 kg/ha and about 8% of the climbing lines evaluated yielding over 1500 kg/ha.

The germplasm collection and evaluation process is still in progress. Materials are also being obtained from research organisations and/or individuals to broaden the genetic base.

VARIETY RELEASE

Using materials from the Malawi Bean Collection, through the process of single plant, single pod and single seed selection, we have produced four named bean varieties. These varieties are now available and are being marketed by the National Seed Company of Malawi Ltd. Some of the characteristics of the varieties are listed in Table 3.

Table 3. Some characteristics of beans on release

Name	Growth habit	Type	Seed Coat Colour	Days to Full Bloom	Seed size g/100 seed	Yield (Kg/ha)
Nasaka	Dwarf	Dry	Tan	35	49.1	1179
Bwenzilawana	Dwarf	Dry	Yellow	37	31.5	2084
Sapelekedwa	Dwarf	Dry	Red	36	49.3	1256
Kanzama	Climbing	Dry	Red	40	51.9	2739

There are also other varieties on provisional release most of which are dry and a few canning ones.

MAIZE AND BEANS IN ASSOCIATION

Mixed cropping, the practice of growing two or more crops on the same piece of land is a popular and traditional cropping system of long standing. It is a strategy used by smallholders for increasing crop yields, crop diversity, and the stability of crop production (Gomez and Gomez, 1983) According to a national sample survey of agriculture (Anonymous, 1970), 94% of the hectarage was grown to crops as mixtures. In the same survey only 1% of the pulses, beans, pigeon peas, cowpeas, etc were grown as pure stand while 99% were grown in association with other crops notably maize.

Intercropping is popular in the tropics (Francis, Flor and Prager, 1978; Igbozurike, 1977 and Francis, Flor and Temple 1976) because of several advantages. These include: increased crop yield (Wiley and Osiru, 1972, Evans, 1960, Baker, 1978 and Edje, 1982a) more efficient use of labour (Norman, 1968), more efficient use of water (Baldy, 1963), reduction in pest incidence (Pearson, 1958, and Francis, Flor and Prager, 1978) improvement in soil fertility (Agboola and Fayemi, 1972). Despite the above advantages, little research has been done on mixed cropping until the 1970's when researchers started "going outside the research stations and talking to the farmers who have been experimenting with intercropping for centuries.

In view of the above we have conducted mixed cropping trials on the following crop combinations:

a. maize and beans

b. maize, beans and pumpkins

c. sorghum and beans

d. cassava and beans

e. groundnuts and beans

f. tobacco and beans

g. Acacia albida and beans

h. Leucaena and beans

i. Eucalyptus and beans, and

j. Gmelina and beans

The strategy in these crop combinations has been designed to ensure that the yield of the main crop, usually maize, is not reduced. Consequently yield increases as high as 62% have been reported (Edje, Mughogho and Rao, 1976). Land equivalent ratios as high as 1.4 have also been reported (Edje, Mughogho, Rao and Msuku, 1981).

Using Food and Agriculture oOrganisation estimates that a 55-kg active man requires 2.5 megacalories and 65g of energy and protein per day, we have been able to show from calculations that more farmers can be fed on produce from mixed than sole crop. This is important since most farm work is done by hand, operations that need high energy food for hard work Ngwira (1981) working on the intercropping of maize,

bean and pumpkins (Cucurbita maxima) showed that maize yield was not significantly affected when grown in association with either beans or pumpkins (Table 4). The bean and pumpkin yields were therefore a bonus crop to the farmer since all three crops were grown on the same piece of land utilizing the same fertilizer meant for maize. She also showed that about two months lafter planting, the pumpkins had completely covered the ground. This, she noted, reduced the frequency of weeding in plots where pumpkins were grown. This is of importance to the smallholder who uses hand tool for almost all field operations.

Table 4. Yield (kg/ha) of maize, beans and pumpkins in monoculture and in association at Bunda College, 1981.

Crop combination	Maize	Beans	Pumpkins
Maize alone (MH12)	6981	-	-
Bean alone (Climbing; var. 1039)		1073	-
Pumpkin (local variety)	-	-	24,478
Maize and beans	7182	222	
Maize and pumpkins	7037	-	10,057
Beans and pumpkins	-	784	13,793
Maize, beans and pumpkins	6138	157	13,602

In recent years, there has been an increased need to integrate crop production and livestock production in Malawi (Spurling, Spurling

and Bowmaker, 1972). Taking an advantage of mixed cropping as a popular cropping system, we at Bunda College began investigating the effect of topping maize, either removing tassel alone or tassel with some leaves on the yield of maize and beans. The basic objective is to feed the topped maize part as green feed or as dry fodder to fattening steers. It was also hoped that by topping, more light would become available to the associated bean crop. The data in Table 5 show the effects of these treatments on crop yield (Edje unpublished and Kubwalo, 1981)

Table 5. Seed yield (kg/ha) of topped maize in monoculture and in association with beans.

Treatments	Maize Yield		Bean Yield	
	Mono	Assoc.	Mono	Assoc.
No topping of maize	7423	6383	2221	774
Top tassel only	8067	6605	-	741
Top tassel and 2 top leaves	7850	6364	-	652
Top tassel and 4 top leaves	6928	5574	-	864

Kubwalo (1981) reported that assuming that one livestock unit equals 454 kg and if one livestock unit feeds on 11.4 kg per day and if it takes five months oto fatten a steer for slaughter, topping tassel only, tassel plus two leaves and tassel plus four leaves should provide eacnough feed for 1, 2 and 3, livestock units/hectare, respectively (Table 6).

