ANNUAL MEETING

held at

Thika Research Station, Kenya

9 - 13 March 1990

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A

REGIONAL PROGRAMME ON BEANS IN EASTERN AFRICA

MINUTES OF THE ANNUAL MEETING OF THE STEERING COMMITTEE

Thika, Kenya, 9 - 13 March 1990

Members Present:

Ato Teshome Girma, Coordinator, Lowland Pulse Research Programme, Institute of Agricultural Research, Melkassa Research Center, P.O. Box 436, Nazreth, **Ethiopia** (Telex 21548 IAR ET)

Mr. S.T. Kanyagia, Coordinator, Grain Legume Programme, Kenya Agricultural Research Institute, National Horticultural Research Station, P.O. Box 220, Thika, **Kenya**.

Mr. A.M. Abikar, Coordinator, Grain Legume Programme, C.A.R.S. Afgoi, c/o Research Directorate, Ministry of Agriculture, P.O.Box 24, Mogadishu, **Somalia** (Telex 3032 MIN AGR SM, Attn. Research Director)

Mrs.Theresa Sengooba, Coordinator, Bean Programme, Kawanda Research Station, P.O. Box 7065, Kampala, **Uganda** (Telex 61406 RAYMA UG, Attn. HEMU for CIAT).

Dr. Roger Kirkby, Coordinator, Regional Programme on Beans in Eastern Africa, CIAT, P.O.Box 67, Debre Zeit, Ethiopia (Telex 21207 ILCA ET).

Dr. K.B. Paul, Agriculture & National Resources Division, REDSO/ESA, **USAID**, P.O. Box 30261, Nairobi, Kenya, (Telex 22964 AMEMB, Attn REDSO).

Associate Member Present:

Dr. Salih H. Salih, Coordinator, Grain Legume Programme, Agricultural Research Corporation, Hudeiba Research Station, P.O.Box 31, Ed Damer, **Sudan** (Telex 50009 TXBOWD SD, attn: Dr Badr A. Saleem for Dr Salih Salih).

Absent with apologies

Mme.Lea Rampanana, Chef, Programme Legumineuses, Centre National de la Recherche Appliquee au Development Rural (FO.FI.FA.), B.P. 1444 Ambatobe, 101-Antananarivo, **Madagascar**
(Telex 22539 MRSTD MG attn: Mme Rampanana).

Mr. Wayne Primeau, Senior Project Officer, Regional Programmes, Anglophone Africa Branch, CIDA, 200 Promenade du Portage, Hull, Quebec KIA OG4, Canada (Telex 053-4140 CIDAHULL).

1. Opening

Steering Committee (SC) members were welcomed to Thika Research Station by its director, Mr S.K.Njuguna. Describing Thika's research on beans, fruits and vegetables, Mr Njuguna mentioned progress in the improvement programme for French or snap beans, which has benefitted from CIAT introductions. He looked forward to the exchange of ideas and results from complementary activities in neighbouring countries, since "scientists know no boundaries", and announced KARI's commitment to funding the revival of the *Phaseolus Beans Newsletter for Eastern Africa*. SC members were invited to encourage contributions from their colleagues. Finally, the Director told SC members that, being now known at the Station, they should feel free to visit Thika at any time without formality.

2. Appointment of Chairman

Kenya's Bean Programme Coordinator, Mr S.T. Kanyagia, had been elected to the 1989/90 chairmanship during the Ad Hoc Meeting of the SC in Nairobi on 6 July 1989. He remained in the chair.

3. Minutes of the Previous Annual Meeting

The Minutes of the meeting held at Kawanda on 1 - 3 March 1989 were read at the Ad Hoc Meeting on 6 July 1989, and had been accepted with the following correction on page 5:

Kenya's released varieties are: GLP 1004 (Mwezi Moja) for low elevations, GLP 24 (Canadian Wonder type) for low/medium elevations, GLP 585 (Red Haricot) and GLP X92 (Rose Coco) for medium elevations, GLP 1127 (Mwezi Moja) and GLP2 (= K20) for high elevations.

4. Matters arising from the Minutes

This item also had been covered in the Ad Hoc Meeting, as follows:
- the Regional Training Officer position was filled from June 1989;
- the extension course requested by Uganda could be planned for 1990;
- the Regional Coordinator (RC) was asked to provide quarterly financial status reports to subproject leaders and national coordinators; this would facilitate their management of funds; - national bean research reports from Ethiopia and Uganda for 1987 had been distributed, and 1988 reports were close to completion; Kenya was preparing a combined 1986-88 report;
- entries in the regional drought nursery had been revised for 1989 and it was ready for despatch;
- the matter of incentives to regional resource persons for courses remained a problem for all countries in varying degrees, and the RP needed to develop a policy on it.

5. Regional Coordinator's Annual Progress Report

The RC presented his report for 1989-90 (see appendix). Mr Jeffreyson Mutimba (Regional Training Officer) and Mr Abadi Haile (Regional Administrative Officer) participated in this presentation and in the subsequent discussion.

6. Discussion on Regional Report

The initiatives being made in farmer's participation in evaluating varietal trials on station should be helpful in understanding the extent to which farmers would be prepared to compromise traditional grain type and quality requirements for higher yield potential. Initial screening for specific characters, such as disease resistance, would remain a breeder's responsibility. Farmer evaluations on stations can be expected to be very useful in deciding whether or not to continue development of a particular novel cropping system, e.g. in agroforestry.

Salary levels within national programmes (NPs) tend not to encourage senior scientists to make extra efforts by contributing to an RP-sponsored course or workshop, and the question of an incentive policy was discussed at length. International organizations, and countries in the region, vary greatly in their practices; it was observed that IARCs sometimes pay lower rates than their donors do. This RP, while encouraging the participation of local & regional resource persons for courses, presently does not pay an honorarium beyond the USD 10 per day miscellaneous allowance, except where a specific government or institution formally requests this. The Committee generally agreed that in-country activities should be guided by government policies in the interest of sustainability, but would like to see CIAT develop a unified regional rate for specialists invited to contribute to regional courses and for Steering Committee members. Dr Paul's offer to try to convene a meeting among regional networks to discuss this matter was warmly welcomed.

Abadi Haile explained that the financial report on budget items subject to Steering Committee decisions included estimates for the period to 31 March 1991. He aims to send out a final report in May. Both CIDA and USAID portions of the budget run to end June 1991.

7. National Coordinators' Progress Report

Written summary reports were presented by Ethiopia, Kenya, Somalia, Sudan and Uganda. More technical information on these countries was given in papers at the Regional Workshop which immediately preceded this meeting.

Dr Salih expressed Sudan's gratitude to the Committee for their invitation to associate with the Network. This would enable Sudan's programme to expand its rather narrow germplasm base for beans. Seven of the eight bean team members have PhD degrees, and the Committee saw a potential there for additional resource persons for the Network.

In further discussion, members wondered whether Somalia's needs for further training and for research funds might be met by encouraging the CRSP to become interested in cowpea research in that country. Cowpeas are much the more important pulse in Somalia, although demand for beans was said to be increasing due to urbanisation.

Madagascar appears keen to participate fully in the Network, but six months notice is apparently required for clearance to travel outside.

8. Consideration of Recommendations made by the Mid-Term Evaluation

Summary recommendations received in February 1990 had been distributed to members. SC responses to each recommendation follow.

#1,2,& 8 (Improved definition of NARS research objectives and workplans).

The RP draft workplan reflects discussions on this between the RC and some NCs. National bean research planning workshops are proposed for Ethiopia and Uganda this year, and for Kenya next year. Detailed objectives and long-range strategies will be developed.

#3 (Plant quarantine restrictions)

Very lengthy procedures or prohibitive requirements affect only Kenya and Madagascar. Kenya should explore whether provision of a quarantine screenhouse (purchasable under National Programme Equipment budget) would facilitate evaluations at Muguga. RP to determine whether Madagascar's situation is now eased by USAID's improvements to their facilities.

#4 (Local germplasm)

Most countries already have collections, and the RP is consulting the relevant national institutions.

#5 (Farmer-participatory research)

The workplan includes a special course on these methods for Ethiopia; it may serve as a model for other training activities later. This topic will also be included in a proposed extension course for Uganda.

#6 (Training in economic analyses)

The Uganda M-Stat course in 1989 included economic analyses; the RP distributes CIMMYT training manuals, and sponsors individuals to the University of Zimbabwe courses. An economics training course for agronomists should be considered.

#7 (Involvement of national universities in subproject research)

The SC has always encouraged this, and felt that the present proportion of projects that are run by university staff (3/9) is a fair reflection of availability of researchers able to take on this responsibility. Several new proposals from university researchers had been received, and the SC would continue to invite proposals from universities and other institutions.

#9 (Linkage with CRSP)

While direct collaboration in research is limited by the absence of a CRSP project within Eastern Africa, other forms of collaboration have developed particularly in the past year. The RP sponsored a Ugandan pathologist on a 6-week study visit to a CRSP research in Nebraska; research plans and results on bruchids are exchanged between the RP and a CRSP/Cameroun project on cowpea bruchids (which should have potential benefits for Somalia especially); the CRSP was invited to participate in our recent Regional Workshop (although they did not attend); and Dr O.T.Edje will represent the CIAT African RPs at the April 1990 annual meeting of the CRSP in the USA.

#10 (Reviews of subproject progress)

An all-day session of the Regional Workshop on 6 March was devoted to reviewing progress on current subprojects, by means of paper presentations and group discussions. Committee members were present and took into account these reviews when considering applications for renewal (see Minutes, p.8).

#11 (A pan-African bean research committee)

Many pan-African activities have been held and are planned, with information passing among SCs mostly through regional coordinators. The pan-African Coordinator will continue to develop mechanisms for direct discussion among the three SCs. At present, pan-African specialist working groups (for cropping systems, entomology etc.) are a vital component in unifying research strategy. SCs had expressed their strong belief in maintaining their separate identities, which permit decision-making at the level of small grouping of countries having much in common. The feasibility of USAID's future interest in merging the three network coordination offices into a single unit (for economic reasons) should be discussed among SCs. The RC felt that present workloads would not make this a feasible strategy in the short term.

#12 (Operating budgets within annual workplans)

This year's regional workplan has been prepared in this manner.

#13 (CIAT expenditure reporting to the RC)

Computerisation of regional accounting, now in progress, should soon facilitate this matter.

#14 (Long-term goals and strategies for a follow-on project)

A draft had been circulated among members and further revision was scheduled.

#15 (Baseline data and beneficiaries for impact)

A meeting of the SC with a USAID Monitoring & Evaluation Methods team was held on 12 March. It was noted that no funds were included in the project for a study at this level of detail, and additional funds would need to be requested if donors wished to see this aspect included in a follow-up project.

9. Regional Workplan for 1990/91

A draft workplan was presented by the RC with assistance from the RTO. (A revised version that incorporates the SC's decisions is appended). The main points of discussion were as follows:

Workshops:

- The Ethiopia planning workshop should be multidisciplinary.
- Priorities among potential participants for major workshops in Tanzania and CIAT were agreed (see Workplan).
- A proposal from the Southern Africa SC to form a bean nematology working group in 1991 was supported; probable participants would be Kenya (2) and Uganda (2).

- A pan-African working group of experienced breeders was proposed for 1991 (season A), preferably in Uganda and perhaps including a travelling workshop; for consideration by other SCs.

Monitoring Tours:

- Entomology tours to be organised by K.Ampofo (CIAT Arusha) to bring together beanfly & bruchid researchers and to use his time most efficiently.
- A Kenya breeders' tour is warranted this year.
- Leaders of the more established subprojects having regional nurseries are expected to organise joint tours with their regional collaborators to inspect nurseries.

Training at CIAT:

- Priority given to crop protection scientists for this year's Sep - Dec course. Candidates include pathologists from Katumani and Kakamega (Kenya) and either Bako or Alemaya (Ethiopia), and one Ugandan entomologist.
- A shorter visit by the Sudan coordinator was encouraged.
- Lower priority was given to a request for F.Opio (Uganda).
- In principle the SC preferred sending breeders for training at CIAT, rather than the Southern Africa SC's proposal for a breeder's course in Africa.

Regional training courses:

- Economics training for biologists: a course is needed for the many potential candidates. Computer training can sometimes be arranged at Egerton.
- The SC welcomed CIAT's involvement with CIMMYT in developing an annual 5-month course at Egerton University for new graduates in crop management, weed science, on-farm research, etc. The SC would in future be able to sponsor individual participants, and RP and network scientists would contribute to teaching. In the meantime the University of Zimbabwe OFR courses will continue to be supported.
- In-country courses for Kenyan technicians, Ugandan extension agents and Ethiopian on-farm researchers were endorsed. The Kenya course could include technicians from Somalia (2) and Sudan (2); an introduction to crossing techniques should be included. NCs would obtain nominations for three Eastern Africa participants at the SADCC/CIAT course in cropping systems.
- pan-African courses in pathology (or crop protection) and in food technology for technicians are priorities for the future - other SCs invited to comment.
- ILCA is running seed production courses, and FAO/SIDA run seed technology courses. R. Griffiths at ILCA Seed Unit should be contacted by NCs having training needs in these areas. Similarly, CIMMYT or ICRISAT should be

approached for training for research farm managers. Ethiopia's request for support for a national training policies meeting can be accommodated, on a test case basis, provided that the requirements for RP resources are minimal.
- An Ethiopian virologist would be sponsored to visit Wellesbourne (UK) and Braunschweig (FRG) to strengthen the BCMV subproject and assure virus-free multiplication of regional nurseries. No decision was taken on Sudan's request for training in virology for a pathologist - to be reviewed subject to availability of funds.

Consultancy visits:

Sudan's request for a second visit by Dr Vetten would be referred to him and to the BCMV subproject. Crop sampling in late December/early January is needed to reconfirm diagnosis of cowpea mild mottle as casual agent of serious "curly top" symptoms.

10. Regional Research Subprojects: Progress Reports and Renewals

All subprojects had been required to make extended presentations to the Nairobi workshop, and the SC found these and the discussions very helpful in considering proposed workplans and budgets for renewals. All monitoring tours are to be funded from the appropriate line items and not from subproject research. SC comments and decisions on each subproject were as follows:

Selection for drought tolerance (Ethiopia)

- Regional drought nursery to be continued for one more season, with seed to be sent to Uganda for a new location in Karamoja; collaborators should meet their own costs of growing the nursery.
- Renewed at a reduced budget of USD 2570.

Bean rust (Ethiopia)

- Principal equipment needs should have been satisfied during earlier years of the project, and costs therefore can be expected to be lower during this 4th year of operation.
- Renewed at a reduced budget of USD 7000.

Bean common mosaic virus (Uganda)

- Comparing the Nairobi workshop report with project report to the Committee in March 1989, it was not clear what work had been carried out since April 1989.
- As Uganda has been extensively surveyed for BCMV during the first two years of the project, the survey objective of the project now should be to provide regional services in support of BCMV research in other countries, using the equipment and expertise acquired during the past years. Specifically, the project's survey priorities should be the following:

  . to encourage and support (technically & financially) survey work in Kenya to be led by Mr Omunyin of KARI Thika, including a possible orientation visit by him to learn ELISA techniques at Makerere;
  . to support financially further surveys for necrotic strains in Ethiopia by Dr Abdulrazak of PPRC Ambo (with technical support in this case from

Dr Walkey of Wellesbourne (UK);
. to support technically and financially a survey in Sudan in early January 1991 led by Dr Salih of Hudeiba Research Station (with lab analyses for various viruses by Dr Vetten of Braunschweig, Germany).

- The second main objective should be the proposed collaboration with bean breeders in Uganda to develop and conduct screening of germplasm for resistance.
- The budget items 1-3 are not funded within the project, as the Uganda breeding programme will provide these inputs for screening; requirements for local travel will be minimal (item 8); international travel (item 9) may include one trip to Kenya and to Sudan, as well as travel expenses for collaborators in Ethiopia and Kenya at rates established by the National or Regional Programmes.
- The maximum budget available is USD 5000.

Common bacterial blight (Uganda)

- A regional nursery to be implemented this year with collaborators in Burundi & Ethiopia; organization by the CBB project should include identifying entries, ensuring that collaborators have seed (their own or introduced), supplying them with field books and adequate instructions, and collating data regionally.
- Essential equipment needs are expected to have been covered in previous years, therefore no major new items to be purchased this year.
- budget reduced to USD 5000

Aschochyta/Phoma blight (Uganda)

- approved at a reduced budget of USD 5600

Beanfly (Ethiopia)

- The proposal as written had no clear regional objectives. Selection for resistance could serve regional interests by including a wider range of materials, with the best entering the Africa beanfly resistance nursery.
- Renewed with an increase in budget to USD 3000.

Bruchids (Somalia)

No formal proposal was received, owing to staff changes. These recommendations were made to assist Mr Guled, the new project leader, in developing a proposal:

- Recognising that most work on the project up to now has concentrated on cowpeas, this year the project funds should be used only for <u>Phaseolus</u> beans.
- The following activities should receive priority:
  . a survey of farm & market stores to identify levels of bruchid infestation of beans;
  . in collaboration with outside specialists, to positively identify the species of bruchids which attack beans in Somalia;
  . evaluation of CIAT bruchid-resistant bean materials for adaptation in the field and for resistance to the bruchid species attacking beans in Somalia;
  . conduct storage trials on beans, as proposed two years ago.

- This research project is considered as a component of a wider regional project on bruchids.
- Budget up to USD 4000, including USD 1500 for the survey, USD 1500 for the lab studies and USD 1000 for field evaluation of resistant materials.

BNF (Ethiopia)

- Assembling a regional collection of bean rhizobium strains (in collaboration with University of Nairobi, Dr Salih Salih in Sudan, and Makerere University) and the distribution of a Regional BNF Strains Nursery, are considered particularly important in order to give the project a regional perspective. Otherwise, the proposal would be too restricted to qualify for support.
- Attention is drawn to the Regional Workshop discussion on the excellent presentation of the project.
- Renewed up to USD 6000.

11. Regional Research Subprojects: New Proposals

Beanfly (Kenya and Uganda)

- These proposals on crop loss and ecology allow a more comprehensive regional approach by complementing existing Ethiopian work on resistance in beans. Dr Nderitu (Kenya) to be asked to assure an informal coordination role among the components for this year.
- For Kenya/Uganda components, regional support to be limited to objectives 1, 2, 3 & 5, eliminating insecticide testing.
- Kenya and Uganda components approved with reduced budgets of USD 3500 each.

Bruchids (Uganda)

- Surveys for incidence, species identification and storage losses should be conducted simultaneously with beanfly surveys, and bruchid project funds are therefore reserved for equipment needs of the solar heating objective.
- The project should operate closely with others in Somalia and Zimbabwe.
- Approved with the reduced budget of USD 1500.

Regional seed multiplication (Ethiopia)

- As discussed last year, the irrigation pump will remain RP property in case the SC should later relocate this project. Approved with a reduced budget (no seed counter) of USD 8000.

Varietal Adaptation to Semi-Arid Highlands (Kenya)

- Number of locations to be reduced.
- Approved, conditional upon the project obtaining a good range of new seed introductions, at USD 3000.

Soils Diagnosis (Uganda)

- Funds may also be used in Kenya if necessary to support field trials of a suitable collaborator in that country.
- Approved at the reduced budget of USD 3500 (due to shortage of funds).

Tolerance to Saline Soils (Sudan)

- Approved at the proposed budget of USD 2000.

New Proposals Not Funded

Anthracnose (Tesfaye Beshir, Plant Protection Research Center, Ethiopia) Accepted as subproject without funds initially, with limited objective of coordinating the growing of the anthracnose race differential varieties in each country.

Tolerance to low phosphorus and acid soils
Three related proposals from Ethiopia (Kelsa Kenna), Kenya (Gideon Rachier) and Uganda (Victor Ochwoh) did not provide convincing evidence that soils in their locations provide ideal selection conditions. At present, southern African locations appear more suitable and would serve pan-African interests. However, a visit to all proposed locations by CIAT's bean nutritionist in April will advise the SC as to whether Eastern African proposals should be reconsidered.

Seed-borne pathogens

(Dr A.W. Mwango'mbe, University of Nairobi)

- Low priority.

Aphids (Dr M.W. Ogenga-Latigo, Makerere University)
This insect pest was rated by the Entomology Working Group as third in importance after beanfly and bruchids. With increased commitments this year to the latter species, funds are inadequate at present to start research on aphids.

Local Seed Enterprise (Agric-Service Ethiopia)
This year's proposal was for verification trials, which do not have a regional component. To be reconsidered next year when farmer seed production is scheduled.

Bean scab (Dr E.W. Mutitu, University of Nairobi)
Considered to have insufficient regional importance.