Table 6. Dry matter and no. of livestock units to be fed on topped maize plant parts

Treatments	DM (kg/ha)	Day/L.U.	L.U./ha
Top tassel only	2390	209	1
Top tassel and 2 leaves	3280	287	2
Top tassel and 4 leaves	5240	451	3

A recent survey (Anonymous, 1981b) showed that 94% of the energy consumption in Malawi is from fuelwood where wood is used for heating and cooking in urban as well as in rural areas. In addition to the above, the checklist of wood use included: curing tobacco, smoking fish, baking bricks, furniture use, houst construction, canoe building, etc. Because of the importance of trees in the economy of the country and the role of trees in maintaining the fragile ecosystem, there has been renewed interest in the re-marriage of agriculture and forest and also livestock in an old land use system now referred to as agroforestry.

One of the areas of agroforestry is the investigation in the integration of crops and trees. Preliminary results (Edje 1982 b, 1982c) showed that beans can be grown successfully under trees during the first year of tree's establishment with reasonable crop yields (Table 7) in what may be termed as the taungya system.

Table 7. Effects of planting trees in monoculture and in association with beans

Cropping sys

Cropping system	Bean yield (kg/ha)
Monoculture	1578
In association with:	
Acacia	1342
Eucalyptus	1282
Gmelina	1292
Leucaena	1390
S. E. ±	76

PLUCKING LEAVES FOR USE AS GREEN VEGETABLE

As indicated earlier under utilization, both bean pods and tender leaves are plucked before pod set, cooked and eaten or parboiled, dried and later as vegetable. Edje, Mughogho and Ayonoadu (1972) reported that plucking bean leaves for use as vegetable reduced seed yield significantly. For example plucking three leaves once or twice reduce seed yield of bush beans by 21 and 40.8%, respectively. Climbing beans were less affected by plucking.

Edje (1981a) investigating the effects of initrogen and leaf remov removal reported that while nitrogen increased seed yield significantly additional nitrogen did not produce enough leaves to offset the effect of lea

of leaf plucking (Table 8).

Table 8. Effects of nitrogen and leaf plucking on seed and leaf yield

N leaves (kg/ha)	No. of pluckings	Seed yield S(kg/ha)	Fresh leaf yield (kg/ha)	Leaf Area Defoliated (dm^2)
0	None	799	-	-
	One	621	1875	67
	Two	555	3034	130
	Three	273	4891	156
	Mean	562	3267	118
40	None	1096	-	-
	One	1034	2933	98
	Two	1164	5298	163
	Three	701	5922	195
	Mean	999	4718	152
80	None	1125	-	-
	One	1287	648	101
	Two	1015	960	172
	Three	737	1230	187
	Mean	1041	946	153
S.E. ±	N levels	48	245	7
	Leaf plucking	89	165	3
	N X Leaf plucking	154	213	6

USE OF LEUCAENA PRUNINGS AS FERTILIZER

Recent increases in fertilizers and the general shortage of fuelwood in the tropics has renewed interest in the use of green manures. Because before the introduction of modern agriculture, farmers in the tropics were of necessity organic farmers. That is they used neither commercial fertilizer nor pesticides.

Trial conducted at Bunda College during the 1982/83 crop season (Edje, 1983, Figure 1) showed that additional fresh leucaena prunings increased bean seed yield significantly. Seed yields for 0, 10, and 20 tonnes/ha of leucaena were 915, 1160 and 1706 kg/ha, respectively. Both 15 and 20 tonnes/ha of leucaena yielded higher than 250kg/ha of a compound fertilizer (20-8.7-0; N-P-K).

GROWING BEANS ON RESIDUAL MOISTURE ON IRRIGATION SCHEME.

There are 16 irrigated settlement schemes in Malawi occupying an estimated area of 4147 hectares and an expansion is planned. Settlement schemes that have adequate irrigation facilities have two crops of rice yearly; while those that do not have adequate water supply produce only one crop of rice leaving the land idle for the remainder of the year. In 1980 several adaptive research trials were initiated aimed at producing package practices for bean production on residual moisture following a rice crop.

The results of variety trial showed that a mean seed yield of 1691 kg/ha could be obtained. The results of other trials showed that beans planted about mid June anhad the highest seed yield of 2100 kg/ha. Planting beans at that time would provide ample time for the crop to mature and to prepare land for a subsequent crop of rice. Preliminary results also showed that a seed rate of 50 kg/ha or a plant population of 111,000 plants/ha grown on flat with 45cm between rows had the highest seed yield of 1589 kg/ha. Increasing the seed rate to 100 kg/ha. Reduced seed yield by 18.4% (Edje, 1982d)

PLANT POPULATION AND PLANTING PATTERNS

Plant populations on farmers fields is usually rather low 30,000 - 80,000 plants/ha presumably because of shortage of seeds or because of

planting patterns which is usually hill planting, excepting in parts of the Northern Region where farmers plant three to four crows on ridges about one meter apart. Earlier work on plant population (Edje, Ayonoadu and Mughogho 1974 and Edje, Ayonoadu and Mughogho 1975) showed that beans were highly plastic and were able to compensate for yield even at low plant densities.

Recent work (Table 8) showed that, at the same plant population, planting pattern ahad effect on seed yield.

SEED INOCULATION

Earlier work (Edje, Ayonoadu and Mughogho 1975a) showed that beans responded to liberal dressings of nitrogen. However, prices of fertilizer in Malawi, as elsewhere, have brisen 293%! in a decade. At this price increase, the purchase of fertilizer has become less attractive.

However, trials on seed inoculation with Rhizobium bacteria have not produced appreddable seed yield increases compared with nitrogen fertilizer (Edje, 1983a, Figure 1)

SEED STORAGE

The commonest storage pest of dry beans in Malawi is Acanthoscelides obtectus. It is not uncommon to see an entire bean crop destroyed by the pest within two to three months after harvest. This insect problem has been one cause of lack of seed for planting.

However, during a bean germplasm collection trip in Northern Malawi

in 1982 we saw farmers storing beans with pod ash. The farmers we spoke to said that the use of the pod alone was more effective than when the ash was obtained from the entire plant (less the seeds of course). The data in Tables 9 and 10 show the results of beans after eleven months in storage. The seeds were stored in metal tins with 3 kg of seeds per tine. Not only did the pod ash protect the seeds in storage, seeds stored in pod ash had more shining appearance than those stored in other "insecticides".

Table 8. Seed yield of six bean varieties at three planting patterns

VARIETIES	PLANTING PATTERNS			MEAN
	One row per ridge (5 cm apart)	Two rows per ridge (10 cm apart)	One row per ridge Hill planting (20 cm apart)	
253/1	1340	1464	1233	1346
1196	1822	1952	1762	1845
P692	1879	2250	1840	1990
P402	2032	1896	2072	2000
336	2007	1607	1557	1724
1039	896	968	1090	1015
MEAN	1678	1690	1592	

Table 9. Effects of various insecticides on bean storage

Insecticides	No. insects/kg seed		Weevilled Seeds (%)	
	Alive	Dead	Not weevilled	Weevilled
Control	25	661	50	50.0
Groundnut oil	51	496	74.7	25.3
Sunflower oil	1376	743	56.7	43.3
Tobacco dust	3	394	88.0	12.0
Actellic	1	1266	87.0	12.2
Bean Pod ash	3	161	92.0	8.0
Bean Varieties				
253/1 (Tan)	27	465	58.8	41.2
336 (Red)	50	826	72.8	27.2
499/5 (Black)	16	581	83.0	17.0
P692 (White)	53	609	66.5	33.5

Table 10. Germination (%) of 4 bean varieties stored with six insecticides

Insecticides	VARIETIES				MEAN
	253/1	336	489/5	P692	Mean
Control	36.4	69.2	61.2	36.0	50.7
Groundnut oil	82.8	58.8	68.0	64.0	68.4
Sunflower oil	24.0	37.2	46.8	30.8	34.7
Tobacco dust	89.2	66.8	77.2	89.2	80.6
Actellic	97.2	76.0	78.8	86.8	84.7
Bean pod ash	98.8	86.8	77.2	92.0	88.7
MEAN	71.4	65.8	68.2	66.5	

BEAN/COWPEA CRSP PROJECT

The title of the Malawi Bean/Cowpea CRSP Project is "Genetic, Agronomic and Socio-cultural Analysis of Diversity Among Bean Land Races in Malawi".

The objectives of this project are:

1. To produce a quantitative estimation of the diversity within and between the bean land races which about 75% of the farmers grow.
2. To determine which plant or seed characteristics play major roles in distinguishing one race from another.
3. To obtain objective descriptions of major agronomic and climatic factor

factors and biological forces operating in the environments in which genetic diversity prevails.

4. To determine the socio-cultural considerations that might be associated with preference for and acceptance of particular land or components of such races.
5. To identify the contribution of farm women to bean production and consumption and their relationship to the central problem of reasons for maintenance of genetic diversity.
6. To develop a synthesis of agronomic genetic and socio-cultural factors that would explain the diversity patterns observed in Malawi and reasons for their maintenance.

ACTIVITIES SINCE INITIATION OF PROJECT

1. GERMPLASM COLLECTION IN THE NORTH, 1982

An intensive germplasm collection trip was made in the Northern Region of Malawi in Easter of 1982 with co-investigators from the Michigan State University and the host country investigators. In all a total of 113 samples were collected.

During the collection, farmers were asked the source and or origin of their seeds, how long they have been growing beans, agronomic practices (time of planting, mixed or pure stand, fertilizer application), reasons for growing several types of beans, utilization, preference, methods of preparation, storage and sales of surplus.

Of the 113 collections, 28 were made from markets and 85 from farmers' fields and/or homes.

The percentage distribution of types grown are shown in Table 11. The number ranged from 1 - 63 and a mean of 14 types per sample.

Table 11. Percentage of types of ebeans in the Northern Collection

No. types	Percentage
1 - 5	25
6 - 10	23
11 - 15	15
16 - 20	10
21 - 25	7
26 - 30	11
31 - 35	5
36 - 40	1
41 - 45	0
46 - 50	1
51 - 55	0
56 - 60	1
61 - 65	1

Majority of the types were medium to large in size, kidney shaped and seed coat colours ranged from brown, green, red, speckled to white and an occasional blue.

Most of the farmers owned their own seed, some having obtained the seeds from their grandparents. The crop was generally planted in mixed stand with maize where the later crop provided stake for the bean crop. Two crops of beans were possible in some areas. The second crop was either relay with beans or grown as a pure crop following a maize crop.