Role of mycorrhizae in BNF (Drs B. Oruko and A. Mwala, University of Nairobi). To be sent to CIAT microbiologist for review, but probably more suitable for funding through IFS or similar.

12. National Programmes Equipment

The SC decided to allocate remaining funds for this phase in the following proportions: Kenya 50% (recongnising that no equipment was previously bought through the RP); Ethiopia and Uganda 20% each; and Somalia 10%.

Priority in Kenya should be given to plant quarantine needs. NCs will discuss detailed requirements with the RC.

13. Proposals for Follow-on Projects

The first phase of project support ends in June 1991. A draft proposal to USAID for a 15-month extension with supplementary funds had been circulated to SC members.

It was agreed that priorities for new or increased emphasis should be seed production of new varieties, training and implementation of participative research techniques, and subproject research in soil fertility and economics. Urgent needs for postgraduate training had not been fully met, and some funds were needed during the next phase.

Somalia was not in agreement with the suggestion that its status be changed to one of associate membership. The SC would prefer Somalia to maintain full membership but to continue receiving resources only in proportion to the relative importance of the crop.

Several members suggested that the present budget for *Operations (Research Station Support)* be employed not only in RP host countries as at present, but also in other countries where RP staff visits are instrumental in increasing research activities on beans.

14. Information Services

The idea of publishing a regional annual report met with general agreement. The report would consist mainly of subprojects progress reports and reports on the work of RP staff (as currently published in CIAT's Annual Report).

Preparation of national annual reports needs continuing attention. 1988 reports are either published (Ethiopia) or almost complete (Uganda). The RP is prepared to assist in a modest way with production costs, including the production of an additional 10 copies per volume for regional dissemination. Ethiopia publishes reports by station and not by commodity; the SC did not consider it worthwhile attempting to combine bean sections into a special commodity report - the full station reports could be disseminated.

15. Next Meeting

The 1991 annual meeting will be held either in Sudan (early February for end of crop season) or Ethiopia.

B

REGIONAL BEAN PROGRAMME FOR EASTERN AFRICA

WORKPLAN APPROVED BY STEERING COMMITTEE
April 1990 - March 1991

USAID Grant No. 623-0435-G-00-4035
CIDA Project No. 806/08301

Program Objective 1: Develop improved varieties of beans, in collaboration with national programmes.

1.a. *Evaluations of new introductions of germplasm from CIAT*

- Ethiopia : Introduce web blight nursery, VEF 90 and IBSAN. Grow out VEF 89, Beanfly nursery and beanfly crosses multilocationally.

- Kenya : Start field evaluations at Egerton & Thika of 1300 materials due to be released from Muguga quarantine. Introduce bruchid-resistant sources.

- Somalia : Bruchid-resistant materials; beanfly nursery; also materials from saline-soil areas.

- Uganda : VEF 90; nine IBYANs; F_2, F_3. F_4 segregating populations; BCMV and bruchid-resistant materials; beanfly reconfirmation nursery. Introduce IBSAN and characterise on Lunnyu soils. (BCMV and bruchid resistance crosses to be made at CIAT).

- Sudan : Make crosses at CIAT between WANABAN and local materials, and introduce F_2 populations. Introduce International Bean Soil Adaptation Nursery (IBSAN), and other materials from saline-soil areas, and evaluate at Hudeiba. If circumstances permit, test elite Uganda materials in Equatoria.

- Madagascar: Introduce IBSAN. Also VEF 90 reds and whites if quarantine capacity is sufficient.

1.b. *Evaluations of new introductions from the region*

AFBYAN-2 to be evaluated multilocationally in Kenya & Madagascar as soon as seed released from present quarantine.

New EAZBEN and EAZBYT to be multiplied in Ethiopia from March 90 and distributed to all E.A countries in June. Five most promising climbing varieties from Rwanda to be introduced (and evaluated in OFTs) in Kisii and Muranga, Kenya. Great Lakes regional trial & nursery to be evaluated at Katchwekano.

2. *Advancing of previous introductions within national programs:*

Numerous introductions into Ethiopia and Uganda since 1985 should continue to be screened, advanced lines moving annually into multilocation and on-farm trials. Somalia yield trial to be sent from CIAT.

3. *Collection and storage of African germplasm:*

Continue reassembling local collection lost from Uganda, with MoA/extension assistance. Assess situation in other countries; where necessary, encourage a local institution to start collections. Seek cooperation from IBPGR and CRSP where appropriate. Ensure conservation in 2 locations ideally, in country and at CIAT. Complete renovation of Uganda seed store.

4. *Development of national systems for variety development:*

a. Quarantine capacity

Seek with KARI a way to streamline introductions through quarantine; may require use of National Programs Equipment budget for local construction of screenhouse. Similarly, explore options with Madagascar that would expand present quarantine capacity.

Continue development of regional seed multiplication facilities in Ethiopia, and invite inspection by quarantine officers (e.g. from Kenya & Tanzania) that could facilitate exchange of clean seed.

b. Germplasm evaluation in decentralized national systems.

Work with national coordinators and the decentralized breeding staff of Ethiopia and Kenya in developing zonal priorities for breeding and interactive national/zonal structure for nurseries & trials-see also workshop item 3.2a.

c. Encourage, where necessary, better articulation of breeding programs with OFR, by feedback to breeding objectives and for realistic on-farm testing prior to variety release.

d. Regional breeder to phase out Uganda breeding responsibility during this year; activities & progress made during his intensive involvement (seasons 89B, 90A and less so in 90B) to be documented. Normal regional collaboration with Uganda from 91A is expected to improve institutional sustainability

in Uganda and allow an increase in regional collaboration in other countries.

5. *Specialist input in germplasm field evaluation and techniques:*

a. Assist the development of problem-focused crossing programs, initially in Uganda, later in Kenya.

b. Analyze (or assist analyses of) multilocation yield data to support the efficient zoning of variety test locations within countries.

c. Evaluate CIAT bruchid-resistant lines in Uganda and Somalia.

d. Assist Ethiopia in the design & conduct of trials for screening F_2 (and subsequent) populations for beanfly resistance.

e. Determine relationship of morphological variants of beans to weed suppression, using present data from Ethiopia and new trials in Uganda.

f. Field visits to Ethiopia and Kenya by staff of Institute of Horticultural Research, Wellesbourne, for virus surveys and subsequent identifications (U.K. funded project with CIAT).

6. *Technical contribution to Eastern Africa by CIAT bean entomologist (SADCC) and pathologist (Great Lakes):*

Entomologist to visit and assist in evaluation techniques for bruchid resistance (Uganda, Somalia) and beanfly (Ethiopia). Also to assist survey of beanfly effect on yield in Kenya.

Pathologist (SRF) to assist development and techniques in all relevant subprojects. Particular attention required to improving the focus of experiments, with less complex studies and screening on individual pathogen/pest basis.

7. *Regional research projects*

Regional staff to provide technical and administrative support as appropriate to assist project leaders in achieving rapid progress to objectives. See Table 1.

Program Objective 2: Develop improved cropping systems and agronomic practices for bean production, in collaboration with national programs.

1. *Analyze diagnostic surveys in important bean-producing areas not yet adequately documented :*

Support analyses of recent surveys in Wollaita and Hararghe, Ethiopia; and Kisii and Muranga, Kenya.

2. *Quantify bean production and its principal determinants:*

Conclude collection of basic secondary data on bean production in poorly documented areas and production systems, including particularly the food bean areas of Ethiopia. Collect additional maps on soils, infrastructure, etc. for mapping of bean production by CIAT's Agroecological Studies Unit.

Staff travel = $ 2000

Table 1.

Subproject	Lead Country	Coop. Country	Resource	CIAT Admin.	Regl. Budget
Bean Rust	Ethiopia	KE/UG/RW/MT	Buruchara	Debre Zeit	$ 7000
Seed Multiplication	"	All	Gridley	" "	8000
Antracnose	"	KE/UG	Buruchara	" "	0
Beanfly	Kenya	ET/UG	Ampofo	D/Z + Kawanda	10000
Semi-Arid Highlands	"	ET/UG	Gridley	Debre Zeit	3000
Bruchids	Somalia	UG	Ampofo	D/Z + Kawanda	5500
Saline Soil Adapt.	Sudan	SO	Lynch	Debre Zeit	2000
Common Bacterial Blight	Uganda	ET/RW	Buruchara	Kawanda	5000
Phoma Blight	"	BU/RW	"	"	5600
Bean Common Mosaic Virus	"	ET/KE/SD	Gridley	"	5000
				Subprojects	= $51100

Staff travel = $ 3000

Initiate pan-African study on bean consumption trends and their determinants.

3. *Assist national programs in planning research priorities and trials on agronomic topics on basis of farmers' needs*

Assessment of needs for soil fertility research and collaboration in this area. Visit by J.Lynch (Cali) to Ethiopia, Kenya, Uganda in May/June, accompanied by CW.
Staff travel = $ 4000
Second visit to Madagascar in Feb. 91. " " = $ 1000

Encourage and work with individual researchers to involve farmers. Staff travel = $ 2000

Develop participative course and materials (see Training, 3.1a)

Research planning workshops to be developed, starting this year in Ethiopia and Uganda (see 3.2a / 3.2b).

Investigate and analyze bean storage problems & issues in Uganda, in collaboration with regional subprojects.
Staff travel = $ 1000

4. *Collaboration with national programs in development and evaluation of on-farm trials programs*

The novel maize/climbing bean system for central Uganda will be moved from station to 15 on-farm locations. Evaluate climbers in Kabale area in collaboration with CARE, and include proven bean lines from Rwanda. Collaboration with an increasing number of development projects is intended to make on-farm experiments more sustainable, and may provide on alternative model to NARI-implemented OFR.

Determine whether a maize/climbing bean system would also be useful in Kisii area, Kenya. Test on-farm with introduced varieties from Rwanda.

Document and evaluate role of farmers in trials design & evaluation, including on station. Develop farmer participative course in Ethiopia as model for future courses.

Provide technical support for on-farm soil fertility diagnostic trials in Uganda and to develop an appropriate set of on-farm trials in Kenya, Madagascar and eastern Ethiopia.

Determine whether farmers' shortage of labour for weeding in Ethiopia and Uganda warrants a change in varietal selection criteria or management recommendations (interpret last 3 years' trials).

Provide economic input to OFR in Kenya and Uganda (also Tanzania, Zambia, Lesotho and Great Lakes Region).

Staff travel = $ 3000

5. *Conduct strategic and methodological research to provide information needed to improve important neglected aspects of local production systems*

a. Continue banana/ bean experiments in Uganda, in collaboration with Tanzania/Rwanda, to determine constraints & opportunities for intensifying this neglected system. Assess & publish bean variety screening implications & system effects on pests, diseases and soil fertility. Commence research on management of nutrient fluxes in this system, using mulch, fertilizer, etc, at Kawanda (coordinated with similar work in Kagera, Tanzania.

b. Complete data from on-farm nutritional screening trials in Uganda and Tanzania. Use to estimate Diagnostic & Recommendation Integrated System (DRIS) norms to improve interpretation of foliar tissue analyses, & to develop Fertility Capability Classification (FCC) for extrapolating results to alike land units in other locations.

c. Develop further the regression & other techniques for assessing constraints priorities (diseases, etc.) from multilocation & on-farm trials.

d. Investigate and document the impact from alternative approaches to the distribution of newly released bean varieties. Encourage development of new subprojects on this topic.

Staff travel = $ 3000

6. Regional subprojects

As already agreed, priority to be given to increasing the number of subprojects in agronomy & economics.
Support to be provided to leaders of projects as follows:

Subproject	Lead Country	Coop. Country	Resource	CIAT Admin.	Regl. Budget
Drought tolerance	Ethiopia	All	Kirkby	Debre Zeit	$ 2570
Nitrogen fixation	"	KE/SD/UG	Kipe-Nolt	" "	6000
Soils diagnosis	Uganda	KE/TZ	Wortmann	Kawanda	3500
				Subprojects =	$12070
				Staff travel =	5000

Program Objective 3: Strengthen national programmes through training, workshops etc.

1. Regional and in-country courses

a. In-country Course on Farmer Participative Research Methods. Awassa/Nazareth, Ethiopia, 3-10 May.
For IAR economists, agronomists and extensionists. Resource persons: JM, L.Sperling (Rubona), T.Gracia (Cali), RK.
Training cost = 4000
Staff travel = 4000

b. Graduate Training Course in Cropping Systems with Beans. Pan-African course at Arusha. 12 May-15 June.
3 places available for E.A.
Resource persons : CIAT/SADCC Team; CW, JM.
(Est.total cost per person from E.A.= $ 2500)
Training cost = $ 7500
Staff travel = 2000

c. Uganda MoA course for Extension Staff. 8-19 Oct.
CIAT Resource persons : JM, CW, HG, BG.
(Organized by, & most resource persons from MoA
Training cost = $11000
Staff travel = 500

d. In-country course on Economics Research Methods for On-Farm Agronomists. Uganda, 24-29 Sept.
CIAT Resource person: BG.
Training cost = $1500
Staff travel = 0

e. Regional course on Bean Research Methods for Technicians. Kenya, 5-16 Nov. Participants: Kenya (16), Somalia (2), Sudan (2).
Resource persons : JM, CW, RB, K.Ampofo (Arusha).
Training cost = $15000
Staff travel = 1500

f. One Ugandan and one Kenyan to be supported for OFR training. University of Zimbabwe (or Egerton).

Training cost = $6000

g. The regional training program will be evaluated. Individual participants and program leaders will be surveyed by the training officer.

h. Continue collaboration with CIMMYT/Egerton/KARI on curriculum development for proposed regional maize/bean agronomy/OFR training from 1991/92, for young graduates from NARS.
Resource person : CW

2. Training at CIAT

Four participants (Kenya 2, Ethiopia 1, Uganda 1) to Plant Protection course 15 Sep - 15 Dec, subject to necessary approvals. (Budget $7000 each).

Training = $28000

Shorter visit by Sudan Coordinator/breeder

Training = $ 3500

3.Regional Workshops

a. Ethiopia Bean Research Program Planning Workshop. 10-14 Sept.
Resource Persons : JM, RK, HG, BG, RB.
Madagascar Coordinator to be observer.

Workshop = $ 5000
Staff travel = $ 2000

b. Uganda Bean Research Program Planning Workshop. Late Sept?
Resource persons : CW, BG, HG, RB.

Workshop = $ 5000
Staff travel = $ 500

c. SADCC/CIAT/CRSP Regional Workshop, Sokoine Univ. 17-22 Sept. Est. cost per person from E.A. = $ 750 SC priority given to Kenya & Uganda (2 each); one Ethiopian subproject leader also possible, presentations not to duplicate those of Nairobi.
E.A. staff participation: RK,JM,RB

Workshop = $ 3000
Staff travel = $ 2000

d. CIAT International Plant Protection Workshop. Feb 1991.Up to 3, as incentives for good subprojects (max one per country) (Est.total cost per person = $ 3000).

Workshop = $ 9000

4. Monitoring tours

a. Beanfly/bruchid survey and techniques, Kenya, May 1990.
For Uganda, Kenya subproject researchers.
Staff: KA

M/Tour = $ 1000
Staff travel = $ 1000

b. Beanfly subprojects pan-African tour, Ethiopia, Aug. 1990.
Staff: KA M/Tour = $ 1800
Staff travel = $ 1000

c. Kenya bean breaders tour, Oct/Nov 1990.
Staff: HG M/Tour = $ 1000
Staff travel = $ 500

d. Rust/Ascochyta/CBB/Drought subproject leaders to organize tours with their collaborators. Available budget = $ 7800

5. *Postgraduate scholarships*

Continue providing financial, logistic and technical support as necessary to 13 M.Sc or Ph.D. scholars (See Data Base).
Academic training = $81900
(No new financial commitments, but RP may assist deserving potential scholars to obtain alternative funding).

6. *Supervision by regional staff of postgraduate thesis research*

Breeder to continue supervising two PhD theses in Uganda.
Coordinator to conclude supervision of one MSc thesis in Ethiopia.
Visits by staff to overseas students & supervisors during home leave/headquarters.
Staff travel = $ 500

7. *Encourage national programs to organise routinely a research seminar series.*

CIAT visitors to set an example; national coordinators to require staff to formally share benefits of their participation in regional activities.

Include in all sponsorship letters a specific encouragement to present a seminar to their colleagues, either as a draft paper beforehand or a report on their attendance.

8. *Technical collaboration and/or sponsorship of production by CIAT of new audiotutorial units :*

"On-farm experiments" - complete and distribute.
"Weed management" - prepare text and slides.
"BCMV" - distribute sets in region.
T/materials Budget = $ 16000

9. *Production and distribution of technical reports and other training materials*

Facilitate publication of national program annual reports.
Produce and distribute an annual regional report.
Produce and distribute didactic materials for courses.
Publish regional workshop proceedings.
T/materials = $ 12400

Chronological Workplan

April 1990	Coordinator finalises semi-annual report to donors and SC minutes. Discuss quarantine in Kenya. Establishment of Uganda trials, season A. Agronomist to assist identification of soil fertility research sites in Africa, visit all regions.
May 1990	Participatory research course, Ethiopia. Bruchids/beanfly survey/monitoring tour, Kenya. Training Officer to organise Arusha cropping systems course. Coordinator to redraft project proposal. All staff to Arusha for pan-African coordination. Breeder on home leave.
June 1990	Economist to assist survey analyses in Ethiopia & Kenya. Monitoring of trials in Kenya & Uganda. Establishment of trials in Ethiopia RP support staff annual evaluations Coordinator on Review team for SADCC/CIAT project.
July 1990	Annual purchases for NPs and subprojects Data analyses, Uganda Coordinator to Madagascar Agronomist on home leave, then to CIAT
August 1990	Beanfly monitoring tour, Ethiopia Monitoring of trials in Ethiopia Establish trials in Kenya & Uganda, season B. Coordinator on home leave and visiting students in USA.
Sept. 1990	Ethiopia bean research planning meeting Economics course, Uganda Sokoine / CRSP / CIAT Workshop, Tanzania CIAT Annual Report and donors´ semi-annual report. Rockefeller soil fertility meeting. Coordinator to Great Lakes annual seminar.
Oct. 1990	Establish off-season multiplication in Ethiopia Uganda bean research planning meeting Extension course, Uganda Monitoring trials in Kenya, Somalia, Uganda
Nov. 1990	Regional course for technicians, Kenya Bean breeders´ monitoring tour, Kenya Data analyses,Uganda
Dec. 1990	All staff to CIAT for Annual Review and coordination meetings. Most take annual leave in part.

Jan 1991	Data analyses, prepare publications.
Feb. 1991	Visit to Madagascar to assess acid soils sites CIAT Plant Protection Conference, Cali Steering Committee meeting
March 1991	Prepare for planting in Kenya & Uganda Prepare SC minutes. Egerton crop management course scheduled to start.

C-1

REGIONAL BEAN PROGRAM FOR EASTERN AFRICA

COORDINATOR'S REPORT TO STEERING COMMITTEE
April 1989 - March 1990

General

The highlights of the past year were the release of three new bean varieties in Uganda and two varieties in Ethiopia (their first releases for 15-20 years) and the signing of a Letter of Understanding between CIAT and the Kenya Agricultural Research Institute (KARI). A workplan agreed in principle last year between KARI and the Regional Program, (RP) has been quickly put into effect.

The regional program was scientifically fully staffed throughout the period. The team was enlarged by the arrival in June 1989 of Mr Jeffreyson Mutimba as regional training officer, and of Dr Robin Buruchara in March 1990 as our first senior research fellow. Mr Mutimba, who joined us from the extension training department of Agritex in Zimbabwe, is based in Debre Zeit, Ethiopia. Both he and regional economist Bill Grisley have pan-African responsibilities. Dr Buruchara will be based in Rubona, Rwanda to provide research and technical support in pathology for Eastern Africa and the Great Lakes regions. Changes in support staff are listed in the Appendix tables.

Considerable time and effort during June and July 1989 was absorbed by reviews. The mid-term project review team of five from CIDA, USAID and CIAT spent two weeks visiting the RP and various national programs. This was followed by a meeting with the Regional Steering Committee in Nairobi, when draft conclusions were discussed. The final report was received in February 1990. Participation of Dr James Steadman from University of Nebraska had the added advantage of strengthening our links with the Bean/Cowpea Collaborative Research Project (CRSP) of USAID. This has already led to a study visit to Nebraska by a Ugandan bean pathologist and the exchange of information on grain legume storage research in Africa between the bean network and Purdue University/Cameroun entomologists. The CRSP has been invited to participate in our regional workshop in March 1990.