Double cropping where beans followed maize was common in the Misuku area. In this area, beans were grown in association with a short-seasoned maize variety. The maize was harvested after physiological maturity but before it was completely dry for storage. The maize was dried on a "shelf" over fire from cooking. Some maize leaves were stripped from the plant, buried and new ridges made and a second crop of beans were planted. The second crop was generally a bush or semi-climber. Some of the Agricultural Extension workers said that farmers were reluctant to accept long duration hybrid maize because it interfered with the second crop of beans. In some areas, a third crop of beans can be grown either on redisual moisture or near a stream.

Farmers did not apply fertilizer to beans. However, where beans and maize awere grown in association, the maize crop was often fertilized

As stated earlier, farmers grew several types of beans. The reasons

givengwere for yield stability and a strategy for stretching the availability of leaves and seeds for food and also for reasons of preference and sales for cash as the small reds, Katolika, were often planted because they were high yielding, takes too long to cook and sours rapidly after cooking.

The red kidney, Saaba, sugar beans, Serenje, the dark reds, Chazama the green, nazuzembe, cream with olive stripes, mwangulungulu etc. were generally preferred either because of taste and/or ease of cooking. Mwangulungulu was said to be good for children while some of the dark reds, Mazungu, were said to cause stomach problem for children.

The small whites and to some extent the large whites were easy to cook but soured easily and stored poorly. Some farmers used the ash t from the pods for storage. Surplus seeds were sold at village markets or to a produce buying organisation, Agricultural Development and Marketin Corporation (ADMARC). ADMARC paid premium price for monocoloured seeds thereby discouraging farmers from selling blends. Since farmers grew beans as mixtures of types, seeds were, therefore, selected before they were sold to ADMARC.

SOCIO-CULTURAL STUDY

Following the initial seed selection in the North, ten women students from Bunda College were trained as interviewer/observer by

Dr Pat. Barnes-McConnell and Dr J Miller with assistance from Dr O T Edje and Mr A Mkangama. These ladies spent two and half months with Dr J Miller and Mr A Mkangama collecting socio-cultural data on bean production and special emphasis bean utilization.

Data collected from household included demographic information about the family, general information about the homestead and the provision and/or availability of production of , production of beans consumption labour preparation and consumption of beans, storage and disposal of surplus. The results of this socio-cultural survey should be available soon.

RANDOM COLLECTION OF BEANS THROUGHOUT MALAWI

The objective of this collection was to obtain at random single plant selection at harvest or random bulk sample of already harvested crop to obtain quantitative estimates of the genetic diversity of beans in Malawi. To this effect, 13 farms were selected in bean growing areas with five sites each in the North and the Central Regions and three in the South. In all 65,309 seed samples were collected from sites that ranged from 930 - 1728 meters above sea level. The number of seeds per region and the frequency of seeds of three major seed coat colours are shown in Table 12. The North had the highest number of seeds, also the highest frequency of all types of seed coat colours. The reason for the high frequency in the North compared to the other two

regions is not quite understood but it is probably that market economy where ADMARC paid premium for monocoloured seeds could be a determining factor. Farmers in the North tended to sell their beans locally or to neighbouring countries where the pressure for monocolour is less pronounced.

Table 12. Mean altitude, no. samples and frequency of seed types by colour in three regions of Malawi

Region Region	Mean Altitude (m)	Sample of seed size	Seed Frequency		
			Mono	Var.	Zebra
North	1312	28678	.302	.101	.037
Centre	1098	18299	.196	.067	.016
South	1833	18332	.224	.057	.00005

Table 13 shows the pattern, shape, the frequency of colours and the different types pooled over regions.

Table 13. Seed pattern and shape of seeds from 13 farms in Malawi &

Seed character		Frequency	No. Types
Pattern			
Monocolour		0.72	23
Variegated		0.23	62
Zebra		0.05	27
TOTAL		1.00	112
Shape	Ratio:L/b		
Globe	Ratio:L/b	0.22	
Oval	1.5 - 1.75	0.63	
Oblong	> 1.75	0.15	

There were 112 different seed types with the variegated representing 55% of the types and the monocolour or plain (Solid colour) and the zebra being 21% and 24%, respectively.

GERMPLASM EVALUATION OF SEEDS COLLECTED - NORTHER REGION

The 113 seed samples which were collected in Easter, 1982 were planted under irrigated and rainfed conditions at Bunda College. Data were collected on agronomic characteristics such as hypocotyl colour, flowering, growth habit (according to classification) and also

on seed characters. The seeds are being increased for future agronomic studies.

GERMPLASM COLLECTION -CENTRAL REGION 1983

During the second germplasm collection in 1983, only 50 samples were collected from the Central Region. The number of types ranged from 1 to 35 with a mean number of 15 types per farm, about the same number as for the North but the range of types and colours were much less in the Central Region.

RESEARCH NEEDS

1. FARMING SYSTEMS RESEARCH APPROACH TO BEAN RESEARCH

Until the 1970s the traditional form of agriculture research which was rather prescriptive and permitted the researcher and the extension worker to isolate the farmer and pass on to his client only the best results and recommendation was the vogue. Trials were conducted under ideal research station with much more fertile soil, better management conditions, complex treatments whose interactions are difficult to interpiet for the benefit of the smallholder farmer.

What is needed, and urgently too, is a detailed farm to obtain information on production areas, production systems and constraints as well as utilization. The survey should be done during the growing season so that the participants have an opportunity to see the crops in the field.

COLLECTION AND EVALUATION OF GERMPLASM

More detailed collection with climatic data, soil information, altitude etc. of germplasm is still needed. Where farmers grow two or more crops during the year, different collection trips should be made since farmers are likely to grow different types during the different seasons.

The evaluation of the germplasm with the view to a comprehensive cataloguing of the material collection is also needed. This is a vital information not only for the collector but also to other bean researchers.

3. VARIETAL IMPROVEMENT

Until about a year or so ago, we were quite enthusiastic about producing one or two varieties for production in Malawi. However, after the field trips we made to the North and the Central Regions of Malawi where the average number of type per farm is 14 - 15, I am beginning to wonder about the justification of developing one or two varieties for farmers to grow.

4. MIXED CROPPING

Growing of beans in association with maize is the most predominant cropping system of growing beans in Malawi. Studies are needed on relative dates of planting; plant density in mixed cropping, planting patterns in mixed cropping, diseases and pest complex. Studies are also needed on relay and double cropping.

5. PLANT DENSITY

Most farmers in Malawi plant beans in hills as a pure stand as a double crop following a maize crop. Research is needed on lthe of cultivars to low density and hill planting on residual moisture.

6. CROP NUTRITION

The ever rising price of nitrogenous fertilizer justifies more search for effecient nitrogen fixing strains of Rhizobium.

CROP PROTECTION

The commonest diseases in Malawi are enthracnose, halo blight and angular leaf spot. Bean fly is the commonest field insect pest especially of late planted crop or where the farmer has a double crop c beans. Resistant varieties to the above pests are needed as a matter of urgency.

SEED STORAGE

With respect to seed storage, research is needed in the evaluation of local materials for seed storage. As reported earlier, the ash from bean pods have been used fairly successfully. Nevertheless, there is need to screen for bean pods with insecticidal qualities for bean storage and also the proportion of ash to seed during storage.

ENERGY FOR COOKING BEANS

In Malawi, 94% of the energy consumption is wood, where fuelwood is used for cooking and heating. However, wood supply is becoming a

problem. This scarcity is bound to affect the frequency of bean consumption. Because of the energy demand for cooking beans. Already some urban dwellers are beginning to cook beans using charcoal instead of electricity because of high electricity bills. Even the frequency of using charcoal is decreasing because of its cost and that of fuelwood.

There is urgent need therefore to search for easy to cook varieties otherwise bean consumption and by logical extension bean production will decrease.

SOCIO-CULTURAL STUDIES

Recent observation in Malawi showed that women played an important role in all aspects of bean production right from lthe choice of "cultivars to plant, land preparation, the actual production, havesting, utilization, storage and marketing of surplus. However, their influential role in bean production is hardly rerecognised and therefore, unfortunately never mentioned in the literature. It is hoped that a socio-cultural study would show the contribution of women to bean production and this might help in designing training programmes at the village level aimed at increasing bean production and utilisation as well as in the preservation of germplasm.

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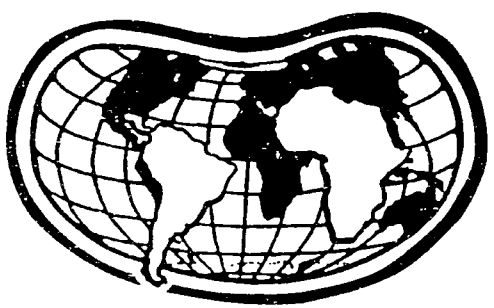
OTE/bsb
9 November 1983

Appendix 10: The Bean/Cowpea Collaborative Research Support Program (flyer) and Brief Report of 1983 Activity