A second team comprised members of the External Program Review and the External Management Review of CIAT. They visited the Debre Zeit regional coordination office and Ethiopia's Institute of Agricultural Research (IAR), as part of a lengthy review of CIAT's activities worldwide. An intermediate step in CIAT's internal review procedures was a planning workshop to develop CIAT's Bean Program strategy for the 1990's; this region was represented by Mrs Theresa Sengooba, then chairperson of our Steering Committee.

Additional special project funds totalling USD 20,000 were obtained by CIAT from FAO to support on-farm research in Africa. These funds were channelled to Kenya (42%), Ethiopia (23%) and Uganda (35%), mostly to initiate work in new areas by institutions lacking operational support for OFR.

Research and training activities are outlined below using the format of the Regional Workplan as approved by the Steering Committee for 1989-90. Appendix tables give statistics on activities. Ordering of equipment and materials for national programs for this year has been completed. Finally, the RP succeeded in restoring telephone services to Kawanda Research Station (after 10 years' interruption)

Program Objective 1: Develop improved varieties of beans, in collaboration with national programs.

1. Evaluations of new introductions of germplasm

a) from CIAT

Ethiopia : F_2 crosses incorporating beanfly resistance into acceptable grain types, and others made at CIAT for CBB resistance by an Ethiopian visiting scientist, were shipped. VEF 87 was evaluated. VEF 88 and Beanfly reconfirmation nursery were received into open quarantine. The Web Blight nursery is still not available.

Kenya : About 60 snapbean lines were released from quarantine and grown at Egerton. 1300 other materials still in quarantine, and priorities for their evaluation have been made as an aid to KARI's quarantine services; will they all be handled by Egerton or would they prefer to pass some direct to Thika? Halo Blight nursery still in quarantine?

Somalia : Much material now available in national program. Lima Bean nursery sent 11/89. Bruchid resistance sources now ready for dispatch.

Uganda : Nurseries for Beanfly, Anthracnose, Ascochyta, Snapbean, BCMV and Angular Leaf Spot, and F_2 populations from crosses at CIAT, were introduced. VEF 88 was received and grown in 89B.

Sudan : No introductions requested specifically, but interest in receiving F_2 populations based on earlier WANABAN introductions discussed during a visit by Regional Coordinator in January 1990. Snap bean nursery received by University of Khartoum.

Madagascar: A nursery of lima bean was sent as this crop is important in drier southern areas of the country.

b) from the region

African Bean Yield & Adaptation Nursery (AFBYAN-2) multiplied again in the dry season in Ethiopia, and distributed to Somalia, Sudan, Lesotho, Mozambique & Madagascar. Results of AFBYAN-1 from 1987-88 analysed across sites and report produced. Introductions made through the AFBYAN are proving that some countries can benefit quickly from regional collaboration. Seed was still in closed quarantine in Kenya & Madagascar, and is unlikely to be evaluated before 90B.

The new AFBYAN-climbers trial from Rwanda was grown at Bako, Ethiopia and in Uganda. The ABDREN (drought nursery) was grown in 2 locations in Kenya and also in Somalia.

The new Eastern Africa Zonal Yield Trial and Nursery (EAZBYT and EAZBEN) were designed, and national programs invited to send seed to Ethiopia for multiplication or distribution. Ethiopia, Sudan, Tanzania and Uganda have provided entries.

About 40kg of seed of 1000 lines was sent from Uganda to Tanzania.

2. Advancing of previous introductions within national programs:

Uganda formally released 3 new varieties in mid-1989, the first releases there for 20 years. The varieties G13671 and Rubona 5 were introduced through the AFBYAN as recently as 1987; the third variety, White Haricot, is a selection from a local landrace. The 3 varieties are suited to different growing conditions and consumer uses.

Ethiopia released 2 varieties earlier in the year - A176 (named Roba), a CIAT-bred line introduced around 1984 for food purposes, & Ex-Rico 23 (named Awash) from Colombia for food and canning.

To ensure rapid multiplication of clean seed, CIAT has agreed to a request from the Uganda Seeds Project to supply a large amount of Rubona 5 on contract; this is to be planted in Colombia in March 1990.

3. Development of national systems for variety development:

The main effort in this period was made in Uganda, where evaluation of germplasm was being restructured to obtain a more systematic flow. Entries in Advanced Yield Trials are being promoted or dropped each season; an Intermediate Yield Trial series has been introduced; the number of lines being retained from introductory screening for Preliminary Yield Trials has been increased from 39 to around 500; and plans are under way for increasing local diversity through routine crossing and handling of segregating populations.

In Ethiopia attention is focussing on decentralization to 3 centers/agroecological zones. Discussions among national breeders this year may lead to a planning workshop next season.

Both Ethiopia and Uganda published Annual Progress Reports on bean research for 1987, and drafts for 1988 are well advanced. Regional staff have assisted in editing the Uganda reports.

4. *Specialist input in germplasm field evaluation and techniques:*

Dr Howard Gridley took up the regional breeder post based in Uganda from April 1989. With the backing of NP breeders he is reorganizing germplasm evaluation procedures in Uganda. He assisted NP breeders in compiling past data to support the release of the new varieties this season. Visits were made to Ethiopia, Kenya and Madagascar. Several regional staff contributed to technicians courses in Ethiopia & Uganda.

5. *Economic study of export market potential for white, black and red beans, as an aid to variety development priorities:*

It was agreed with USAID Kampala that the internal markets study will be contracted by USAID locally, and Makerere University staff have been contacted.

Two draft reports were produced: "The socioeconomic context of dry bean and snapbean production & utilization in the developing world" (W.Janssens and G.Henry, CIAT) and "A summary of the world trade in dry beans, 1983-85" (W.Grisley, CIAT/EA).

Angola is the largest importer in sub-Saharan Africa. This year, countries of the region have found new formal markets for red beans in Rwanda and Cuba, so the earlier concern over breeding black beans for export should be alleviated. Some introductions of elite black lines from CIAT are warranted.

6. *Technical contribution to Eastern Africa by CIAT bean entomologist (SADCC) and pathologist (Great Lakes):*

Dr Ampofo, entomologist at SADCC/CIAT Arusha, visited Somalia to work with the bruchids subproject, following earlier contact during training at CIAT in late 1989. In August he organised a priority-setting meeting of entomologists (see under workshops), and the Beanfly Resistance Nursery was distributed. Two visits to Kenyan research stations & entomologists were made.

The proposed pathology position for Africa did not materialize because the number of staff positions in Rwanda was reduced in Phase II and the GL region gave higher priority to having a breeder than a pathologist. This gap is being filled from 3/90 by the recruitment of a Kenyan pathologist as Senior Research Fellow, while Dr Allen (CIAT/SADCC) has continued to assist by commenting on pathology subproject documents.

7. *Regional research projects*

Several regional subprojects produced good progress reports at the urging of the Steering Committee and under pressure from a program review. The Steering Committee (which held an ad hoc meeting in Nairobi in July) approved a revised proposal on biological nitrogen fixation from Alemaya University, Ethiopia; referred a Ugandan proposal on aphids to the African Entomologists Meeting; and rejected another Ugandan proposal on seed nutritional quality. The Committee said it would like to see more proposals in agronomy and economics.

The Rust subproject followed the example set by the drought subproject, and distributed a regional nursery (to Kenya, Tanzania, Uganda & Zambia). The project leader visited Kenya & Uganda for coordination purposes.

The BCMV subproject cohosted an African working group meeting on bean/cowpea virology.

Regional staff have followed up last year's SC meeting by encouraging new proposals to be submitted in the areas of regional seed multiplication, small farmer seed production, and soil fertility.

Program Objective 2: Develop improved cropping systems and agronomic practices for bean production, in collaboration with national programs.

1. *Conduct diagnostic surveys in important bean-producing areas not yet adequately surveyed*

Ethiopia : An informal survey was conducted by Alemaya University staff in Hararghe and a formal survey was carried out by IAR in Wollaita, both with input from the regional economist. These are two of the most important food bean areas, and the importance of beans in the system has been little recognized until recently. A preliminary report on the Hararghe survey was produced; analysis of Wollaita data is delayed by a staff change.

Kenya	:	The first diagnostic survey on beans for many years was started in Kisii, western Kenya, with assistance from the regional agronomist. A second survey in Central/ Eastern areas was also started.
Uganda	:	The results of 1987/88 surveys were published in Annual Progress Reports. The importance of fresh beans (mature but not yet dry) for home consumption & local sales is becoming apparent in Ethiopia and Uganda; quick cooking is an advantage.
Somalia	:	Results of a survey of storage practices were reported by the bruchid subproject in April 1989. Field work this year limited by security problems and staff changes.

2. *Quantify bean production and its principal determinants:*

District level data was collected in Kenya and questionnaires are in preparation through extension services in Ethiopia and Uganda to improve the database on bean production, which is poor in areas of intercropped and subsistence production. The crop´s importance in Sudan also appears to have been under estimated, particularly in Equatoria, but the security situation precludes activities there.

3. *Assist national programs in planning research priorities and trials on agronomic topics on basis of farmers´ needs*

An outline research program for the Kisii area of Kenya was drawn up on the basis of priorities identified during an informal survey of farmers there. Previously, only the maize component of the predominant maize/bean intercropping system has been extensively studied in field trials.

The RP is discussing with several countries a suggestion for a national planning workshop for bean R & D, so as to draw upon the results now available.

C.Wortmann, T.Sengooba et al are developing the use of regression analysis for relating crop loss in multiplication trials in Uganda to disease incidence. Preliminary results suggest that BCMV, CBB and anthracnose are very important, while aschochyta did not cause crop loss in this trial series.

4. *Collaborate with national programs in design and evaluation of agronomy trials on station:*

C. Wortmann and/or R. Kirkby visited research stations in Ethiopia, Kenya and Uganda to discuss current programs; in

Ethiopia the national planning conference was attended. A full program of trials is in progress in Ethiopia and Uganda, as reported in previous periods.

Initial results from a banana/bean trial at Kawanda suggested that bush bean varieties selected for sole cropping also are best under bananas. This result requires verification.

Trials on maize/bean intercropping in Uganda continued, and are expected to move to OFR next season. Farmer evaluations of these and variety trials on station were introduced to improve design criteria, and proved useful.

5. *Collaboration with national programs in development and evaluation of on-farm trials programs*

On-farm trials in Kenya were planned jointly on the basis of the survey in Kisii. The first trial was planted on 4 farms in October.

Regional involvement in on-farm trials in Ethiopia and Uganda is now mostly confined to assistance in planning and evaluation, with national scientists entirely responsible for their execution. Both programs are considered to be well developed.

A national workshop for Uganda was held by Makerere MoA/CIMMYT/CIAT; improved linkages between commodity and OFR teams may be one outcome. A national workshop for economists in Ethiopia, held by IAR/CIMMYT/CIAT, focused on improving economic skills.

Program Objective 3: Strengthen national programs through training and workshops

1. *Regional and in-country courses within Eastern Africa*

All activities carried out as planned, except Ethiopia course on participative research methods (now scheduled for May 1990).

a. Application of MSTAT-C in the Design, Management & Analysis of Experiments, Kawanda, Uganda, 10-20 June. 16 postgraduate participants from MoA and University, with resource persons from CIAT and two Ugandan biometricians. Eight participants were fulltime bean researchers, others were from important complementary programs and are expected to lead to a multiplier effect within Uganda.

b. Pulses Research Methods In-Country Course for Technicians, Nazreth Ethiopia, 21 August - 1 September. 27 bean technicians who had not attended the first course in 1986 were trained in research methods, with emphasis on improving the quality of field trials data, disease recognition, etc. Also a great morale booster, as technicians rarely get opportunities to visit other stations or to learn new techniques. Most resource people came from national institutions. The regional training officer managed the course with IAR's training officer so that the capacity to conduct Ethiopian courses would be institutionalized.

c. Bean Research Methods Course for Technicians, Mukono, Uganda, 30 Oct - 10Nov. Similar to (b) above, and the second Uganda course for a regional group of 24 from Uganda and 2 from Somalia.

d. In-country Workshop on Economic Analysis, Holetta, Ethiopia, 22-26 Jan, organized by IAR/CIMMYT/CIAT for 19 economists from IAR and MoA.

2. *Regional Workshops*

All activities carried out as planned (see appendix).

a. A meeting of the Pan-African Bean Entomologists Working Group was held in Nairobi of 7 9 Aug with participants from several countries of the region. Participants agreed that regional activities should focus on beanfly, aphid and bruchids only, and current and proposed work in these areas was critiqued.

b. A Pan-African Virologists' Working Group was convened in Kampala, 17-20 Jan. Cosponsored by CIAT Eastern & Southern Africa Programs, and by IITA, since virus problems on beans & cowpeas are similar. The BCMV subproject at Makerere cohosted the meeting.

c. Simultaneous meetings were held by the Pan-African Working Groups on Crooping Systems and on Soil FErtility, at ICRAF, Nairobi, 12-14 Feb. Research priorities were identified and possible new subprojects were outlined, with prospects for initial leadership by Ethiopia, Kenya and Uganda.

d. The Second Regional Workshop on Bean Research in Eastern Africa was held in Nairobi, 5-8 March and hosted by KARI.

e. National Orientation Workshop on On-Farm Research, Makerere/MoA/CIMMYT/CIAT, Mukono, Uganda, 12-17 Nov. Papers presented: "Objectives and methods for on-farm experiments"(R.Kirkby) and "Farmers' participation in bean research in Uganda" (C.Wortmann, J.Kisakye, M.A.Ugen, T.Sengooba).

3. *Monitoring tours*

A bean/banana cropping systems tour of the Kagera Basin by researchers from Uganda, Rwanda & Tanzania was made in November. Strategies for soil fertility improvement were discussed.

Two subprojects organized monitoring tours. The Rust project leader visited Kenyan and Ugandan collaborators to exchange results and plan a regional nursery. An Ethiopian collaborator in the Uganda-led BCMV project repeated the previous year's collaborative survey of bean viruses in a large area of Ethiopia.

Other subprojects have not yet organized visits.

4. *Individual training on short courses*

Three on-farm researchers from 3 countries were sponsored to attend the University of Zimbabwe/CIMMYT annual training workshop in On-Farm Research Methods-Experimentation Phase, Harare, 28 Aug-9 Sept. One of them returned to Zimbabwe for the Diagnostic phase course, 5-23 Feb.

Three Kenyan and two Ethiopian breeders attended the 3-month course at CIAT Cali, Sept-Dec. This was the first English-language bean breeders' course to be structured in this manner at CIAT headquarters.

5. *Postgraduate scholarships*

Funds from USAID and CIDA are now fully allocated, following Steering Committee decision to allocate on a first-come basis (formal university offers received by candidates who had been accepted in principal by the Committee). Those who started studies during the period were: S.Musaana, B.Male-Kayiwa, F. Opio and M. Ugen (Uganda); A. Abebe, F. Negasi, M. Ayele and S. Yetneberk (Ethiopia); M.Handulle and A.Hussein (Somalia). J. Kisakye (Uganda) in June was the first candidate to return with her M.Sc. A.Oree completed his M.Sc early in 1990.

6. *Supervision by regional staff of postgraduate thesis research*

H. Gridley was accepted as co-supervisor of two locally conducted theses in Uganda. R. Kirkby continued to supervise one thesis in Ethiopia.

7. *Encourage national programs to organise routinely a research seminar series.*

No progress to report

8. *Technical collaboration and/or sponsorship of production by CIAT of new audiotutorial units in the following topics:*

"On-Farm Experiments" almost complete. Other titles not yet started.

9. *Continue distribution of training materials and oversee distribution within region of CIAT's Pages of Contents Service*

50 boxed sets and 929 individual study guides were distributed to 89 institutions or individuals in the region

"Agromyzid pests of tropical food legumes - a bibliography" (N.S.Talekar). Published by CIAT & AVRDC as Africa Bean Network Working Document No.1 - a new series. Distributed.

Constraints

Housing for senior staff posed the biggest single problem during the period. In Uganda, rehabilitation of the house allocated to the economist was delayed further, apparently by the contractor's lack of liquidity and/or managerial ability. Senior staff are meanwhile sharing a house. In Ethiopia, ILCA refused to abide by its agreement with CIAT to vacate a house at Debre Zeit rented by CIAT for the training officer position; eventually an apartment was found in Addis Ababa.

A severe shortage, and often total absence, of economists and social scientists from bean programs is seen as a hindrance to further development of OFR in all countries except Ethiopia.

Very low salaries for scientists and technicians limit what can be achieved in several countries, and most notably in Uganda. The regional program provides some opportunities for travel-related perdiems, but the solution to this problem lies beyond our control. The potential for distorting national priorities through incentives is high; it is therefore important that regional agricultural research networks act in a coordinated manner in this regard. In Uganda wage rates are too low to attract workers for weeding trials.

REPORT ON BUDGET ITEMS ALLOCATED BY STEERING COMMITTEE, AS AT MARCH 1990 (IN US$)

USAID FINANCING

BUDGET CODE EUB	ORIGINAL TOTAL BUDGET	EXPENDITURE NOV:84 THRU MARCH '89	EXPENDITURE APRIL '89 THRU DEC '89	EXPENDITURE TOTAL	REMAIN. BALANCE Dec '89	APPROVED BUDGET APRIL '89 March '90	EXP. April '89 THRU MARCH '90	REVISED BUDGET JAN.90 THRU March '90	REVISED BUDGET APRIL '90 THRU MARCH '91	REVISED BUDGET APRIL '91 THRU JUNE '91
32 National Program Support	46900.00	22518.00	17667.00	40185.00	6715.00	17100.00	19367.00	1700.00	6800.00	1700.00
41 Training at CIAT	71900.00	57125.00	21106.00	78231.00	(6331.00)	24800.00	26106.00	5000.00	21000.00	5000.00
42 Training in Region	64100.00	19468.00	38633.00	58101.00	5999.00	23400.00	45308.00	6675.00	26700.00	6675.00
43 Training Materials	31100.00	8091.00	15085.00	23176.00	7924.00	8400.00	16935.00	1850.00	7400.00	1850.00
44 Training - Scholarships	105000.00	43385.00	28095.00	71480.00	33520.00	37600.00	33695.00	5600.00	22400.00	5600.00
45 Monitoring Tours	23900.00	2017.00	5142.00	7159.00	16741.00	8700.00	5892.00	750.00	3000.00	750.00
46 Regional Workshops	52500.00	31348.00	11735.00	43083.00	9417.00	19000.00	14260.00	2525.00	10100.00	2525.00
5 Subproject Research	114900.00	15796.00	33035.00	48831.00	66069.00	36908.00	46035.00	13000.00	40000.00	13000.00

CIDA FINANCING

BUDGET CODE EUZ	ORIGINAL TOTAL BUDGET	EXPENDITURE JAN.'85 THRU MARCH '89	EXPENDITURE APRIL '89 THRU DEC '89	EXPENDITURE TOTAL	REMAIN. BALANCE Dec '89	APPROVED BUDGET APRIL '89 March '90	EXP. April '89 THRU MARCH '90	REVISED BUDGET JAN.90 THRU March '90	REVISED BUDGET APRIL '90 THRU MARCH '91	REVISED BUDGET APRIL '91 THRU JUNE '91
32 National Program Support	65254.00	52014.00	6262.00	58276.00	6978.00	13200.00	6900.00	1750.00	5250.00	-
41 Training at CIAT	26440.00	37813.00	4867.00	42680.00	(16240.00)	8680.00	6617.00	1750.00	7000.00	1750.00
42 Training in Region	39330.00	16193.00	9984.00	26177.00	13153.00	12200.00	14944.00	4960.00	19840.00	4960.00
43 Training Materials	97120.00	18932.00	2115.00	21047.00	76073.00	24500.00	7365.00	5250.00	21000.00	5250.00
44 Training-Scholarship	149330.00	2827.00	23484.00	26311.00	123019.00	62400.00	47984.00	24500.00	59484.00	24500.00
45 Monitoring Tours	37800.00	1519.00	-	1519.00	36281.00	16300.00	2000.00	2000.00	8000.00	2000.00
46 Regional Worshops	27040.00	40255.00	1029.00	41284.00	(14244.00)	6400.00	3679.00	2650.00	10600.00	2650.00
5 Subproject Research	158640.00	40297.00	4235.00	44532.00	114108.00	39900.00	58547.00	10250.00	21000.00	10250.00
74 National Programs Equipment	115420.00	39874.00	10464.00	50338.00	65082.00	44000.00	21314.00	10850.00	43400.00	10850.00

* National Program Support for Ethiopia and Uganda is not under Steering Committee decisions.

C-2

PROGRESS REPORT ON NATIONAL PROGRAM IN ETHIOPIA - 1989

1. Bean production and priorities

Bean production in the year 1989 was found to be very good in most bean growing areas. The total rainfall and its distribution had favoured bean production.