BEAN/COWPEA CRSP RESEARCH PROJECTS

HOST COUNTRY Research Institution	Lead US Institution / Collaborating Institution(s)
BOTSWANA Ministry of Agriculture	Colorado State University
"Development of Integrated Cowpea Production Systems in Semi-Arid Botswana"	
BRAZIL Empressa Brasileira de Pesquisa Agropecuria (EMBRAPA)	University of Wisconsin
"Identification of Superior Bean-rhizobia Combinations and Utilization in Cropping Systems Suitable for Small Farms in Brazil."	
BRAZIL EMBRAPA	University of Wisconsin
Improved Techniques for Development of Multiple Disease Resistance in Phaseolus vulgaris L."	
BRAZIL EMBRAPA	Boyce Thompson Institute
"Insect Pathogens in Cowpea Pest Management Systems for Developing Nations."	
CAMEROON L'Institut de Recherche Agronomique au Cameroun	University of Georgia Boyce Thompson Institute
"Pest Management Strategies for Optimizing Cowpea Yields in Cameroon."	
DOMINICAN REPUBLIC Secretaria de Estado de Agricultura	University of Nebraska
"Biology, Epidemiology, Genetics & Breeding for Resistance to Bacterial & Rust Pathogens of Beans (Phaseolus vulgaris L)*."*	
DOMINICAN REPUBLIC Secretaria de Estado de Agricultura	University of Puerto Rico Mayaguez Institute of Tropical Agriculture (MITA)
"Improvement of Bean Production in the Dominican Republic."	
ECUADOR Institute Nacional de Investigaciones Agropecurias	Cornell University
GUATEMALA Instituto de Ciencia y Technologia Agricolas	Cornell University
"Agronomic, Sociological and Genetic Aspects of Bean Yield and Adaptation."	
HONDURAS Escuela Agricola Panamericana	University of Puerto Rico
"Increase and Stabilization of Honduran Bean Production through disease resistance."	
INCAP Institute of Nutrition of Central America and Panama	Washington State University Colorado State University Kansas State University Michigan State University University of Puerto Rico USDA
"Improved Biological Utilization and Availability of Dry Beans."	
KENYA University of Nairobi, Kabete	University of California-Davis University of California-Riverside
"Improvement of Drought and Heat Tolerance of Disease Resistant Beans in Semi-arid Regions of Kenya."	
MALAWI Bunda College of Agriculture	Michigan State University Virginia State University
"An Analysis of Genetic Agro-Ecologic and Socio-Cultural Factors Which Account for Persistent Patterns of Bean Land-Race Diversity in Malawi."	
MEXICO Instituta Nacional De Investigaciones Agricolas (INIA)	Michigan State University
"Improving Resistance to Environmental Stress in Beans through Genetic Selection for Carbohydrate Partition and Efficiency of Biological Nitrogen Fixation."	
NIGERIA Ibadan University University of Jos	Michigan State University
"Medical Problems Associated with Feeding Cowpeas to Children."	
NIGERIA University of Nigeria, Nsukka	University of Georgia
"Appropriate Technology for Cowpea Preservation and Processing and a Stuidy of its Socioeconomic Impact on Rural Populations in Nigeria."	
SENEGAL Institut Senegalais de Recherches Agricoles	University of California-Riverside University of Arizona University of California-Davis
"A Program to Develop Improved Cowpea Cultivars for Production and Utilization in Semi-arid Zones."	
TANZANIA University of Dar es Salaam, Morogoro	Washington State University University of Illinois
"Breeding Beans for Disease and Insect Resistance and Determination of Economic Impact on Subsistence Farm Families."	

THE BEAN/COWPEA COLLABORATIVE RESEARCH SUPPORT PROGRAM (CRSP)



An international community of persons, institutions, agencies and governments committed to collectively strengthening health and nutrition in developing countries by improving the availability and utilization of beans and cowpeas.

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THE BEAN/COWPEA CRSP
Michigan State University

The Bean/Cowpea CRSP is a coordinated effort addressing hunger and malnutrition in Africa and Latin America through research on the production and utilization of beans (Phaseolus vulgaris) and cowpeas (Vigna unguiculata).

Beans and cowpeas are dietary staples in the countries associated with this CRSP. Among the poor, these legumes provide the major source of high quality, affordable protein, as well as an important source of B vitamins. Beans and cowpeas generally are grown as food for household consumption, rather than as export crops. They are typically grown on subsistence farms and, in some countries, are grown solely by women on whose shoulders fall the major responsibility for providing the food for family consumption.

Based on a global plan developed in concert with Host Country colleagues, the CRSP is made up of a series of discrete but integrated international research projects involving teams of scientists collaborating in a study of designated facets of the overall plan. Eighteen research projects, each led by a principal investigator from one of the 9 lead US research institutions, were selected from over 80 proposals initially received.

These vigorous international research partnerships directly involve research institutions in 13 Host Countries, 2 International Centers and 14 US agricultural research institutions, which include the 9 having lead roles in the CRSP.

To attack the complex factors underlying the limited availability of beans and cowpeas, the CRSP has directed its resources to:

- Supporting close collaboration between Host Country and US colleagues within the individual projects throughout the entire process.
- Including in each project training components at the graduate level for Host Country nationals.
- Monitoring project impacts on women and their families, emphasizing each project's contributions to women's roles in the fight against hunger and malnutrition.
- Emphasizing multidisciplinary research, especially integrating with the production components such non-production components as the health, nutritional and socio-economic aspects of the farming systems.
- Requiring the expenditure of a minimum of one-half of each project's allocated funds in or directly on behalf of the project's Host Country.
- Emphasizing maximum use of research sites in traditional settings, including field trials on small farms.
- Identifying mechanisms for the subsequent distribution of research findings in ways which will benefit families in all bean/cowpea consuming countries.

This CRSP will make important contributions to the resolution of difficult and persistent problems associated with bean and cowpea production and utilization. Additionally, there will emerge from this CRSP a heterogeneous cadre of professional research colleagues who are comfortable and confident with one another and can address long-term troublesome constraints to adequate food and nutrition in poverty regions of the world.

BEAN/COWPEA CONSTRAINTS

The Bean/Cowpea CRSP is based on a comprehensive global plan which includes agronomic, socio-economic and farming systems components in problem identification and project implementation. The research projects, which emphasize problems of subsistence farmers in their traditional settings, focus on the following constraints:

- crop performance limitations due to pests/diseases
- crop performance limitations due to the physical environment
- inherent plant response limitations
- farming practices limitations
- storage problems
- economics of production and consumption
- nutrition/food preparation/health factors
- socio-cultural factors
- limitations of education, training and research capability

Each project research team concentrates on a particular area or areas of research drawn from the global plan. A research team includes a principal investigator from one of the 9 lead US institutions who is linked with a collaborating principal investigator from a Host Country institution. Frequently, additional US and Host Country institutions and their designated researchers are also involved.