Because of a bilarteral agreement between the government of Ethiopia and Cuba, bean production especially the red kidney bean (Red Wolaita) has increased both in small farmers and state farms. Moreover there seems to be an increase in areas from the customary production zones to the high altitudes.

2. Organization and research for beans

One of the leading organization which is doing research on beans is the Institute of Agricultural Research (IAR). The research in IAR on beans have been conducted nearly for the last two decades and is still given high prominance.

Lack of suitable varieties, diseases, pests, draught and poor cultural practices are the main causes for low yielding of beans in the country. To alleviate this problems, in IAR the bean program launched a number of research programs in all disciplines.

The other institution which does research is Alemaya Agricultural University (Eastern Ethiopia) and this year (1989) expanded its sites, types and number of bean trials. Several non-governmental organizations (private aid organizations and churches) participated in demonstrating of released varieties.

3. Bean research activities

The breeding program at Melkassa conducted 14 bean trials at different locations in Ethiopia. Table 4 shows types of trials, number of entries and locations where the trials were despatched for testing.

A verification trial on Awash 1 (Exrico 23) was done on one hectare at Melkassa and by Ethiopian Seed corporation farm at Shallo. It is a part of a request by National Releasing Committee to consider it for permanent release.

Most of the data received from the different research centers and sites were analysed. The top yielding varieties of national, pre-national and nursery II trials are shown in Table 1, 2 and 3 [omitted from Appendix version].

In nursery I 412 varieties were tested at four locations (Melkassa, Awasa, Alemaya and Pawe). Twenty five varieties from each group of white pea bean, different color bean and large seed bean will be advanced to nursery II for the 1990 season.

African bean yield adaptation nursery (AFBYAN) trial was conducted at three locations (Awassa, Melkassa and Pawe). The varieties which showed good performance were GPL x 92, Nain de Kyondo, A 410 and G 2816.

In the 1989 the bean program received the following new germplasms.

- VEF 88 - 1004 lines
- Beanfly segregation populations - 48 lines
- Beanfly reconfirmation trial - 11 varieties

VEF 88 was planted during the offseason under irrigation. Those lines which pass open quarantine will be tested as initial screening nursery I in 1990/91.

The Plant Pathology Section besides regional program on bean rust which was presented to the workshop, has carried out screening of varieties in the national, prenational and nursery II trials for common bacterial blight, Anthracnose and rust. The section also made routine annual surveys to determine the distribution and intensity of bean diseases, inspection seeds for quarantine purposes, and also monitor the development of minor pathogens.

The entomology section carried out two trials on beanfly; that is, host plant resistance and sowing date x plant density which were partially reported in the workshop.

The aim of bean agronomy research is to develop appropriate cultural practices such as studying effect of weeding frequency and seeding rate on growth and yield of bean varieties which was also reported.

The socio economics section has tested the economic evaluation of hand weeding vs herbicide in controlling weeds in beans. This trial will be tested again in 1990/91 seasons.

Bean cookability is one of the criteria for variety advancing and selection. Therefore, varieties which were in the trials in 1989 were subjected to the cookability test which is still in progress.

Different activities of the bean researchers

Workshop:

- Two breeders participated in bean improvement workshop in Africa in Lesotho, from 30 Jan. to 2 Feb. 1989.
- Five researchers from different disciplines joined others in research methods for cereal/legume intercropping workshop in Malawi, 23-27 Jan, 1989.
- One soil scientist participated in soil survey for land use management workshop in Kenya from 13 to 25 March, 1989.
- Two entomologists participated in Africa bean entomologist working group meeting in Kenya, 7-9 August, 1989.
- One soil scientist participated in nitrogen fixation in beans workshop held in Kenya, 27-29 October, 1989.

Short term training:

- Three researchers participated in weed management cource held at Uganda from 20 to 30 March, 1989.
- One economist participated in on-farm research training held at university of Zimbabwe in August 28-9 September 1989.
- Two breeders received three months training in CIAT, Cali from September to December 1989.
- 27 research technicians from different research centers and organisations were trained on lowland pulse research methods form August 20 - 1 September 1989 in Nazret, Ethiopia.

Post graduate training

- One breeder left to USA for his Ph.D study in August, 1989
- Three researchers from different disciplines (entomology, breeding and food science) left for their M.Sc studies.

Seed Multiplication

All varieties to be used for 1990/91 trials are planted at Melkassa under irrigation during the offseason (January to April) in order to multiply seeds for the trials.

Table 4. Haricotbean Trials Dispatched for Sowing in 1989

Trials	No of Entr.	Shoa West	Shoa South	Shoa East	Shoa East	Sidamo	Illubabor	Wellega	Semen Omo	Metekal	South Wollo	West Harr-erge.	Harrerge	Assossa
		Ambo	Zeway	Melka-ssa	Wolen-chiti	Awassa	Jimma	Bako	Areka	Pawe	Wollo	Meiso	Alemaya	Assossa
NVT														
White	9	x	x	x		x	x	x			x		x	x
Different	10	x	x	x		x	x	x	x		x		x	x
Large	8	x		x		x	x	x	x		x		x	x
PNVT														
White	15			x		x	x	x					x	x
Different	15			x		x	x	x	x				x	x
Large	15			x		x	x	x	x				x	x
NUR II														
White	25			x		x		x					x	x
Different	25			x		x		x					x	
Large	25			x		x		x					x	
NUR I	412			x		x				x			x	
Drought	25		x	x	x							x	x	
AFBYAN	25			x		x				x				
Climbind bean	25					x		x					x	
Introduction														
*VEF 88	1004			x										

* planted in the off season 1990.

REPORT FROM KENYA NATIONAL PROGRAMME

(see also: various papers at Regional Workshop, Nairobi, 5-8 March 1990)

BEAN PRODUCTION SURVEY: PROGRESS SUMMARY

Objectives

a. To understand farmers' bean production practices and techniques.

b. To determine the extend of adoption of new recommendations.

c. To identify key farmer problems.

Survey sites

1. Nyanza: Kisii (Bosongo & Kenmbu Divs.) - Sept. 1989

2. Central: a) Muranga (Kangema, Kigumo, Kandara, Makuyu & Kiharu Divs) Oct. 1989.

   b) Kiambu (Limuru, Kiambaa, Kikuyu, Gatundu, Githunguri, Lari & Thika Divs) Dec. 1989.

3. Eastern: Meru (South Imenti, N. Imenti, Tigania Divs) Jan/Feb. 1990.

Results

1. Kisii and Muranga: (40 farmers interviewed)

Maize and beans are first and second in importance as food crops. Main cash crops besides tea and coffee are groundnuts in Kisii and cotton in Muranga.

Mixed cropping is common in both areas. Also relay cropping of maize, beans and wimbi is practiced in Kisii.

Keeping of oxen for land preparation is predominant in Kisii.

In both places, planting occurs during the short and long rains seasons.

Rose Coco is a common variety. Less common vars in Kisii are Canadian Wonder and a small seeded Rose Coco. Other vars in Muranga are CW, Mwitemania and Red Haricot.

In maize/bean system, maize is usually in rows of 75-105 cm by 30-75 cm with 1-3 seeds/hill Bean in maize may be:

- 1 row beans between maize, 1 seed/hill
- beans & maize same row but different hills.
- beans random between maize 2-3 seeds/hill
- In Kisii only beans and maize are planted in same row and same hill,

75 by 30cm, 1 seed each of maize & beans.

Commercial fertilizer such as DAP are used in cash crops and only as left overs in beans.

Weeding is by use of hoes, and selective pulling of common weeds. Pangas are used in Muranga. Herbicides are never used in food crops.

Diseases & pests are the seed borne ones, beanfly, systates weevi cutworms.

Beans are eaten dry, as fresh seed or leaves (Mwitemania var.) and stover fed to livestock. Demand for beans as food is higher in Muranga than Kisii.

Rose Coco is the most preferred bean but it's Canadian Wonder which commands the highest market price.

Production constraints in Kisii and Muranga.

1. Diseases & pests.
2. Labour shortage due to demand by other enterprises.
3. Soil fertility
4. Unreliable rain in cotton zone.
5. Low market prices.

2. <u>Kiambu (50 farmers)</u>

Zones: Tea, Coffee and marginal cotton.

Main enterprises: Beans & maize, vegetables, cutflowers, fruits tea & coffee. Livestock include cattle, pigs, poultry, sheep, goats etc.

Land preparation is by jembes & pangas

Varieties: RC, CW, MT, RH and MM.

Maize varieties 614 and 512; the former is the better type. Farmers use own seed and rarely dress seed.

Beans are intercropped with maize, potatoes and bananas. Relay cropping is practiced using maize, beans and cabbage. Farmers do not follow recommended plant arrangement. Beans is usually random between maize and sometimes in same hole.

Beans are rarely fertilized although maize gets DAP.

Hand weeding is practiced to remove Commelina sp, Galinsoga sp Bidens pilosa and Tagetes minuta the common weeds.

Diseases and pests include anthracnose, root rots, common blight, leaf spots, beanfly and aphids. other problems are porcupines, wild dogs and maize streak virus on maize.

Beans are mainly harvested green more than dry for home consumption. Labour is from family, but may be hired at 18-30/- per day with or without lunch.

RC and CW are most preferred beans.

Main constraints are:

i) high cost of inputs
ii) diseases and pests
iii) poor soil fertility
iv) poor adoption of recommendations.

3. Meru (24 farmers)

Zones: Tea, coffee and cotton

Beans awere intercropped mainly with maize. Other enterprises were millet, irish potatoes, cassava, pigeon peas, bananas, vegetables, and fruits. Cash crops were coffee, tea and tobacco.
Cattle, goats, sheep and hens were kept.

Land preparation starts in Feb/March and again June/August. In Meru short rains occur in March and the long rains in October/November. Land is prepared using hoes, oxen drawn plough and sometime tractors.

The most preferred variety is Rose Coco from which crosses "nylon" varieties have resulted. Mwitemania is next in importance. Other types exist such as white types from Tanzania.

Semi climbing Red haricot was observed in tea zones but farmers were unaware of the value of climbers. Planting of mixtures was also noticed in tea zone.

Labour is provided by family but occasionally it it is hired.

Constraints were as follows:

1. Low prices 4-8/- per kg.
2. Drought in cotton zones.
3. Low fertility.
4. Diseases and pests.

BEAN RESEARCH PROGRAM IN SOMALIA

A. M. Abikar

Introduction:

The main grain legumes grown in Somalia in order of preference are cowpea, mungbean, groundnut, common bean and lima beans.

Cowpea and mungbeans are considered as secondary crops, inter-cropped or relay planted in Gu' (April - June) with staple food crops (maize, sorghum). They are seen rarely in pure stands at the main agricultural areas of the country (Shabelle, Jubba and Bay regions). But cowpea becomes principal crop in the central regions of Somalia (Mudugh and Galgadud), where the estimated annual rainfall is about 300mm/year. The chance of crop failure is often very high than at the Shabelle and jubba regions. Even so, the central regions provide the major source of cowpea for Mogadishu markets.

Common beans and lima beans are grown to a lesser extent at jilib area in the Jubba regions and some parts of the Shabelle regions. The crop is allocated to a very negligible area. Some common beans are grown for their green pods as vegetable crops for Mogadishu markets. Other beans (lima beans) are grown by isolated farmers at the two river sides (Shabelle and Jubba) for grain purposes. Farmers, see bright future for beans in the local and external markets. Presently, beans are higher competative to other traditional grain legumes (cowpea, mungbean) grown in Somalia.

Many people in the under developing world, their daily food is based on products rich of starch, mainly cereals and tubers lack of proteins in terms of quality and quantity. Improvement of their diet through animal products (meat, milk cheese and eggs) somehow is involved in high cost of production.

In Somalia prices of meat, milk and eggs are increasing continously. People who cannot afford the high prices of animal products are forced to manipulate other resources available at farmer's disposal and in the local markets.

Pulses are the main source of proteine available to the farmers in remote areas, and also to low income groups in urban areas. The present production connot sustain the high demmand for grain legumes in the urban areas [est. 61,000ha in 1986].

Regarding the socio-economic condition of the Somali people and the heavy population pressure immigration in the urban cities, one of the solution of dietary probelm may be the devélopment of suitable varieties of beans that could suit in the actual cropping systems and improvement of the cultural practiees of pulses in general.

Little attention has bean given to grain legumes as a source of food nutrients. It is recently that the Central Agricultural Research Station (CARS) at Afgoi has come up with programs of Grain Legume Improvement. The objectives are as follows:-

i) Collection and evaluation of local and exotic germplasm (Cowpea and Beans).
ii) To develop varieties of pulses (cowpea, beans etc) having field and storage tollerance to major pests and disease of economic importance, and that could fit better into the agricultural systems of the country.

2. Past Research and Information on Beans

Seven varieties of beans for vegetable purposes were tested in 1964/65 at the Central Agricultural Research Stations (CARS), Afgoi. Their marketable yields were in the range of six to ten tons/ha of immature green pods (table 2). But beans for grain purposes is a new research area started in Der (Oct-Dec) 1988 with the seed materials from CIAT.

Commercial farmers oriented towards vegetable production for export and supply of quality products to the local markets, are very keen to grow beans either for vegetable or dry beans. But due to lack of improved and adapted cultivars in Somalian environmental condition, these farmers obtain their seed materials from overseas seed companies. There is urgent need for bean research in Somalia. Promising varieties that could fit into the local agricultural systems is very much needed.

3. Future Research Areas on Beans

Starting 1990 in the three years plan of work (1990-1992), the following research topics will be covered at the Central Agricultural Research Station (CARS), Afgoi.

i) Observation Nursery of Bean Lines:

Importance will be given to ph. Vulgaris and ph. Lunatus. These will consist mainly arbustivo bean lines, International and African drought resistant lines.

ii) Varietal Evaluation of Beans under Irrigation and Rainfed:

Promising bean lines and International Bean Yield trials, tollerance to pests and diseases of economic importance will be considered. Continuation of storage pests will be continued by the Grain Legumes staff at CARS.

iii) Evaluation of Promising Bean Varieties in the local Cropping Systems:

Different cropping systems (sole crops, intercropping, cropping sequences) and other ogronomic trails (time of planting, plant dessity irrigation) will be considered for On-station and On-farm research.

iv. Food recipies and Quality test of Beans:

As Beans are not at the present time very popular into the local dishes, display of different food preparations used in international and local households will be prepared by the help of the CIAT and Faculty of Agriculture Lectures' in Food Technology and Nutrition. Quality and consumers' preference at local and External markets also will be investigated.

4. Schedule and Implementation

Selection and screening Bean lines is on going research work started in Der 1988 at the Central Agricultural Research Station, Afgoi. This work will be continued with the seed materials from CIAT.

In t.e first and second year (1990-1991) items (i), (ii), and (iii) of the future research area will be covered. Collection of beans scattured in isoleted agricultural areas of the country also will be accomplished in this period.

In the third year (1992), items (iii) and (iv) of the future research will be covered by the help of FSR at CARS and Food technology and nutrition at the Faculty of Agriculture and CIAT.

The above research autivities will be implemented by the Grain Legume Program at CARS, Bonka and Faculty of Agriculture with the materials and financial support of CIAT.

Table 2. Bean Vegetables Tested at CARS 1964/65

Crop Variety		Marketable Yields (t/ha)	Remarks
1.	Long Toma	10.0	
2.	Richman Wonder	9.0	
3.	Master piece (Victory)	8.8	
4.	Black Wonder	6.9	very fibrous
5.	King horn wax	6.1	very tender
6.	Brittle wax	6.1	" "
7.	Saxa	5.7	Beant beans, but not fibrous

A Progress Report on Bean Research Programme in the Sudan, 1989/90 Season

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Introduction

The food legumes on which research is intensified in the Sudan include faba bean, chickpeas, lentils, common bean and dry peas. Research on the first three crops is financed by a grant from the Government of the Netherlands which has been donated through ICARDA (The International Center for Agricultural Research in the Dry Areas, Aleppo, Syria) starting January 1989 and for three years. The IDRC used to financially support research on common beans and peas through a 'food legume improvement project' but that was terminated in 1988 and is, till now, not renewed. Therefore, for the last two seasons research on beans was supported by the local budget.

In Sudan dry bean is produced in two different agroecological zones. In the south of Sudan it is believed that the crop, which is mainly rain-fed, is produced in about 20,000 ha. However, due to instability in that part of the country, no research has been conducted. In the north of Sudan bean is produced as an irrigated crop in a area of about 4000 ha.

Research in this crop has been conducted in Hudeiba Research Station since 1960. Now, minor research is carried out in other stations, e.g. Shendi, Shambat and Wad Medani, besides the Faculty of Agriculture in Shambat.

Research Staff:

The staff working on bean includes: one breeder (PhD), two agronomists (PhD), one soil scientist (PhD), one entomologist (PhD), one pathologist (PhD) and one microbiologist (MSc).

Research activities:

The 1989/90 programme of work concentrated on the following:

I. Cultivar improvement. The following trials were conducted:

1. National bean trial, composed of 13 genotypes that have passed through preliminary and advanced yield trials. The trial was tested in four production areas.

2. Advanced yield trial, having 16 promising white-seeded selections, tested at Hudeiba.

3. A variety trial for some of the CIAT white-seeded genotypes. Most of these are bush types. It was found that they are quite vulnerable to some of the prevailing diseases.

4. AFBYAN: All the genotypes in this trials are not adapted to North Sudan conditions. They were badly attacked by diseases, especially "curly top" disease.

5. Assessment of single plant local selections and three white-seeded introductions from the USA sent by Dr M.J. Silbernagel; these are claimed to be resistant to curly top disease. Their stand, however, was poor.

II Seed multiplication of the promising lines for multilocational testing.

III Agronomic studies included testing of: plant populations, watering intervals, nitrogen fertilizer and micronutrients application.

IV Pest and disease management included:

1. Continuing screening of insecticides against white flies.

2. Dressing with different fungicides to control diseases.

V. Nitrogen fixation work included screening of different *Rhizobium* strains for efficient fixation of nitrogen.

However, the bean crop has just been harvested and therefore the data are not yet available.

Other Activities:

Dr Salih H. Salih, bean breeder, travelled to Lesotho to attend the workshop on bean improvement in Africa (Varietal Improvement) held in Maseru 30 January - 2February 1989.

Dr H.J. Vetten, virologist from the Institute of Plant Viruses, West Germany, visited Sudan, 8 - 13 December 1989 to investigate the bean virus problems. From bean samples he took to Germany he could isolate Cowpea Mild Mottle Virus (CMMV), transmitted by whiteflies, suggesting that it might be the causal agent of the "curly top" disease of beans in the Sudan.

Dr R. Kirkby, the regional bean Coordinator, visited Sudan 21-29 January 1990. He visited Hudeiba, Shendi and Shambat research stations and the Faculty of Agriculture, Khartoum, to make contacts with research scientists, and also visited some farmers' fields in Berber area. He visited the ARC administration in Wad Medani with regard to the Sudan being considered an associate member in the East African Bean Programme.

UGANDA COUNTRY REPORT ON BEAN RESEARCH 1989 -
Prepared for Steering Committee March 1990

By T. Sengooba

STAFF

Two expatriate staff; a breeder Howard Gridley and an economist Bill Grisley settled in their position as Regional staff at based at Kawanda Research Station in Uganda. Jane Kisakye completed her Msc. training at Florida University and came back to Kawanda where she has continued to work with the Regional agronomist on both on-station and on-farm research activities. Michael Ugen-Adrogu and Mary Mugisa left for their M.Sc. studies in Cornell and Ohio State Universities respectively. Sophy Musaana, Beatrice Male Kayiwa registered for their Ph.d at Dar-es-Salaam University and A.P. Opio registered at Morogoro Sokoine University. T. Sengooba possible registration her Ph.D at Dar-es-Salaam and changed to Sokoine and possibilities are that she will be registered for the 1990 academic year.

The programme lost one officer, C. Bakamwangiraki who passed away after a very short illness.

GERMPLASM

Germplasm transfer with CIAT Headquarters and within the Region continued. Nurseries received from CIAT included: VEF 88 with about 800 entries; Anthracnose, Ascochyta blight, Snap bean, BCMV, black rot, angular leaf spot, and Bean Drought Resistant Nurseries. There was very high disease pressure and thus good screening for Anthracnose, ALS, and Ascochyta. Some selections were made from these nurseries.

PRELACW Nurseries for both climbers and bush beans were received and these were grown at Kachwekano and Kawanda. Some selections were made from them.

Some land races were sent to Dr. Silbernagel for studies on black root.

With the arrival of the regional breeder there were some changes in the germplasm evaluation sequence slightly shifting emphasis from disease importance to yield during the earlier stages of the evaluation. The terminology was changed to Preliminary, Intermediate, and Advanced Yield Trials, the latter two being carried out at multilocational centres though sometimes depending on seed availability and accessibility. There is a start in dividing up the PYTs and IYTs into different trials depending on plant type.

HIGHLIGHTS

1. Three cultivars were released. These were G13671, White Haricot, and Rubona 5 and they outyielded the control (K20) by 93%, 84%, and 49% respectively. The former two were originally received from AFBYAN Trials and the latter was from selections within a land race.

2. Hybridization programme was started for CBB and Ascochyta resistance incorporation.

3. Bean variety evaluation on-station with farmers was started thus involving farmers in selection of genotypes for Advanced Yield Trials.

4. Methodology on how to lay down a trial when screening for CBB was finalized and documented.

5. Methodology for CBB and Ascochyta blight chemical and cultural control were investigated and possible control measures were documented.

6. Strains of BCMV in the region were identified. The strain NL3 (both necrotic and systemic types) has been characterized in the region.

7. Disease levels were studied in intercrop versus pure stand and it was found that CBB and rust were decreased while angular leaf spot and Ascochyta blight were increased. In several cases these differences were statistically significant. Almost in all cases there was no significant interaction between genotypes and cropping system.

TRAINING

1. Successfully organized two-week training course for technicians - 28 people attended this course.

2. Successfully organized a bean working meeting on potyviruses (January 17 - 2 February 1990 in Kampala. Twenty people attended.

3. Regional and National Bean Programme staff participated in a Farming Systems Workshop organized jointly with CIMMYT in November 1989.

4. Virologists concluded a one week virology course in Mukono District Farm Institute, Kampala (12 - 19 February 1990) for Agricultural Officers from 7 districts where beans are largely grown.

FUNDS

More funds were required and spent during the year due to:

1. Increased activity due to increased senior staff members and supporting staff.

2. Revised and increased allowances for travel in-country, for example, the night allowances are more than twice the monthly salary. Money from USAID has dwindled down and was more difficult to get throughout this year.

C-3.a

REVIEW ON RESEARCH RESULTS ON AFRICAN BEAN DROUGHT NURSERY

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Introduction

In most parts of Eastern Africa rainfall is the major limiting factor in crop produciton. The annual mean,rainfall exceeds the potential evaporation from an open water surface on only 2 or 3 percent of the land surface (2). The distribution of rain is also erratic. It usually starts late and ends early. In addition the soils are shallow and have problems of compaction and surface crusting or sealing which lead to a low water infiltration and high runoff (4). As a result, rainfed agriculture is a risky enterprise, being more so when the rainfall is below normal or when very dry long period occur during the growing season.

Although bean is adapted to relatively dry areas, yet its yield is greatly influenced by variation in amount and distribution of rainfall. Yield losses are particularly high when drought occurs at flowering or at pod filling stage. Eventhough precise estimates are not available, bean yield losses in water stress areas can easily go upto 50% or more. Further, the probability of yield loss due to drought influences the use and utilization of fertilizer and other inputs. Drought, therefore, is probably responsible for much high economic loss than indicated.

Drought is the major constraint to bean production in many ocuntries of Africa. In Ethiopia beans are grown in the lowlands and in the rift valley areas where drought is a major problem. The neighbouring countries do also produce bean under similar conditions. In these areas bean production appear to be more affected by regional variation in the time and total supply of rain than any other factor. Drought-tolerant varieties can provide a high cost effective means of reducing fluctuations in regional grain production on this and other capital deficient areas and can increase stability of year to year food production among small-scale farmers.

To minimize the moisture stress effects and increase crop production in drought prone areas several countries in the semi-arid parts of Africa have launched many breeding programs to develop drought tolerant cultivars in maize, sorghum, cow pea, and other cereals. However, very little attention is give to beans.

In view of this the bean drought nursery sub project was initiated during the year of 1987 by the steering committee for bean improvement program for Eastern Africa. The research activity started in 1988 cropping season by selecting early maturing bean cultivars based on past experience in Ethiopia and introducing drought tolerant bean cultivars developed by CIAT.

The sub project was initially designed to include countries in Eastern Africa only. But during the workshop on drought resistance in beans which was held in Harare during 9-11 May 1988, it was decided that it should also include drought affected parts in the southern region: (Lesotho, Malawi, Botswana, Zimbabwe, Tanzania, Zambia). Thereafter, it was considered as African Bean Drought Nursery and carried out in many African countries.

The major objectives of the nursery were as follows:

1. To evaluate performance of promising cultivars identified under drought conditions in Ethiopia and Latin America, across a wide range of African dry environments.
2. To develop further regional testing net work for beans in Africa
3. To examine and interpret genotypes responses of different patterns of drought.

This paper is divided into two portions. In the first part research result highlights of the bean drought nursery from Ethiopia and Kenya are reviewed. Results from other cooperating countries in the Eastern Africa region were not received and as a result not included. The second part of the paper includes review of the progress of work of SADCC/CIAT drought sub project, since actual research results were not received.

Materials and methods

Field experiment were conducted in 5 and 6 different sites during the 1988 and 1989 cropping seasons respectively in Ethiopia and one site (Katumani) during 1989 long rains at Kenya. Detailed description of the experimental sites is indicated in appendix 1. The design used was 5 x 5 triple lattice with 25 treatments replicated 3 times. The different treatments included during both 1988-89 cropping seasons are given separately in appendix 2. The plot size was 4 rows, 40 cms apart and 5 m long. 2 seeds were planted in a row at a distance of 10 cm from one another and thinned to appropriate population after emergence. Two middle rows were used to estimate yield and take all required parameters. The trials in Ethiopia were planted duirng the first week of July (main rainy season) and the trial was planted during long rains. Agronomic data such as emerging date, stand count after thinning and at harvest, plant height, dry matter, days from emergence to flowering and maturity etc. were recorded. Seeds were weighed to determine yield per unit area and 100 seed weight by adjusting to 10% moisture content. The data was subjected to statistical analysis.

Result and Discussions

Twenty five different bean cultivars was tested at six different sites Melkassa, Wulenchite, Meisc. Ziway, Jijiga, Babile in Ethiopia and one site at Kutumani in Kenya during 1988-89 seasons. Moisture stess was not limiting at Melkassa 'first planting) Ziway and Sirinka (1988 season), while all entries experienced stress problems during early growth, at an thesis and grain filling during both seasons. Thus the overall location mean grain yield was higher at Melkassa and Ziway compared to other locations (Table 1-3).

There were significant di erence in grain yield, 1000 seed weight, and days to flowering among varieties for each location during both seasons (Tables 1,3). Variety G-2816 produced the highest grain yield across locations compared to all common bean varieties tested and cow pea variety Black-Eye Bean gave the lowest yield during 1988 (Table 1). Besides single analysis for each location showed significant difference in grain yield among varieties

(Table 1,3). However, the combined analysis indicated that the effect of variety by location interactions were not significant during the 1989 season (Table 6). This shows that the performance of varieties across locations were similar and stable across locations. This results are very encouraging, because previous studies had indicated that identifying genotypes that show minimum interaction with environments or posses greatest stability (1) is an important consideration specially in regions where environmental fluctuation are considerable and means of modifying the envrironment is remote (3). The combined analysis for grain yield showed that Ex-Rico-03 is the best performing variety across locations outyielding all varieties tested (Table 6). This variety has performed well under moisture stress conditions in previous trials and is proposed for release for such areas (Teshome Girma personal communication). The varieties also differ significantly in 100 seed weight (Table 4,6). However, the increase in 1000 seed weight was not consistent with increase of seed yield per unit area.

The varieties varied significantly in the number of days from emergence to anthesis (Table 2,5) Ex-Rico-23 the highest yielder is among the earliest varieties (Table 6).

At Kutumain in Kenya the same experiment was conducted in one location. The experimental results indicated significant difference for all parameters considered seed yield, days from emergence to anthesis and 1000 seed weight. Although yields and growth was limited by moisture stress problems due low rainfall (Table 7). The grain yield for the different bean cultivars ranged from 279-618 kg/ha. Varieties G-5201 and A-154 produced the highest and lowest grain yield respectively (Table 7).

Although the results gave indications that some varieties are found to be promissing for moisture stress areas, the experiments should be repeated considering more drought tolernt indicating parameters and testing across different locations in the region.

Review on the Progress of the SADCC/CIAT Drought Subproject 1988-89

The overall objective of this sub-project was to improve bean yields under conditions of soil moisture stress. The subproject was divided into four components as follows:-

A. Drought Tolerance Mechanism Study

This trial was conducted at Bunda College in Malawi under irrigations during the dry season of 1988. Fifty two genotypes from Malawi, South Africa and CIAT were included in two replications as a randomized block. The main aim of the trial was to identify physiological mechanisms that contribute yield formation under drought for later use in breeding drought tolerant genotypes. Data collected include leaf expansions, leaf difference resistance leaf transpiration, temperature, vigour score and other phenological data and yeield etc.

During the 1988/89 seasons the trial was planted at two different sites*. The purpose of this second experiment was to determine yielding potential of the genotypes under no stress and stress conditions. Phenologist and yield data were collected. This subproject is coordinated by Malawi.

B. Drought Nursery

This is part of the African Bean Drought Resistance Nursery. The cooperating countries include Malawi, Lusatho, Zambia, Tanzania, Zimbabwe This compnent is coordinated by Zambia.

C. Agronomic Practices in Drought Situations

The drought sub-project intends to develop agronomic management practices which can be applicable to drought stricken areas to improve bean yield. It was planned to prepare a questionaire by Tanzania and send to the participating countries for application after approval by the SADCC/CIAT cropping systems agronomist. The progress has not been reported.

* Under high and low rainfall areas.

D. Breeding for Drought Resistance

Zambia has been charged with excutition of this component as soon as the ground work has been so proposed by the foregoing components that breeding for drought tolerance could be effective and practical. Funding for this component has not been effected until the time of this reporting period.

Future Research Directions

The experiments will be carried out for one more season as previously planned (i.e. for three years) and varieties will be screened out to a mangeable size. In phase II of the programme more physiological mechanism studies to identify characters or traits which are indicator of drought resistance/ tolerance will be studied. Thus the following parameters will be collected.

- leaf water potential
- stomatal resistance
- leaf extension rate
- leaf area index (LAI)
- rooting density and pattern
- heat tolerance
- soil water potential etc.

and incorporate these traits in the breeding programme.

Line source sprinker irrigation system will be used to monitor the desire level of water stress required in testing cultivars under stress conditions. Since rainfall interference occuring in rainy season was a problems.

The possibility of restoring two planting dates in a single season will also be continued to obtain different patterns of cultivars respons in one season.

Make monitor tours to assess the progress and exchange ideas and experiences of the different experiments conducted by the cooperating countries in the region.

Table 1 Seed yield in kg/ha as influenced by bean cultivars across locationary 1988

VARIETY	LOCATIONS								
	Kob*	Mel* 1st	Mel* 2nd	Mie*	Sir*	Wol*	Ziw*	Mean	Rank
G-5059	924	3036	950	2056	720	1038	2622	1735	9
G-4446	753	4078	1038	2082	444	1409	2183	1712	10
G-8025	625	3318	1031	1883	392	1037	3060	1620	13
BAT-477	743	3594	812	2014	611	1265	2527	1652	12
BAT-125	789	2642	711	1602	465	1099	1913	1327	23
G-5201	588	2917	881	1458	525	1227	1888	1355	21
G-4830	682	3370	864	1343	661	1509	2743	1596	16
EMP-105	1546	3264	904	1510	438	1327	1422	1487	20
A-54	1176	2727	970	1468	450	1052	1594	1348	22
BAT-798	1043	3316	970	2700	810	1122	1940	1700	11
Aquascalintes-13	1581	3492	472	2318	924	1355	2161	1758	7
EMP-175	1305	3291	1094	1140	331	1137	2458	1537	18
PAN-133	2022	3332	821	1946	930	1193	2690	1848	5
AND-187	1116	3551	777	1671	273	1434	2489	1616	14
ICA-15506	659	3245	1135	1237	359	1042	1019	1242	21
A-410	1099	4087	1270	2226	1125	1457	3920	2169	2
AND-338	1195	3748	824	1222	1034	1163	1811	1571	17
A-422	1301	3873	1632	1379	861	1953	1910	1913	4
BAT-338-1C	791	3530	969	1585	672	1223	1907	1526	19
EX-RICO-23	1264	4378	919	2032	680	1059	1987	1766	6
G-2816	1467	4588	1351	2701	850	2485	3167	2373	1
Mexican-142	810	3745	417	2094	639	1679	1835	1603	15
T.V.X-309-1G	1463	3368	295	2315	1314	2367	1028	1736	8
Black eye bean	1047	938	567	1278	319	975	423	792	25
ILCA-7380	2109	2457	1093	2799	1571	2049	1593	1953	3
MEAN	1124	3387	911	1862	696	1385	2164		
LSD(0.05)	982.7	657.5	528.3	501.2	796,1	627.7	1550.1		
S.E ±	71.38	89.94	47.71	62.10	54.76	57.99	132.03		
Rainfall(mm)	460.10	506.30	260.00	349.50	656.30	370	520		

* Kob - Kobo , *Mel 1st - Melkassa 1st planting
* Mel 2nd - Melkassa 2nd Planting , * Mie - Mieso
* Sir - Sirinka , Wol - Wolenchiti
* Ziw - Ziwai

Table 3 Mean Grain yield kg/ha of bean cultivars included in Drought nursery across locations, 1989

Treatments	LOCATION								
	Mei-1	Mei-2	Ziw	Wol	Mie	Bab	Jig	mean	rank
1 Harold pink	1876.04	1058.33	3159.38	1500.00	770.83	562.50	252.08	1354.17	15
2 G-2816	2825.00	752.08	3371.88	1450.00	708.33	531.00	202.81	1405.87	9
3 Ex-Rico-23	2628.13	3477.42	4145.83	796.63	417.91	625.00	183.43	1757.80	-1
4 Rosa pink	2489.58	1109.37	2769.79	787.50	483.33	645.83	246.87	1218.90	22
5 A-422	3228.13	1330.21	4247.92	1303.13	322.92	562.68	71.14	1580.88	-3
6 AND-338	2112.46	734.38	3964.58	667.71	447.92	526.04	162.81	1230.84	21
7 N/W-590	2204.21	1258.33	3656.25	745.83	645.83	437.50	112.50	1445.50	8
8 A-410	3142.67	1045.83	4107.29	992.71	250.00	437.50	239.99	1459.28	7
9 ICA-15506	2024.96	738.54	3605.21	593.75	406.25	351.04	119.58	1119.90	25
10 AND-197	2281.29	747.92	4114.58	911.46	531.25	422.92	67.08	1296.79	18
11 G-5059	2517.63	625.00	5120.83	1419.96	281.25	479.17	73.82	1502.52	4
12 G-8025	2829.17	1113.50	3819.79	781.25	510.42	458.33	222.97	1390.78	11
13 G-4446	3358.29	868.75	4081.25	1260.42	281.25	375.00	120.31	1477.90	6
14 BAT-477	1965.54	737.50	4338.54	1212.71	697.91	489.58	120.21	1366.60	14
15 PAN-133	2128.13	762.50	4091.67	1557.29	968.75	666.67	175.52	1478.64	5
16 Olathe	2542.71	1116.67	3630.21	979.17	375.00	375.00	201.51	1317.18	17
17 Emp-175	2588.54	786.46	4090.63	1006.25	250.00	479.17	99.68	1328.68	16
18 BAT-338-1C	2143.75	691.68	3992.71	1220.83	239.58	420.83	69.27	1254.09	20
19 Aquaseulient-13	2069.79	746.88	3523.96	1511.46	947.92	541.67	247.39	1369.87	13
20 G-4830	2366.67	1159.37	4517.71	1273.96	1375.00	541.67	220.20	1636.37	-2
21 Vivapink	2692.71	1120.83	4134.38	867.71	427.08	500.00	94.79	1405.36	10
22 EMP-105	2810.42	958.33	4552.08	695.83	197.91	354.17	61.14	1375.70	12
23 A-154	1988.46	772.92	3857.29	878.13	302.08	390.62	114.68	1186.31	23
24 BAT-798	2149.96	1171.87	3208.02	862.71	229.17	479.17	107.70	1172.66	24
25 G-5201	2616.29	700.00	3547.92	1060.42	489.58	518.75	110.93	1291.98	19
$\bar{X}$	2374.54	906.21	3911.33	1055.83	484.50	472.21	113.50		
LSD ($p \geq 0.05$)	827.70	1591.00	1223.00	794.8	501.6	180.4	137.9		
Rainfall (mm)	530.1	270	545	347	274	-	-		

Table 7 Mean grain yield in kg/ha as influenced by bean cultivars at Kenya, 1989.

Treatments	Seed yield kg/ha	Days to flowering	1000 seed wt
1 Harold pink	494.18	44.67	215.00
2 G-2816	416.33	44.00	250.33
3 Ex-Rico-23	470.26	43.33	178.7
4 Rosa pink	447.84	42.33	202.7
5 A-422	403.63	46.00	194.7
6 AND-338	597.85	44.67	163.0
7 N/W-590	515.75	45.67	156.7
8 A-410	480.40	45.00	190.7
9 ICA-15506	407.52	46.00	196.7
10 AND-197	454.95	44.67	192.3
11 G-5059	290.37	37.00	359.3
12 G-8025	569.50	47.00	180.3
13 G-4447	544.84	44.33	214.0
14 BAT-477	289.54	38.33	484.0
15 PAN-133	360.80	40.00	463.7
16 Olathe	564.13	36.33	318.7
17 EMP-175	418.65	38.33	470.3
18 BAT-338-1c	455.43	38.67	249.7
19 Aquaseulient-13	494.78	43.00	159.7
20 G-4830	353.48	39.00	180.0
21 Viva pink	599.73	35.33	326.7
22 EMP-105	413.15	39.67	167.7
23 A-154	279.26	39.33	346.3
24 BAT-798	300.04	45.00	132.0
25 G-5201	618.91	37.67	145.0
LSD ($P \geq 0.05$)	203.8	5.60	72.11

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Appendix III

Budget for 1990 Drought Nursery*

	Estimated Cost $US
A. Equipment & Supplies	
Cloth and plastic bags	100.00
Meter tape	50.00
Strings	20.00
Stakes	30.00
Films	50.00
B. Trial Management	
Labourers and Technical Assistance	1000.00
Chemicals	150.00
Seed production costs	200.00
C. Transport	
Site visites	1000.00
Travel allowance (monitoring tour)	4500.00
Total	US$ 7070.00

* This budget request is only for trials in Ethiopia other cooperating countries are expected to prepare their own request.

Bean Rust Sub - Project

Budget Proposal for 1990/91

Habtu Assefa

The bean rust sub-project was initiated in 1987. Since then several research programes were undertaken that include:

1. Rust survey
2. Assessment of losses
3. Pathogenicity analysis, and
4. Varietal resistance

Research results obtained in each of these area is given indetail in the report presented to the second regional workshop on bean research in Eastern Africa. The results found at the beginning of the programme formed the base for the expansion of the research activity. The bean rust in common bean was studied extensively. In the last three years modifications were made in handling and managment of the experiments. As found necessary additions were made to specific proposals interms of increasing location, varieties, and assessment procedures.

Since March 1989 the sub-projects activities have been incorporated as part of a PhD programme. Beginning 1990, after consultation with the Uganda, Kenya, Zambia, and Rwanda bean programmes, a regional rust nursery is proposed. Seeds to be included in the nursery are already despatched to most of these countries.

In December 1989 a short trip was made to Uganda and Kenya to discuss about rust and CBB collaborative activities. Discussion focused on the regional bean rust nursery, regional CBB nursery and possibilities for duplicating part of the PhD proposal in Kenya and Uganda. As part of the bean rust sub-project and in addition to the reginal bean rust nursery the activity is now expanded to encompass:

1. Survey of foliar diseases of beans and the importance of rust in the multiple patho-system.
2. Crop-Loss studies
3. Pathogencity analysis
4. Partial resistance

5. Components analysis, and
6. Varietal resistance

Having seen the bean rust PhD proposal, Uganda and Kenya agreed to collaborate on:

a. The Pathogencity analysis study - Uganda
b. Varietal Mixtures - Uganda
c. Partial resistance - Kenya

For effective running of these experiments the two national programmes require the following:

1. Budget for improvment of the greenhouses both at Uganda and Kenya.
2. Allowances for casual labour and perdiem
3. Allowances for laboratory and greenhouse equipments

It is with this background that we feel to continue the sub-project and request the attatched budget for the 1990/91 fiscal year. The PhD programme is propsed to continue for the next 3 years.