Basic attention to farm family goals and farm family structures, as well as the rural culture of subsistence farmers, is crucial to the ultimate usefulness and acceptance of the research findings of these projects. The constraints, therefore, are addressed with a serious concern for appropriateness and relevance and with a sensitivity to the implications of applying the findings among women, who have an important role as producers, processors and consumers of beans and cowpeas.

THE BEAN/COWPEA CRSP ORGANIZATION

The Bean/Cowpea CRSP operates on resources from the United States Agency for International Development (USAID) and the participating research institutions. It is guided by the Board of International Food and Agricultural Development (BIFAD). Four administrative components are involved:

The Management Entity — Michigan State University (MSU) was designated the management entity upon the recommendation of the 9 lead institutions participating in the program. MSU has created a CRSP Management Office consisting of a director, deputy director, women-in-development specialist and administrative officer, plus office support staff.

The Board of Directors — Elected by and from the institutional representatives, who are designated by their respective institutions' presidents, the Board of Directors serves as the policy-making component of the CRSP. The five person Board is typically made up of administrators of international programs who hold their positions on the Board for two-year terms. The Board has provided for a sixth, non-US member.

The Technical Committee — Elected by the Board of Directors, the Technical Committee consists of five members from US institutions engaged in CRSP projects plus two international members, one from an international research center and one from a Host Country collaborating institution. Members are appointed for two-year terms. They advise the CRSP in areas of research technology, project management and technical review.

The External Review Panel — With recommendations from the CRSP, persons with international research and program management expertise are appointed by AID/BIFAD to review and evaluate CRSP management and research progress.

BEAN/COWPEA CRSP
BRIEF REPORT OF 1983 ACTIVITY
NOVEMBER 15, 1983

The Bean/Cowpea collaborative Research Support Program is an international community of persons, institutions, agencies, and governments committed to collectively strengthening health and nutrition in developing countries by improving the availability and utilization of beans and cowpeas. The Program brings together the research and training resources of the U. S. and of identified Host Countries through 18 integrated projects.

SUMMARY OF ACTIVITIES

TRAINING -- 167 persons received training including 103 males and 64 females; 92 in informal programs and 75 in formal programs; 104 from project Host Countries, 18 from other developing countries, and 45 from the U. S.

RESEARCH - COWPEAS --

University of Colorado - BOTSWANA: Cultural practices, involving intercropping, plant population, time of planting, micronutrient application, and efficiency of rhizobial strains were studied. A minimum tillage cultivator/planter was developed in collaboration with EFSAIP, which reduces the number of draft animals needed. A new harvesting system was devised. Germplasm collection with more than 400 local lines were catalogued, and 180 lines evaluated in the field. 327 varieties, local germplasm and exotic lines, were screened.

University of California, Riverside - SENEGAL: Very early cowpea strains have been developed which produce high yields in extremely dry years. Heat tolerance has been discovered in certain strains and is being incorporated into local varieties. Rapid progress is being made toward the development of complete, improved systems of cowpea production and storage.

Boyce Thompson - BRAZIL: Insect pathogens, anticipated to be safer than most chemical insecticides and produceable from within developing countries, have been developed for cowpeas. Methodology ready for world wide distribution. Surveys of diseased insects have provided more than 100 fungal isolates for further investigations.

University of Georgia - CAMEROON: Cowpea insect pests' seasonality, numbers, and habits have been assessed to identify appropriate time, place and method for effective control. Research includes cowpeas in the field and in storage.

University of Georgia - NIGERIA: Processing improves the already high protein quality of cowpeas. Processes have been developed to achieve over 95% efficiency in removal of seed coat; extrusion processes have been developed for cowpea meal. Fungi growth controls have been established.

Michigan State University - NIGERIA: A survey of two areas in Nigeria has identified the population percentage of children susceptible to gastrointestinal problems associated with cowpea ingestion. Six Nigerian cowpea varieties have been analyzed for implicated oligosaccharides.

RESEARCH - BEANS --

University of Puerto Rico - DOMINICAN REPUBLIC and HONDURAS: Five improved multiple disease resistant genotypes were released (white, red, and black seeded lines) and made available to other breeding programs in the tropics and the United States. Rust resistance in standard cultivars is anticipated.

University of Nebraska - DOMINICAN REPUBLIC: New sources of disease resistance have been identified. The genetics of resistance to blight have been determined. Interactions between bacterial isolates, concentrations, and host genotypes were identified.

University of Wisconsin (B) - BRAZIL: Experiments suggest superior bean selections can fix adequate nitrogen to produce commercially acceptable yields in small farm traditional cropping systems. Promising *Rhizobium Phaseoli* strains from Brazilian sites are being evaluated and the use of rhizobium inoculum in bean production is being promoted.

University of Wisconsin (H) - BRAZIL: Promising new techniques have been developed to produce, collect, store, quantify, and apply dry inoculum and to more efficiently assess disease severity in beans. These new techniques promise to help the breeder expedite the development of new disease resistant beans.

University of California, Davis - KENYA: Bean cultivars, tolerant of dry conditic and showing disease resistance, have been identified. Leaf characteristics of drought heat tolerant cultivars have been evaluated. The bean-tepary breeding program has identified drought resistant P. vulgaris x P. acutifolices in field trials.