Budget Proposal for 1990/1991

A. Equipment and Supplies

1. Ethiopia		US $ Price
Vials	-	100
Chemicals	-	250
Media	-	350
Films	-	150
Diskettes/computer papers	-	200
Settling tower inoculator	-	1000
2. Uganda		
Vials	-	100
atomizers	-	50

3. Kenya

atomizers	-	50

B. Labour

Ethiopia	-	2500
Uganda	-	500
Kenya	-	500

C. Perdiem

Ethiopia	-	2500
Uganda	-	500

D. Greenhouse Maintenance

Ethiopia	-	500
Uganda	-	~~500~~
Kenya	-	500

E. Monitouring tour (To visit the regional bean rust nursery and other collaborative activities) - 2500

Total	=	US $ 12,750

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F

REGIONAL SUB-PROJECT ON BEAN RESEARCH

PROJECT TITLE: ANALYSIS OF SEROTYPES AND STRAINS OF BEAN COMMON MOSAIC CIRUS (BCMV) IN COUNTRIES WITHIN CIAT'S EASTERN AFRICA REGIONAL PROGRAME ON BEANS.

S.A.P. Owera,
Department of Crop Science,
Makerere University, Uganda.

INTRODUCTION

Date of Commencement: May, 1988.

Objectives:

1. Survey and identify bean common mosaic virus strains in Eastern Africa,
2. Evaluate/screen germplasm collection against prevalent BCMV strains within the Eastern African Region,
3. Conduct comparative studies of pathotypes against promising materials,
4. Carryout identification of alternate hosts to BCMV strains and other possible bean viruses.

Although dry beans is an important source of edible proteins in most tropical countries, it is not immune to infection by seed transmitted viruses which pose serious risks in its production and improvement programs. Beans are susceptible to natural infections by many viruses like other leguminons plants. Indeed for many grain legumes (i.e. bean, broad bean, cowpeas, lentils, BCMV Project (Owera)

Work - Plan 1990

1. January 17-21

Attend and participate in a workshop in Kampala on potyviruses.

2. February

Prepare a report on progress made in the year 1989 and also draw a budget for 1990.

3. March - June

(a) Survey of viruses present in the bean field in the low and high-land areas in Kenya with a view to compare Kenyan strains of BCMV with those strains already documented in Uganda and Ethiopia. The main purpose of this exercise is to draw up an inventory of BCMV strain available in Eastern Africa.

(b) Assit the CIAT breeder with field screening of segregating materials particularly against black root disease.

4. July - September

(a) Carry out greenhouse screening against BCMV - type and NL-3 in Uganda.

(b) Request Micheal Omunyin to a similar greenhouse screening of bean materials against the prevalent strains in Kenya.

(c) Open up 2 acres of land in two location, in Uganda and conduct field screening for BCMV resistance using materials from National Program on beans in Uganda.

(d) Prepare a manuscript for Bean Workshop.

(e) Attend a Bean Workshop in Morogoro - and use this opportunity to discuss work on BCMV in Tanzania with Professor Femi Lana of Sokoine University.

October - November

Analyse results

December

(a) Prepare a progress report

(b) Prepare a manuscript for publication in either Plant Disease or Annals of Applied Biology or Crop Protection Journal.

BUDGET PROPOSAL (1990)

TITLE: REGIONAL SUB-PROJECT ON BCMV (CIAT)

Expenditure	Cost (USD).
1. Ploughing and Harrowing (2 acres at 2 locations	400
2. Labour (plot layout; planting, sampling harvesting 100 mandays at 2 locations at US $ 1.5 per day	800
3. Field materials such as bags, ropes, fertilisers and other agrochemicals at each location	1400
4. Pots and labels x 2	400
5. Insect cages x 2	100
6. Laboratory chemicals	600
7. Laboratory assistant (Technician) at approx. US $ 30 per month x 2	720
8. Local travel + per diem	2000
9. International travel by Principle Investigator (PI) to Ethiopia and Kenya and Tanzania (see later)	1500
10. Per diem for PI during 21 days of International travel at US $ 80	1680
11. Publication of results in reputable journal	400
GRAND TOTAL	10,000

REGIONAL COLLABORATIVE RESEARCH PROJECT ON COMMON BACTERIAL BLIGHT (*Xanthomonas campestris* pv. *phaseoli* (Smith) Dye of Bean (*Phaseolus vulgaris* L.)

40126

SOPHY MUKWANA MUSAANA

and

ASINASI FINA OPIO

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Kampala, UGANDA.

Abstract

A progress of the work carried out by the breeder and pathologist from 1987 to 1989 is given. The work covered include identification of suitable methodologies for resistance to common bacterial blight (CBB), breeding for resistance to CBB, formation of the East African Regional common bacterial blight nursery, and evaluation of various chemicals for the control of common bacterial blight. The prospect of production of disease free seed in dry areas was investigated. Future plans are given.

The results showed that the square arrangement with the test line planted two weeks after the spreader was the best method of planting and arrangement of spreaders. From the nurseries that were handled the best materials for CBB resistance were G 4399, Xan 159, Xan 112, BAT 1500, G 5448, GN Jules, GN Tara, PI 247262. All the copper chemicals reduced the severity of CBB but non-completely eliminated it. Yield increase were significantly different between the chemical treated plots than the control. From the results, dry area seed production with furrow irrigation facilities may be the only solution to the seed production problems in Uganda and probably other parts of Africa.

Justification

Common bacterial blight caused by *Xanthomonas campestris* pv. *phaseoli* (Smith) Dye (Xcp) is one of the five most important diseases of beans in Uganda (Leakey, 1963; Sengooba, 1985). The other four are angular leaf spot (*Isariopsis griseola*), Rust (*Uromyces phaseoli* var. *phaseoli*) in the low altitude areas and halo blight (*Pseudomonas syringae* pv. *phaseolicola*) and Ascochyta blight (*Phoma exiqua* var. diverspora) in the highlands. Of these, angular leaf spot and common bacterial blight (CBB) are the most prevalent (Sengooba, 1985).

Apart from Uganda, the disease is of serious concern in other parts of Eastern Africa. It is regarded as a major problem of beans in Ethiopia (Assefa, 1987), Kenya (Mukunya *et al*. 1981; and Burundi (Perreaux *et al*. 1986). It is also prevalent in many low altitude areas of Tanzania.

Although CBB was identified as one of the important diseases of beans in Uganda in the early 1960's (Leakey, 1963) no particular attention was given to it. The breeding programmes on this crop focussed on anthracnose and later angular leaf spot (Sengooba, 1987). Because of lack of resistance to the disease in the commercially acceptable varieties and land races in the country, the Uganda seed multiplication project faced a problem with bean seed in the early 1980's. There was an outbreak of CBB at their main seed multiplication farm and bean seed multiplication had to abandoned.

Presently bean varieties with resistance to CBB have been developed in temperate countries. Such varieties are Xan 159, Xan 112, the Nebraska selections (e.g. GN Jules, GN Tara, GN Nebraska selection 27, PI 207262) (Coyne and Shuster 1969, Coyne et al. 1963). These varieties are, however, poorly adapted to the tropics and hence appear susceptible (Webster, 1983). There are well developed materials at CIAT (Cali, Colombia) that show resistance to CBB but these need to be tested under our conditions. There is therefore need to develop resistant bean varieties well adapted to this region within the region itself. Various aspects of the disease need to be studied so that an integrated approach is sought in controlling the disease.

The project is being handled on a regional level because of its importance and widespread nature in the region. Countries included in this collaboration are Ethiopia, Kenya, Burundi, Rwanda, Zaire and Tanzania. Since these countries share the same ecological zones as Uganda, results generated can be utilized by any country within the region and materials with resistance to the disease can be circulated within these countries within the shortest time without duplicating efforts.

Year of Approval : 1987

Objectives

1) To identify suitable methodologies for evaluation of bean germplasm for resistance to common bacterial blight when artificially inoculated under field and/or greenhouse conditions.

2) To control common bacterial blight of beans through breeding.

3) To develop a common bacterial blight nursery within the Eastern African region.

4) To study the variation and host range of Xanthomonas campestris pv. phaseoli (Smith) Dye in the Eastern African region.

5) To control common bacterial blight using chemicals and dry areas (this was mainly for seed production).

6) To study the symptomatology of common bacterial blight on beans.

7) If found necessary - to study the inheritance and heritability of resistance to common bacterial blight in P. vulgaris and thereafter determine breeding methods.

Adjustments in the objectives

The study of symptomatology (i.e. No.6) was removed. Studies on seed transmission and survival of the pathogen have been added starting with 1990.

RESULTS

The progress will be given for each objective in the order given above.

1. Identification of suitable methodologies for evaluation of bean germplasm for resistance to common bacterial blight

Three aspects of planting spreaders were investigated as follows:

(a) Time of planting spreaders: Spreaders were planted 1, 2 and 3 weeks before test lines.

(b) Frequency of planting spreaders: Spreaders were planted as follows: (i) A single row of a spreader for every test line was used as control, (ii) single unbroken rows of a spreader for every 6, 8 and 10 test lines.

(c) Arrangement of spreaders: Double rows of a spreader for every 2, 6, 8 and 10 test lines but after a path of 60 cm the ends of the test lines were planted with spreaders giving the plots a square effect.

This work was carried out in 1987 and 1988. In all cases the spreaders were inoculated and disease records taken at flowering (R6), Podding (R8) and Physiological maturity (R9). Twelve bean varieties were used in all cases.

The results indicate that planting test lines 3 weeks after the spreader rows was not effective in spreading CBB. Planting the test lines one or two weeks after the spreader rows was effective in spreading the inoculum with no significant differences between the two, though the means for the 2 week planting were slightly higher. CBB scores taken at physiological maturity (R9) were best for the two years. May be due to the fact that even pod reaction could be rated at this stage. The results also indicate increasing plant susceptibility as the crop matures. There was no interaction between planting time with disease scores at R6 (Table 2). Significant interaction (P = 0.01) were however, noted between disease scores at R8 and R9 and planting time after 2 and 3 weeks. This indicated that in both years, scoring CBB at R8 was shown as best for the three planting times since all their means were significantly different from the scores at R6.

Analysis of variance of disease scores made at different growth stages when spreader rows are planted at different intervals with test lines and arranged differently revealed significant differences (P = 0.01) for varieties and scoring date (Table 1). The different arrangements of the spreader rows or the frequency at which spreader rows were planted per test lines gave significantly (P = 0.01) different CBB scores for both years. The different varieties also behaved differently during the experimentations. The best stage for scoring CBB was when the crop was at Physiological maturity (R9) (Table 3). The best frequency of spreader rows was 6 test lines between the spreaders. This is when the scores were not significantly different (P = 0.01) from the control of 2 test lines between spreader rows. When the spreaders were arranged in a square as many as 8 test lines could be planted between spreader rows arranged in a square form.

Disease scores at R9 gave consistently significant differences with R6 or R8 with the different frequencies and arrangement of spreader rows. For the control (2 test lines between spreader rows) records at R8 could make meaning.

The overall results indicate that planting test lines 2 weeks after spre rows with the spreader rows, planted after every 6 test lines arranged in a square form was the best way of spreading CBB inoculum in the field. But with the square arrangement as many as 8 test lines could be planted between spreader rows without producing significantly different disease scores from the control of 2 test lines between spreader rows.

2. Breeding for resistance to common bacterial blight

From the International CBB nurseries 1987 and 1988 grown at Kawanda in the respective years, the following lines were identified as donor parents in a crossing block. Xan 159, Xan 112, G 4399, PI 207262, GN Jules, GN Tara, Xan 93 and GN Nebraska No.1 Sel.27.

At Kawanda in 1989A the donor parents used were G 4399 and Xan 112 and the recurrent parents were Kanyebwa, Rubona 5, K20, ZPV 292 and Red Wolaita. The donor parents were crossed to each of the recurrent parents. Pods were formed with some crosses to the tune of 40%. In season 1989B, the F_1 plants from the crosses made in 1989A were grown between parents used in the cross. Plant type and colour were used to ascertain successful crosses. At R6 the F_1 plants developed black root and by R9 the F_1's of G 4399 and Xan 112 were wiped out.

At Bukalasa in 1989B the donor parents used were GN Nebraska No.1 Sel.27, GN Jules, GN Tara, Xan 159, Xan 112 and PI 207262. The same recurrent parents as 89A with addition of Namunye were used. Successful crosses were made to the tune of 60%. Crosses with Xan 112 and Xan 159 were lost due to black root. F_1 seed from other crosses was, however, harvested as single pods and a single seed descent pedegree selection will be used to advance crosses. Backcrosses will be made.

In the International CBB nursery 1989/1990 black root was observed on Xan 159, Xan 112, GN Tara and GN Jules. This has greatly reduced the number of donor parents which can be used for improving the land races. In future donor parents without I gene would be used.

Another crossing block using the following donor parents has been set up at Kawanda: GN Jules, GN Tara, PI 207262, GN Nebraska No.1 Sel.27, Xan 6, IAPAR 16, ICA-64, Amanda (75-20), G-09857, MX 259-8.

The same recurrent parents as used in 1989 are being used.

3. The development of a common bacterial blight nursery within Eastern Africa

The aim of this nursery is to identify bean materials resistant to CBB in all the countries in this region and put these together to form an East African Regional Common Bacterial Blight Nursery. This nursery is to be used by all countries in the region especially for identifying resistant lines which breeders can utilize in breeding programmes.

118 lines were selected from both local collections and introductions for inclusion in this nursery in 1988. They were grown in Kawanda in season A 1989. The lines selected had previously shown resistant reaction to CBB. A few intermediates and susceptible lines were included for comparison. In 1989, 30 lines were received from Ethiopia and these plus six lines from Burundi were added to this nursery and planted at Bukalasa. The Burundi lines had shown resistance to CBB in both Rwanda and Burundi.

Unfortunately most of the initial 118 lines have gone down with black root and therefore in 1990 adjustments have to be made. Hopefully resistant lines (genotypes) will also be obtained from Kenya, Tanzania, Zambia and Zaire before the end of the year.

4. Variation in Pathogenicity of Xanthomonas campestris pv. phaseoli (Xcp)

Detailed studies on variation of varition of Xcp has now started at Kawanda. Isolates have been collected from various ecological zones of Uganda. Several varieties of common bean (Phaseolus vulgaris L.) and Tapery bean (Phaseolus acutifolius) with differing levels of resistance to CBB are being used for this study. Bacteriophages will also be used in differentiating the isolates. At a later stage these studies will be extended to Ethiopia initially and then Tanzania and [redacted] Kenya.

5. Control of common bacterial blight on beans

Two aspects were considered with the control of CBB:

(a) Chemical control.

(b) Utilization of dry areas or off seasons for production of disease free seed.

Chemical control

A chemical evaluation study was set up at Kawanda from season B 1987 to Season A 1989. The experiment was a randomized complete block with four replicates. The plots were 4.8m x 5m. The chemicals and their rates per plot in paranthesis were as follows: Cupric sulphate (2.5 gm), Cuprous oxide (2.0 gm), Cupric nitrate (2.5 gm), Copper chloride (3.0 gm), Streptomycin sulphate (5%). Water 5 l was used as a control. Each copper chemical was dissolved in 5 l of water before application. All copper chemicals were applied as foliar sprays at two weekly interval until physiological maturity. Severity was assessed using a scale of 1 to 9 at three stages (R6, R7 and R8). Total and clean yield were taken at harvest.

In all cases CBB scores were higher in control plots than other treatments. This was for all the three ratings (R6, R7, R8) but was more pronounced at R7 and R8 (Table 4). At these two stages, there were significant differences ($P = 0.05$) between all the treatments and the control but differences in severity between the chemical treatments were not significant. The disease increase rate was lowered by all the chemicals although differences between treatments were not significant.

All the chemicals increased yield (Table 5). Cupric carbonate and Sulphate gave the highest yields while control had the lowest.

In 1989, Cupric carbonate and Sulphate were combined with different chemicals previously recommended as seed disinfectants for bacterial diseases with a hope of getting a much better control of the disease. The seed dressings were mercuric chloride, Alcohol (70%) and Streptomycin. Three varieties (i.e. Kanyebwa, K20 and Ikinimba) were used. A split plot design was used with varieties in main plots and chemical combinations in subplots.

There was a reduction of CBB by the chemical combinations used but differences between the chemical treatments were not significant. All combinations of Cupric carbonate with seed disinfectants gave significantly higher yield ($P = 0.05$) than the control in 1989B.

The fact that there were no differences between treatments in total yield while differences in clean yield were significant may mean that Cupric carbonate reduced the spread of the disease from leaves to pods. Since it is only through pod infection that seed infection occurs and seed infection leads to seed discolouration or unclean seed. Examination of pods revealed that fewer pods were infected in Cupric carbonate sprayed plots than with other treatments.

The results obtained here indicate that seed disinfection using either Alcohol, Mercuric chloride or streptomycin does not improve on the control of CBB than when only Cupric carbonate or Cupric sulphate alone is used. Therefore where there is absolute need to spray only Cupric carbonate (or in its absence) Cupric sulphate could be used. However for seed production purposes none of these chemicals would be useful. This is because as long as there is CBB in the seed even if it is as low as 0.5% infection of the total seed, epidemics could build up from this seed if planted when environmental conditions are favourable to the disease. These conditions (high temperature and high humidity plus rain splash) are very common in Uganda and Eastern Africa as a whole. Other methods of control such as production of clean seed (disease free) by using dry areas with furrow irrigation facilities would be most appropriate.

For dry season seed production, Mobuku which is in a dry rain shadow area but with furrow irrigation facilities was used. Five land races were planted in a randomized complete block design with four replicates. Severity was assessed using a scale of 1-9 at R8. This trial was carried out in one off-season 1988 and two off-seasons 1989.

The severity of CBB was very low (maximum 2) in 1988 off-season and first off-season 1989. But in the second off-season 1989 - the rain continued into the off-season period. The CBB scores were high (mean 6) at R7. This second off-season did not serve our purpose of dry seed production. More work still need to be carried out during appropriate dry season.

It may therefore be concluded that for seed production purposes:-

(a) Chemicals may not be useful.

(b) Dry seed production using furrow irrigation may be the most appropriate solution to the seed production problems in the region if areas with proper dry season could be identified.

Future work on CBB will emphasize the following objectives:-

1. To incorporate resistance to CBB into some landraces and establish quantitative differences among the different resistant sources with respect to susceptibility to CBB.

2. To study the interrelationships between resistance to CBB and other quality traits in common beans.

3. To establish the stages at which reliable selections can be made from segregating populations.

4. To establish the relationships between seedling and adult plant resistance and compare the accuracy of greenhouse and growth chamber methods in predicting field resistance.

5. To study the variation in pathogenicity of Xcp in the Eastern African region.

6. To determine whether there are differences between varieties in their ability of transmitting CBB and if so select for low seed transmission efficiency.

7. To study the survival of CBB on weeds, non-hosts and soil.

8. To continue with the identification of varieties to be included in the Regional CBB nursery.

It is expected that all the objectives will be accomplished by December 1992.

Work Plan FoR 1990

Pathology

1. Studies on variation of Xcp will continue in 1990 mainly in the screen-house. Collection of isolates to be continued in both seasons A and B in Uganda.

2. Seed transmission studies to be done in th laboratory, screenhouse and field. This will be continued throughout the year.

3. Studies on survival of Xcp to be started in season A, 1990 and continued through the year.

4. The CBB regional nursery to be planted at Kawanda. The nursery is to to be modified and those entries that were affected by black root to be removed and other entries added.

Breeding

1. Observations on F_1 populations involving reciprical crosses where donor parents having the I-gene were used as males.

2. More crossings involving new donor parents and recurrent parents from other collaborating countries.

3. Inoculations of different plant parts to observe genetic control of the resistance for different plant parts.

4. Studies on seed resistance of different donor parents.

Budget for Years 1990/91

Item	Cost in US $ Yearly
Equipment	2,000.00
Chemicals	1,000.00
Labour	
10 men for 12 months	1,500.00
Overtime	
12 men for 20 days .. .. each season (i.e 40 days/year)	1,000.00
Inland Travel	
Per diem for 2 Scientists .. .. for 15 nights each (30 nights)	1,500.00
Overseas Travel	
4 trips for 2 scientists .. .. (2 trips each)	3,000.00
TOTAL	10,000.00

.˙. TOTAL AMOUNT REQUIRED PER YEAR = US $10,000.00
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Table 1: Analysis of variance for time of planting, frequency and Arrangement of Spreader Rows

Source	dif.		"F" Values					
	Time	Freq. Arra.	Time 1987	Time 1988	Frequency 1987	Frequency 1988	Arrangement 1987	Arrangement 1988
Rep.	2	2	NS	NS	NS	NS	NS	NS
A	11	11	**	**	**	**	**	**
Error	22	22	-	-	-	-	-	-
B	2	3	**	**	**	**	**	**
AB	22	23	NS	NS	*	NS	NS	NS
Error	48	72	-	-	-	-	-	-
C	2	2	**	**	**	**	**	**
AC	22	22	**	NS	**	**	**	**
BC	4	6	**	**	**	**	**	**
ABC	44	66	NS	NS	NS	NS	NS	NS
Error	144	192	-	-	-	-	-	-

Table 2: Interaction of planting time with scoring date

Planting time	Scoring date	Mean Scores 1987	Mean Scores 1988
1 week	R6	3.039a	3.333a
1 week	R8	4.583b	4.944bc
1 week	R9	5.102d	5.972c
2 weeks	R6	3.000a	3.083a
2 weeks	R8	4.518b	4.417b
2 weeks	R9	4.986c	6.139c
3 weeks	R6	3.023a	3.000a
3 weeks	R8	4.508a	4.694b
3 weeks	R9	4.579b	5.417bc

Means followed by the same letter are not significantly different (P = 0.01) using Duncan's Multiple Range Test.

Table 3: Mean separation of disease scores for frequency and arrangement of spreader rows and at different of growth stages of the crops.

No. of test lines between	Frequency of spreaders		Arrangement of spreaders	
	1987	1988	1987	1988
2	4.672c	4.528b	3.028b	4.481b
6	4.635bc	4.481ab	2.991ab	4.252ab
8	4.588ab	4.435ab	2.944ab	4.241ab
10	4.563a	4.352a	2.898a	3.991a
Scoring stage				
R6	2.889a	3.104a	2.910a	2.910a
R8	2.931ab	4.042b	2.972ab	3.743b
R9	2.993b	6.201c	3.014b	6.069c

R6 = Flowering, R8 = Pod filling and
R9 = Physiological maturity.

Means followed by the same letter are not significantly different using Duncan's Multiple Range Test.

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PROGRESS ON THE STUDIES OF PHOMA BLIGHT OF BEAN IN EASTERN AFRICA

By

Sengooba T. and Male-Kayiwa B. S.

Abstract

Progress is reported on Breeding and pathological investigations on Phoma blight (PB) (Phoma exigua var. diversispora of bean initiated in 1987. Extensive screening has been done at Kachwekano in S.W. Uganda. Disease pressure was found to vary across seasons. Resistance was very rare among bush beans but was found to be fairly stable for G 4603, AND 556 and G.17098. More resistance was found among climbers the best ones being G 12582, G 10747 and VRA 81051. A number of P. coccineus lines showed very high resistance. Crosses for improving local genotypes and for inheritance studies were started in 1989. A Regional nursery has been developed.

Studies have been conducted on the development of PB in pure bean stand versus with maize intercrop. The disease was more in the intercrop especially under inter-row patterns but the differences were in most cases not significant. Genotype X cropping system interactions were not significant. Fungicidal application and cultural control reduced PB infection but the difference was significant only for the former. Cleaning infected seed by planting them in a disease free area proved promising.

Introduction

Phoma blight (PB) caused by Phoma exigua var diversispora (CIAT Ann. Rep. 1987) occurs in many bean growing areas of the World. In Eastern Africa PB is of notable importance under cool, humid conditions which tend to prevail at high altitudes. Areas where PB is a constraint to bean production in Eastern Africa include: the highlands of Southwestern Uganda, the slopes of mount Elgon, the highlands of Kenya, the island of Madagascar, and almost the whole of Rwanda and Burundi (Schoonhoven 1980; Personal communications) all adding up to a large and important bean production zone.

A regional sub-project was initiated in 1987 to investigate the breeding and the pathological aspects of this disease which is widespread in Eastern Africa. There had been very little work on PB in the region therefore a regional sub-project was sought to facilitate access to a wide range of variation in terms of germplasm, environment and pathotypes which in turn support faster progress and sustainable results. Though some control measures have been documented for PB (Schwartz & Galvez 1980), these had not been evaluated in terms of effectiveness and applicability under Eastern Africa conditions. Attempts to breed for PB resistance in beans have had limited success. CIAT (Annual reports for 1986 & 1987) showed that some resistance exists in P. vulgaris climbers but was extremely rare in bush beans. After an extensive selection and intensive crossing programme CIAT developed a PB nursery in 1987. The genotypes in such a nursery could only be useful to Eastern Africa if found resistant in the region and would then be utilized in a crossing programme to incorporate resistance in popular, acceptable genotypes in the region. It had been observed that the occurrence of PB across seasons is most varied and in bad seasons heavy losses are incurred. Therefore studies on the epidemiology and control of PB were necessary. Intercropping has been reported to reduce disease (van Rheenen et al 1981, Francis 1986). Some studies were carried out to enlighten on PB levels in bean in pure stand versus intercrop.

This sub-project was initiated with the following objectives:

1. Screen a wide range of germplasm locally to identify genotypes resistant to PB.

2. Make a regional PB nursery to study resistance across sites and tap pathogenic variation and host-pathogen interactions that may exist in the region.

3. Develop resistant genotypes through hybridization.

4. Study the inheritance of resistance so as to identify suitable breeding strategies.

5. Study the epidemiology of this disease in pure stand and in intercrop with maize.

6. Identify integrated control measures.

A number of studies have been conducted in line with the above objectives.

1. Germplasm screening for resistance to PB.

About 1000 lines have been screened for PB at Kachwekano in S.W. Uganda (Table 1.). Three metre rows replicated at least two times were used in the screening trials except in case of VEF 86 and CIAT accessions where there was no replication. Spreader rows were planted between entries. Some trials were inoculated at the flowering stage (R6) with PB diseased leaves spread within the trial (1987-88) and in 1989 a spore suspension collected from infected leaves was used. Phoma blight scores were taken at the initial flowering (R6), pod filling (R7) and pod ripering (R8) stages of the crop and at R7 only in non-inoculated trials. A scale of 1-9 was used where/1 and 9 referred to no disease and total destruction respectively. Selected entries for further screening and for use in crosses had to have resistance or tolerant to other major diseases especially Halo blight)Psendomonas phaseolicola and anthracrose (Colletotrichum lindemuthianum both of which can be serious in the cool conditions.

The results of the different screening trials are presented in Table 1. Among the bush beans resistance was not consistent across seasons. Fairly stable resistance was recorded for line G4603 (Pintado) and AND 556. Catu, Carioca and Emp 117 showed very high susceptibility and are being used as spreaders in screening trials. The IBYAN P. Coccineus subsp polyanthus had high levels of resistance, the best line being G35182. The few lines that have bean identified for inclusion in the Regional trial include: G35182, G4603 AND 556, Naine de Kyondo, BAT 1416, BAT 1565 and Urubonobono.

2. Hybridization Programme and Inheritance Studies.

From the initial screening in 1987, four bush bean genotypes viz: G4603, BAT 1416, PAI 119, BAT 1569 and two Climbers including G10747 and VRA81051 were selected for crosses. In 1989A four crosses namely Rusipi X BAT 1416; Namunye Red X BAT 1416, PAI119 X BAT 1416 and PAI 119 X BAT 447 were successfully done and the F1 were grown in 1989B.

Crossed for the inheritance study were started in 89B at Kawanda and Kachwekano. 13 crosses for bush beans were accomplished at Kawanda. Problems encountered in these crosses included Bean Common Mosaic and black rot which led to loss of some crosses and poor pod set especially in the climbers.

Crosses with parent climbers were set up at Kachwekano in 1989B. However the season was exceedingly wet, humid and windy thus only a few crosses were successful. These crosses will be advanced and the crossing will be repeated in 1990A.

3. Phoma Blight levels in bean grown in pure stand and in intercrop with maize.

This study was conducted in order to elucidate on how PB would behave in pure stand versus intercrop and also to draw some idea on how the disease would behave across seasons and (later) across sites. Realizing that the structure of the intercrop would affect the behavior of the disease the variables of cropping pattern and maize density were the emphasis in one experiment and that of genotype in another.

3A. **Phoma Blight evaluation under different Cropping patterns and maize densities.**

This study was carried out at Kachwekano during 1987B and in both seasons of 1988. The design was a RCB with three replicates. Plot size was 3.6 x 6m. The treatments included 2 (or 3) genotypes; two cropping patterns namely maize within or between bean rows and maize intercropped at 3 densities which were 1 maize plant to 300, 600 or 900 sq cm of the bean crop. In addition to the factorial part of the experiment (2 (or 3) x 2 x 3) two extra treatments including pure stand and farmers' practice were included. Under farmers' practice, maize was planted at 120x100 cm between bean rows. The beans were consistently planted at 60x10cm. Disease was recorded on a scale of 1-9.

The results of PB levels that developed under the different cropping patterns are presented in Table 2. The disease was more severe where the maize was planted in between rows than where the maize was within rows and the difference was significant at both R6 and R7 during 1987 and at R6 during 88B. The trend of PB being higher where the maize was between rows versus within rows was however maintained through the seasons and the growth stages. Differences in PB levels were not significant for the genotypes or the maize densities. The disease level was very low in 1988A and no significant differences between treatments were recorded.

These results supported that intercropping maize between bean rows favoured PB development more that planting the maize within the rows. Maize put within rows appeared stunted and less able to influence the micro-environment than that planted between rows. It was therefore logical to test the subsequent genotypes effect under an inter-row arrangement.

3B. **Phoma blight evaluation in bean genotypes grown in pure stand and in maize intercrop.**

The experiment was started in 87B when 24 bean genotypes were planted in double rows, in between maize rows planted at 90 x 30cm . The design was a three replicate split plot, with pure bean stand and the intercrop as the main block and bean genotypes as the sub-plots. The some trial was repeated in 1988A & B but with 40 bean genotypes. In 1989 the same trial lay out was used to design a Regional PB trial with 20 entries. The objectives of the Regional trial were: to study the resistance of a range of selected genotypes to PB across the region, to tap different PB pathotypes and to confirm the behaviour of PB in pure stand versus intercrop. In an attempt to make a more precise study of the development of PB in pure stand versus in maize intercrop a two factor randomized complete block experiment with 5 replicates was started in 1989B. The two factors were genotypes (3) and cropping patterns (2). Plot size was 4.5 x 6m. In these trials PB was assessed on a scale of 1-9 at R5/6/7 and 8. In 1989 also percentage leaf infection and number of lesions on ten randomly selected plants were recorded.

The results of the trial to study of the development of PB on different genotypes in the two cropping system (89B) are presented in Table 3 where PB was significantly more severe in intercrop by R5 as expressed by percentage leaf infection and number of lesions on the plants. In all other trials no significant differences were detected between PB level in pure stands versus intercrop though the disease tended to be higher in the intercrop. The genotypes were consistently significantly different in their resistance to PB and such a result is expectable. Genotypes that showed highest resistance incd PVA 563 introduced from CIAT/AFBYAN 1986. Urubonobono from Burundi, Naine de Kyondo from Zaire and Pintado obtained from the CIAT 1987 international PB nursery.

4. Control of Phoma Blight

Chemical and cultural control measures which can be utilized to control PB have been investigated. Three treatment viz:

1. Dress seeds with Benomyl and spray with Mancozeb at 10-day intervals from 3 weeks from germination to physiological maturity; 2. Dress seeds with Bonomyl; 3. Rougue out infected seedlings from emergency to second trifoliate leaf stage (V4) and the control. The experiment was a two factor RCBD with four replicates. Plot size was 4.2x6m. The data recorded include percentage leaf infection, number of lesions and a general score taken at R6, R7 and R8.

The data of number of lesions recorded under the different treatments at R6 & 8 (Table 4) showed that the treatment of dressing the seeds combined with fungicidal application significantly reduced the infection. The rouguing treatment tended to decrease the disease in both seasons of 1989 though not significantly. The data of percentage leaf infection was highly correlated with that of number of lesions, again depicting the seed dress/spray treatment as significantly more effective in controlling PB than other measures. The multiregression analysis (for 1989B)showed significant (Regression Co efficient 0.88) increase in disease with time and a significant, (13.05%) reduction in PB with the spray treatment. The yield data showed the treatment of seed dress and spray to result in significant increases over the control in 1989A and during the other two seasons there was no significant differences between the yield data. Angular leaf spot was very high in 1989A and its control possibly contributed to the significant increases in yield with the spray treatment. PB was very severe in 1989B and the 10 day spray interval appeared insufficient in controlling the disease.

5. **Cleaning Seed by Growing in a Disease free environment.**

Considering that PB is seed borne. Growing the seed crop under the lower warm environment could be a usefull control measure.

Seed from a heavily infected crop (90-100% plant infection) was harvested from Kachwekano in 1989A and planted at Kawanda in 1989B. The disease was recorded in 6x10 cm plots randomly picked in the crop and percentage plant infection was computed.

A percentage of 1.66-1.83 and 6.50-8.67 was recorded in the crop at the flowering and pod ripening stages respectively. The results suggested that growing the seed in the warmer lowland areas of the region could eliminate seed infection but further work is required on this aspect.

Conclusions and Future Plans

1. Some resistant lines have been identified. The breeding programme will be intensified *P. coccineus* subsp *polynthus* will be included among the donor parents. Gene pyramiding and mutation breeding will be applied in this study.

2. Some genotypes have been identified for the Regional PB nursery. This trial needs and will be planted across locations and more entries are being identified.

3. The pathological work will shift emphasis from studies on PB development in pure stand versus intercrop to studies on epidemiological aspects which cause PB levels to be so much varied across seasons and possibly location. The study on PB pathotypes in the Region for example has just been started and needs to be exhaused. Infection rate under different conditions and some transmission aspects need more study.

4. Studies carried out point to resistance, disease forecast and chemical control as important components in the integrated control package we are aiming at and hope to achieve if the study is funded for two and half more years.

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Budget for 1990	Quantity	Cost(US$)
Lab. Chemicals	-	200
Seed trays	100	100
Polythene sheets.	50m	100
Hygrometer	2	450
Travel (inland)	-	5,000
Travel (Regional)	4 trips of 5 days @ (Ticket + per diem)	4,000
		9,850

Budget for 1991 will be mainly for travel thus amounting to 9,000 dollars.

Table 1: Summary of Trials and Number of entries Screened for Phoma blight Resistance in 1987-9

Season	Trials	Seed source	No. of entries	% entries scoring 1-2 at R7
87B	Bush Nursery (CIAT)	CIAT and	62	32
	" " (local)	Kawanda Germ-plasm		
	Climber Nursery(CIAT)	CIAT	13	85
88A	Climber Nursery(local)	Kawanda germ-plasm	14	14
	AFBYAN I	National Progr-ammes (Africa)	25	0
88B	IBYAN P. _coccineus_	CIAT	10	70
	Subsp _Polyanthus_(climber)			
	VEF 86 and CIAT Accessions (Bush)	CIAT	648	40
89A	Greeat Lakes Regional (Climbers)	Rwanda	16	37
	G.L.R. Trial(Bush),	Rwanda and CIAT	108	9
	VEF 87, Selections from VEF 86 and Accessions			
89B	AFBYAN II	National Progr-ammes (Africa)	147	1.3
	Regional Nursery Yiled Trials			
	Internat. Nursery Climber	CIAT	12	25
	Internat. " Bush	-	12	0

1 R7 = pod filling growth stage.

Table 2: Phoma blight Levels on bean genotypes in pure stand and in intercrop with maize under two Cropping patterns at Kachwekano.

Season	Cropping pattern	BP R6	Scores at: R7	R8
1987B	within rows	6.55	7.55	8.27
	between rows	7.00	7.94	8.39
	CV%	10.32	6.64	8.29
	SE	0.16	0.12	0.16
	LSD	0.37	0.17	NS
1988B	within rows	1.88	3.65	4.16
	between rows	2.41	4.03	4.17
	CV %	45.43	28.64	32.10
	SE	0.18	0.21	0.25
	LSD	0.52	NS	NS

Score range was 1 - 9. (1) R6 = flowering:
R7 = pod filling; R8 = pod ripening growth stage.

Table 4: The level of Phoma Blight on bean subjected to Cultural and Chemical control measures at Kachwekano

Season	Treatment	No. lesions per 10 plants at Growth stage R61 root(1)		R8 root		Yield/ ha
88B	Seed dress/spray	1.39	(1.78)	1.47	(2.11)	1592
	Seed dress	3.45	(12.89)	4.32	(18.71)	1436
	Rouging	3.62	(14.11)	4.58	(21.10)	1422
	Control	3.40	(12.78)	4.01	(16.11)	1460
	CV%	28.36		19.61		29.11
	SE	0.28		0.24		143.41
	LSD	1.41		1.26		NS
89A	Seed dress/spray	2.73	(7.45)	2.91	(8.47)	1704
	Seed dress	4.20	(20.17)	3.91	(15.29)	1094
	Rouging	4.07	(17.58)	3.39	(20.16)	1015
	Control	4.34	(21.67)	4.40	(19.36)	990
	CV%	35.32		46.74		34.01
	SE	0.39		0.49		117
	LSD	1.13		NS		339
89B	Seed dress/spray	6.09	(38.58)	11.00	(124.00)	624
	Seed dress	8.12	(70.08)	11.63	(137.00)	595
	Rouging	7.08	(52.50)	11.22	(128.67)	572
	Control	7.28	(55.92)	11.37	(131.25)	520
	CV%	17.59		11.17		22.83
	SE	0.36		0.36		38.18
	LSD	1.04		NS		NS

(1) Sqare root values and their analysis.

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INTEGRATED MANAGEMENT OF BEANFLY ON HARICOT BEAN

Melaku Wale

In Ethiopia beanfly can cause a total failure of haricot beans under extreme conditions. Infestation levels of upto 100% are common and yield losses range from 14-35%.

Host plant resistance and improved cultural practices provide dependable opportunity to the small farmers. With this background variety screening, sowing date and plant population trials were tested in 1989 cropping season at Melkassa and Awassa.

Sowing date VS Plant Population

Four sowing dates (26 June, 6 July, 15 July and 24 July at Melkassa and 27 June, 7 July, 17 July, 27 July at Awassa) were used as main plots while plant populations 100000, 200000, 300000, 400000, and 500000, plants per hectare were used as sub-plots. Plot size was $20m^2$. Parameters recorded were dead plant count, percent infestation by bean fly, plants with adventitous roots, number of bean flies number of parasites, stand count and grain yield. Analysis of variance was computed for each parameter. The results for sowing date x plant population are presented in Table 1. Percent dead plants at Melkassa was not statistically significant at both sowing dates and had almost no dead plants at Awassa. With delay in planting % BNF infestation has statiscally significant higher at Melkassa. At Awassa early planting had high BNF. Both yields and percent infestations were generally higher at Awassa than Melkassa. Late sowing at Awassa had a significant increase in adventitious root formation and the number of harvested plants while it had less number of bean flies and parasites and less grain yield.

At both locations, with the increase in plant population there was a significant decrease in mean % bean fly infestation and an increase in mean grain yield. All plant densities at Awassa didn't have significant difference in the number of adventitious roots. At this location, more plant density had significantly less number of bean flies and parasites while it had significantly more number of harvested plants and yield.

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Varietal Resistance

Results of the 1989 experiment conducted at Awassa is given in Table 2. Fifty entries were included in the experiment. Entries DOR 62, A114, Carioca, A176, GO 3844, BAT 338-1C show slights lower level of infestation by bean fly. But only G03844 exhibuted no bean fly when five plant samples were observed for the presence . There is no any particular trend between the number of bean flies and paramites as observed in the five plant samples.

Table 1: Effect of sowing date and plant population on bean fly infestation and yield of haricot beans at Awassa and Melkassa, 1989.