Michigan State University - MEXICO: Field experiments under drought and non-drouc stress show that carbohydrate storage and remobilization under stress imply that abili to remobilize dry weight from stems and/or roots to seed during stress does not, in ar itself, assure high yield and may be only one of several factors including leaf size, tion, and orientation and properties of root systems. Four top-yielding crosses, as d mined by geometric mean of yield under stress and non-stress conditions, have been sel for detailed biometrical genetic analysis of drought tolerance and its component facto

Michigan State University - MALAWI: A seed color-pattern-size-shape census has documented extensive diversity among "land-races" in Malawi. Genetic heterozygosity w demonstrated with 0-2.25% outcrossing. Multi-variate studies of genetic distances are underway. Pilot socio-cultural observations suggest the diversity is not necessarily preferred but factors in traditional family farm management, especially factors relate labor constraints, may contribute to that diversity.

Cornell University - GUATEMALA: Two plant processes have been confirmed in farmer fields: (1) at relatively lower altitudes, daily node number increases as temperature rises, causing earlier flowering and maturity, and (2) a delayed node development resp to high temperature (elevation) and long daylengths (latitude) together causing late flowering and maturity. Each cultivar's genetic response eliciting its fewest days to flowering occurs at its optimum elevation where change toward earlier and later flower are balanced. Useful in breeding programs,
this research suggests the world can be divided into zones for the identification and designation of cultivar adaptation.

Cornell University - ECUADOR: A farming systems research methodology is being developed. Initial questionnaires and interviews have been done in two regions-- statistical analysis in process.

Washington State University - TANZANIA: Beans supply an estimated 72% of the diet protein; disease losses approximated 40% of production in one area. Growing mixed bea was shown to reduce rust and angular leaf spot and increase yield. Biological control agents have been found effective against pod borers when used in combination with minir chemical sprays for other pests. An integrated breeding program is underway which considers socio-economic information.

Washington State University - INCAP: Research on bean storage and processing indic that sundried beans require longer cooking time than forced warm air dried beans. Prehe ing or soaking beans in salt brine before storage prevented hard-to-cook problems. Methodologies have been established to facilitate understanding of protein digestibilit and the affect of various storage and cooking processes.

Data were collected in a number of countries (Dominican Republic, Ecuador, Guatemal Malawi, Nigeria and Tanzania) on input requirements for traditional production, includi women's labor, and the social-cultural factors affecting the utilization of beans and cowpeas in the local diets. This information is being integrated with project findings help to guide research. Cooperative linkages have been established with national progr IITA, CIAT, and SAFGRAD.

IMPACT -- A greater number of bean and cowpea varieties appropriate to local growing conditions, with greater disease resistance, are available.

New germplasm, important to the US bean industry, and to subsistence agriculture in developing countries is being developed; genetic research is strengthened by new pest a disease control technolngy. Farm management research is addressing yield limiting bottl necks from interaction of agricultural practices, bean plant response limitations, soci cultural constraints and economic issues. Trained US and LDC personnel are being prepa to work with international agricultural industries.

NEW INITIATIVES -- The Bean/Cowpea CRSP and CIAT are presently planning new bean resear initiatives in east Africa.

Appendix 11: Work Groups: Suggested Discussion Questions/Guide

WORK GROUPS

SUGGESTED DISCUSSION QUESTIONS/ GUIDE

TOPIC I: Identification of Regional Research Priorities in East Africa.

1. Select recorder for the group
2. Review the list of sub-topics under your area (genetic improvement, agronomic management improvement, utilization/nutrition).

   Is this list complete ? What else should be added as needed research topics?

*3. Review complete list and put sub-topics in priority order. Rank them in order of being regional, rather than just national or local, priorities. Are these priorities shared by everyone in your group? Where is there consensus? Where is there disagreement? Try to get consensus on the top two or three.

*4. Within each sub-topic, what are more specific priority research areas?

   Begin with those 3 sub-topics ranked highest. For each one, list at least 4 or 5 research areas/topics. After discussion as to which ones have greater regional impact, rank these specific areas in priority order. Where is there consensus? disagreement?

   If time is left, do the same for the rest of the sub-topics. Try to get consensus on the priority one or two specific topics under each sub-topic.

TOPIC II : Discussion of socio-economic context, baseline data needs and identification of training requirements.

A. REGARDING SOCIO-ECONOMIC CONTEXT OF RESEARCH:

1. Identify socio-economic and cultural constraints to improved production and utilization of beans. List at least 10-12 constraints.

*2. Have the group select the top 3 of these contraints common to the region and rank them. Try to get consensus on the three.

3. Discuss how to deal with these "top three" contraints. (Limit discussion so you will have time to talk about the following two topics).

4. What are the implications for research priorities?

B. REGARDING BASELINE DATA NEEDS:

1. List types of baseline data currently being collected by country. (Briefly).

2. What are the baseline data that are most relevant to actual increases in yield and production? (If time, priortize)

*3. Which of these baseline data studies are not currently available? The answer to this would identify needed research areas.

4. Rank responses to question 3 in priority order.

C. REGARDING TRAINING REQUIREMENTS:

1. What training needs are common to the region?

   a) By discipline, by degree level
   b) Workshop topics
   c) In relation to staffing needs of agricultural research/ extension programs
   d) Others

2. What are the implications for training needs of the previous discussion on research priority areas, socio-economic constraints and needed baseline data.

*3. Select 2 or 3 specific (limited) and clearly stated regional training needs that are the highest priorities for your work group. Rank them. Try to get consensus.

* = Most important "outputs" of your discussion. All are consensus, priority statements.