Sowing date (SD)	Melkassa: % dead plants	Melkassa: % BNF infestation (20 plants)	Melkassa: Grain yield kc/ha (10% moisture)	Awassa: First stand count	Awassa: BNF Infested plants out of 20%(%)	Awassa: Plants with adverntitious roots out of20plants (%)	Awassa: No.of BNF (out of 20 plants)	Awassa: No.of parasites (out of 20plants)	Awassa: Harvested plants (No.of)	Awassa: Grain yield (kg/ha)
SD_1	13.03 a	21.33 a	1068 a	449.53b	83.00a	6.67c	8.00 c	45.93 a	353.40 b	3324 a
SD_2	8.08 a	29.67 ab	1250 a	553.20a	98.00b	11.67c	5.93bc	22.33 b	436.00a	3418 a
SD_3	7.32 a	43.33 bc	1170 a	526.20a	77.33a	30.00b	4.27ab	12.13bc	401.07a	3369a
SD_4	13.90 a	52.67 c	925 a	549.80a	73.33a	51.67a	3.20a	5.73c	428.07a	2891b
Mean	10.76	36.75	1104	519.68	82.92	25.00	5.35	21.53	404.63	3251
S.E.	1.82	2.62	112	12.26	3.69	2.20	0.60	3.32	12.82	122
CV(%)	37.88	27.59	2253	9.13	17.24	34.16	43.64	59.63	12.27	1455
Plant density										
100,000	13.27 b	47.08 b	768 c	165.25e	89.58b	24.58a	7.67c	34.75a	120.17e	2531 c
200000	14.37 b	37.50 ab	989 b	326.67d	79.17a	22.08a	7.00c	26.42b	254.58d	3281 b
300000	9.83a	36.25 ab	1131 ab	534.08c	84.58ab	29.58a	5.50bc	20.17bc	422.00c	3560 a
400000	8.18 a	31.25 a	1296 a	732.67b	82.08a	25.42a	3.67ab	14.17cd	577.33b	3487 ab
500000	8.19a	31.67 a	1330 a	839.75a	79.17a	23.33a	2.92a	12.17d	649.08a	3394ab
Mean	10.76	36.75	1104	579.68	82.92	25.00	5.35	21.53	404.63	3251
S.E.	0.83	2.40	060	8.03	1.95	2.67	0.78	2.60	11.14	84
CV (%)	15.42	22.64	1082	5.36	8.16	37.01	50.19	41.84	9.54	890

Means, within a column followed by the same letter are not significantly different from each other at 5% level(DNMRT)

	Melkasa	Awassa
SD_1	26 June	27 June
SD_2	6 July	7 July
SD_3	15 July	17 July
SD_4	24 July	27 July

Table 2. Screening of haricot bean varieties for resistance to beanfly. Awassa, 1989

Entry	No.of plants (first count)	Infested plants by beanfly out of 5 plants(%)	Plants with adventitious roots outof 5 plants(%)	Bean fly (No). out of 5plants	No.of Parasites out of 5 plants	No.of harvested plants	Grain yield kg/ha
G05253	28	100	1.5	1.5	10	21.5	2098
G02005	27.5	100	1	1.5	14.5	19.5	4665
G05773	28	100	0.5	5.5	24	19.5	3522
G02472	30	100	2	3.5	18.5	25	4367
G03844	22	80	1	0	13	21	3184
G00158	28.5	90	0.5	1.5	12	21	1709
Mexican142	30.5	90	2	0	8.5	20	2755
Red Wolita	29.5	100	1.5	1.5	15.5	22.5	3483
A-410	29.5	90	1	1.5	17	24	2787
BAT-338-IC	25	80	1	1.5	18	16	3614
EXRICO 23	30	100	0.5	0	13	23.5	3920
Diacol.calima	30.5	100	1	1	21.5	25.5	3730
Caricoa	26.5	70	0	3.5	7	21.5	4744
CCD3579	27	90	0	0.5	16.5	22	3097
ICA15551	29	100	0.5	1	22.5	25.5	3557
AND327	29.5	100	1	1.5	13	21.5	3177
BAT1629	27.5	100	2	1.5	19	20.5	3082
XAN 158	28	100	0.5	4.5	18.5	21.5	3618
AND 338	29	100	1	0.5	23.5	19	3917
Acc.No 325726	31	100	0.5	1	19	21.5	2459
AFR 191	28.5	100	1	3	11	24	3400
RIZ 22	27	100	0	1	24.5	18.5	3632
HAL 3	29	90	1	1.5	11.5	20.5	3999
G00841	28	90	0.5	1.5	22.5	21.5	3744
A 114	28.5	80	0.5	2.0	18	20.5	4769
AND 326	27.5	90	0.5	0.5	14	23.5	3184
AND 305	30.5	100	0.5	2.5	9.5	21	2935
AND 336	31.5	100	2	0.5	5.5	22	3587
GUERRERO 9	28	100	1.5	2.5	8.5	21.5	4215
EMP 87	29.5	90	1	0.5	12.5	20.5	4513
DOR 62	28.5	60	0.5	3	15	22	4525
Ikinimba	29.5	100	1	3	22.5	22.5	3910
A-265	26.5	100	1	0.5	6	19	3727
A-445	28.5	100	0.5	1	22	24.5	3930
A-422	28.5	90	0.5	1.5	9	23.5	3954
BAT 85	27	100	0.5	1	7.5	21	3715
A-62	30.5	100	2	1	15	22.5	1683
A-176	29.5	80	0.5	0.5	9	20	3184
BAT 1281	22.5	100	0	1	15	16	2502
PAN 135	28.5	100	0.5	1.5	13.5	23.5	3985
BAT 1198	27.5	100	0	0	12	20.5	3717
A 262	29	90	0.5	2.5	9.5	21	2935
A 483	32	100	1	2	32.5	24	3767
Negromecentral	26.5	100	1.5	2	18	21.5	2494
G 2816	27	90	1	4	21.5	19	3039
GLPX 92	27.5	100	0.5	0.5	33.5	21.5	3799
AND 371	31.5	90	1	2	23	24	3065
PAN 112	31.5	90	1.5	0.5	11.5	26	4032
AND 280	30	90	0	1.5	17.5	25	3507
PAN 134	29	90	0.5	1.5	20.5	22.5	3849

RESEARCH PROPOSAL ON BEAN FLY

Bean fly (Ophiomya phaseoli) is one of the most important insect pests of beans in several countries of East Africa. In Ethiopia this pest has been reported causing complete destruction of beans. With bean fly infestation levels being as high as 100%, yield losses range 14-35%.

In previous years control methods such as use of insecticides, resistant varieties and cultural practices have been undertaken in Ethiopia and some results obtained. The following research programes proposal for 1990/91.

1. BEAN FLY RESISTANCE RECONFIRMATION NURSERY

Objectives: To evaluate performance of cultivars reported as resistant or promising to bean fly across a wide range of environments.

Procedures:

Design - Split plot, 3 replications

Main plots 1) Endosulfant treated seeds

2) Untreated seeds

Sub plots - 11 Bean cultivars (including local check)

Plot size - 8 rows x 2m

Crop management - Local practices

Location - Awassa and Melkassa

Data to be collected

One week after emergence

Stand count

Four weeks after emergence

- Seedling mortality rate (No/row)damping off, deed plant
- Plant vigor (1-9 scale); 1-vigorous, 9-very poorly adapted)
- uproot 10 adjacent plants and rate them individually for adventitious roots, stem cracking
- dissect stems and count larvae and pupae per plant
- yield data on central rows

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2. SEGREGATING POPULATIONS AND BEAN FLY

Promising entries with good bean fly resistance were identified and crossed with those varieties that had better seed qualities. These crosses are to be tested for bean fly resistance.

Objectives: To select within and among segregating bean populations, plants that are superior for yield and bean fly resistance.

Procedures:
- For selecting bush types use 10-20cm between seeds and 50-60 cm between rows
- For Semi climbers and climbers use support systems (stakes, maize). Bean seeds spaced at 60-100cm apart for individual selection of plants at harvest.

Cultural practices - Grow where uniform bean fly pressure

Location - Melkassa and Awassa

Data to be collected
- growth habit of F_2 population
- diseases on a scale of 1 to 9, where 1=no damage and 9=severe damage
- Vegetative vigor at flowering (1 to 9 scale, 1= very vigorous, 9 dead or dying)
- reproductive efficiency (visual estimation of pod load at harvest, 1-9 scale, 1=excellent, 9=very poor).
- No of individual plants selected from the population when a pedigree strategy is used. If the seed is harvested in bulk or single pod descent, this should be indicated.

58 F_2 population for cultivar improvement

11 varieties for bean fly resistance reconfirmation (Table 1)

Cooperators - Awassa (IAR)
Teshome Girma, Melkassa (IAR)

Estimated budget for 1990	USD
Casual labour	1500
Supplies	
Chemicals	150
Jam bottles 200	70
Paper bags 1000	125
Plastic bags 10 kg	50
Travels	
2000 km	600
perdiems (20days)	180
	2675

Table 1. List of cultivars to be included in the Bean fly Nursery

TRT NUMBER	CULTIVAR NAME
1	EMP 81
2	G 2472
3	G 3696
4	G 5253
5	G 5773
6	IKINIMBA
7	BAT 1373
8	A 74
9	ZPV 292
10	A 55
11	LOCAL CHECK

GRAIN LEGUME STORAGE PEST CONTROL IN SOMALIA

Abdirahman A. Guled

A. A Survey of Storage of Grain Legumes in Lower Shabelle and Middle Shabelle

The small holding farmers practice the grain legumes extensively. Several Spp are commonly cultivated by the Somali farmer's, the major ones are cowpeas (Vigna Unguiculata L), Mungbean (V.radiata) and Phaseolus Lunatus) common beans (buluko) which is cultivated by few farmers, who usually broadcast few seeds within the main crop e.g maize and the other cereals and grain legumes continue growing and producing even after the cereal crop is harvested.

Ninety percent of the farmers intercrop grain legumes with the cereals mainly with the maize. This system results a fairly low yield per hectare for the grain legumes. The use of grain legumes as a sole crop is limited by the presence of heavy insect attack at the different stages of the crop growth and reduce the farmers interest for the grain legumes production. Other constraints such as poor cultural practice and poor storage status of the farmers, contributed also the low yield.

Therefore, to familiarize the overall problems of the small holding farmers and particularly to acqeraint the practice and the traditional the practice and the traditional storage of the grain legumes, survey was conducted.

Methodology

A questionaire was prepared with the basis of the post harvest techniques and a traditionally existing materials on storage. A survey was conducted in five days in two provinces namely lower shabelle and middle shabelle in Somalia and a similar survey was done last year at middle Juba.

In fifteen villages, twenty one farmers who significantly grow grain legumes were selected. Yield estimates and the major constraints in the field and in the store were under taken. The land use, storage facilities, control measures against pests, loss assessment and crop use were talked on this study.

Table 2 shows that, most of the farmers in every category use intercropping rather than sole crop. Mainly they intercrop grain legumes specifically cowpeas with maize in both dyr and Gu, the farmers follow no regular ratio of intercropping, they plant cowpea seeds scatterdly with the maize. Only few farmers grow common beans in both lower and middle shabelle provinces but not in considerable way like the other crops, they just scatter the beans at the borders of the farms giving the least priority.

In both the regions surveyed, the four major crops frequently cultivated are maize, sesame, cowpea and Mungbean, generally the yield per hectare is higher in Gu season except the sesame where the yield is high in dyr (table 3, Most of the farmers grow sesame to produce sufficient oil which has a satisfactory price in the market.

Table 2: Average areas of sole crop and Intercropped Land in different seasons of the year.

Group Categories (ha)	Av. total land (ha)	Sole crop Gu	Sole crop Dyr	Cultivated land (ha) Intercrop Gu	Cultivated land (ha) Intercrop Dyr
Less than 2.5	1.2	0.05	0.1	0.7	0.65
2.6-5	4.0	0.96	0.07	2.75	1.64
More than 5.I	21.8	4.39	II.5	9.4	6.4

Table 3: Crop yield in intercropped system Qt/ha

Group Category	Cowpea		Mungbean		Maize		Sesame	
	Gu	Dyr	Gu	Dyr	Gu	Dyr	Gu	Dyr
Less than 2.5	2.8	3.2	2.2	1.8	17	1.00	0.2	2.4
2.6 - 5	3.5	0.8	0.9	-	25	5.8	-	5.6
More than 5.I	3.II	0.7	0.27	0.72	13.55	1.20	-	5.44
Average	3.14	I.57	I.12	0.84	18.52	2.67	0.07	4.48

In Gu maize (18.52) Q/ha. cowpea (3.14)Q/ha Mungbean (1.12)Q/ha yield better than sesame (0.07 Q/ha) in the small farmers level.

Cowpea is always intercropped with maize and its yield is generally low due to the low population density the presence of a heavy insect attack. Similarly mungbean yields lower than the cowpea as a small number of farmers are involved its production and many farmers abandoned its cultivation due to its shattering character.

Table 4: Percentage of farmers having problems in growing grain legume crops.

Group Categories	Number of farmers	Insects	disease	Birds	Rodents & Pi
Less than 2.5	5	100	0	60	0
2.6 - 5	7	100	0	42	14.3
More than 5.1	9	100	11.00	44	22
	21	100	3.33	48.6	12

Table 4 Shows that 100 percent of the farmers in all categoris have the insect problem, 3.33 percent have disease problems 48.6 percent have bird problem and 22 percent stated other problems including Rodents and Wild Pigs. The major insects observed in the field in both the provinces include Maruca sp, aplids, sucking bugs, bean flies and bruchids at the store which is destructive in cowpea and mungbeans.

Table 5: Methods, duration average period of conservatism and level of losses

Methods of Storage	Percent farmers	Av. Period of conservation (months)	Level of loss
Underground Pit	5.50	14 months	Light
Drums	81.90	12-24 months	Light
Sacks	10.80	1 month	Heavy
Others (Ugulow)	1.80	6 months	Heavy

Table 5 shows that about 82 percent of the farmers surveyed use drums, the grains can be kept in that method for a period of one to two years with light or no infestation. The farmers stated that, this kind of storage can only be effective if the drum is maintained full and air tight.

10.80 percent of the farmers use sacks as a means of storage. Most of them use unthreshed grains. This method was reported to be ineffective and the farmers could not reply on it more than one week because of the rapid infestation of the bruchids.

About 5.5 percent of the farmers use uderground pit using untreshed grains. The method was reported effective for the control of bruchid and can be safe for a period of one year but seeds turns hand and take a longer time to be cooked and the seeds loose germination ability as they are kept longer time to be cooked and the seeds loose germination ability as they are kept longer.

There are other methods used such as Ugulow (a fabricated basket) usually hung over the fire place to be disinfected, this method is not much reliable and ineffective.

Conclusions

A survey was made in two provinces in February 1990; with an objective of finding out the farmers problems on the grain legumes, both in the field and in the storage. Cowpea was noted to be the major grain legume crop cultivated in both the seasons as an intercrop; mungbeans phaseolus have a lesser priority.

Insects are the major constraints in the field and in the store, lack of the necessary practice is also existing. Others include birds, rodents and water insufficiency.

Major methods of storage used are drums, sacks uderground pits other containers such as Ugolow is also used; of these, drums are the most efficient and the sacs, the least.

The farmers present condition of storage need a considerable improvement. Drums are expensive and the chemical use is not existing.

Other cheaper means of pest control, such as of plant oils and resistant varieties, are worthwhile and easily acceptable to poor farmers.

B. Screening of Resistant Varieties Against Cowpea Bruchids (Callosobruchus maculatus).

Techniques that would allow beans in storage to be kept free of insect pests would clearly provide economic benefits to bean growers and bean consumers as well as providing markets with higher quality produce. One technique, with great practical significance to subsistence farmers, is the use of pest resistant varieties. In the case of cowpeas, lines resistant to the most severe storage pest, *Callosobruchus maculatus*, have been bred at the International Institute for Tropical Agriculture (IITA), and some of this material has been received in Somalia.

The study reported here was a preliminary attempt at screening the resistance to Bruchid pest damage of seven varieties of cowpeas received from IITA together with a local cowpea as a susceptible check.

Materials and Methods

Bruchids were reared in glass bottles holding about half a kilogram of cowpea seeds to provide a sufficient source of infestation for the trial. Adult Bruchids were introduced into the bottles with the new seeds and left to multiply until a sufficient population was established.

Eight varieties were tested in the trial; 7 were introduced from IITA and local variety was included as a check; see the tables of results for the actual lines used. A bottle formed an experimental unit and each variety treatment was replicated 4 times. One hundred grams of newly harvested seed of the test varieties was put into each bottle which and a perforated lid for aeration. Newly emerged adults were collected from the source of infestation introduced into the test bottles; ten newly emergent adults (not sorted for sex) were used in each test. The test sample were infested on 28/9/89.

The insects were allowed to lay eggs; during the deposition period, egg counts were taken three times for each bottle of the trial. Egg counts started on 23/10/89 with further counts on 30/10/89 and 6/11/89 i.e 25, 32, and 39 days after the initial infestation. A sample of 100 seeds were checked each time and the mean numbers of eggs were determined. The numbers of adults were also determined in three separate counts on 15/11/89, 20/11/89 and 25/11/89 i.e 48, 53 and 58 days after the initial infestation. The number of holes per 100 seeds was determined in all the test materials on three occasions 14/11/89. 26/11/89, and 3/12/89 i.e 47, 59 and 66 days after the initial infestation. The data gathered was transformed into log (x + 1) and the means were compared using Duncan"s multiple range test (DMRT).

Results and Discussion

Egg deposition.

At the first time of assessment, IT86D-534 (1) showed the highest number of eggs and this was significantly different from the rest of the varieties including the local check. This variety continued to show high number of eggs was not significantly higher than that of the local check. See Table 1. Varieties IT84S-275-9 (2), IT86D-472 (4), and IT81D-1137 *8) showed considerably lower egg deposition than the local check by the of the last assessment.

At the time of final count the lowest numbers of eggs were observed on IT81D-1007 (3), IT84S-2246-4 (5) and IT85F-2205 (7) with about 90 - 100eggs per 100 seeds; this should be compared to the local check (6) with about 600 eggs per 100 seeds. From these results, it is clear that variety (1) was favourable for egg deposition by these bruchids in this test. Varieties (3), (5) and (7) were not favourable for egg deposition. No attempts were made to understand the factors causing the non-preference of the adult bruchids to these varieties.

Table 6. Mean Number of Eggs per 100 Seeds Assessed at Three Times After Infection.

Variety		Time after infestation		
No	Treatment	25 days	32 days	30 days
1.	IT86D-534	119 a	187 a	518 a
2.	IT84S-275-9	38 c	88 ab	136 bc
3.	IT81D-1007	44 c	37 c	99 bc
4.	IT86D-472	36 c	54 b	124 bc
5.	IT84S-2246-4	34 c	35 c	93 c
6.	Local check	52 b	147 a	620 a
7.	IT85F-2205	20 d	54 b	88 c
8.	IT81D-1137	55 b	72 b	205 b
	CV(%)	9.7	9.3	13.0

Treatments followed by the same letter were not significantly different at the 4% level.

Adult survival

The mean numbers of adults per hundred seeds on three sampling occasions are shown in Table 7. The number of adults that survived were generally low compared to the high levels of the eggs deposited. However one experimental variety. IT86D-534 (1) and the local variety (6) maintained the highest adult survival, and the local variety (6) maintained the highest adult survival. In first two samples, the mean differences were not statistically significant although varieties (2) and (6) showed the highest number of adults. By the time of the last sampling, variety (1) showed significantly higher numbers of adults than the all other varieties tested except for the local variety (Table 2). The Local variety (6) and the exotic varieties (4) and (8) showed intermediate numbers of adults. Varieties (2), (4) and (7) showed low numbers of adults, while variety (5) had the lowest number of adults surviving. All varieties showed a low adult emergence which indicated that only few of the numerous eggs laid were viable.

Table 7: Mean Number of Adults Surviving on Three Occasions

No	Variety Treatment	Time after infestation 48 days	53 days	58 days
1.	IT86D-534	2.00	27.75	38.00 a
2.	IT84S-275-9	22.50	6.75	3.00 c
3.	IT81D-1007	1.75	11.00	2.00 c
4.	IT86D-472	1.50	5.25	15.50 b
5.	IT84S-2246-4	1.75	7.50	0.75 d
6.	Local check	22.50	14.75	20.50 ab
7.	IT85P-2205	1.75	15.50	3.00 c
8.	IT81D-1137	2.50	7.75	5.75 b
	CV (%)	- *	- *	30

* No significant differences between treatments.

Treatments followed by the same letter were not significantly different at the 50% level.

The adults also died soon after their emergence as a considerable number of young adults were found dead at the initial sampling. This was pronounced in varieties (3) and (5) as well as (8) which showed a low number of adults surviving.

Holes per Seed

Damage can be measured by the number of holes per seed. The results in Table 8 show that variety IT86D-534 had the highest number of holes in the last two samplings and thus appeared the most damaged; its damage was significantly higher than even the local variety. On all occasions varieties (3), (5) and (7) were the least damaged of all the varieties and showed low levels of overall damage. The data for the numbers of holes per seed were very variable and few other conclusions can be drawn.

Table 8: The Mean Number of Holes per 100 Seed on 3 Occasions

No	Variety Treatment	Time after infestation 47 days	59 days	66 days
1.	IT86D-534	40.00 b	89.50 a	119.75 a
2.	IT84S-275-9	5.75 c	29.00 b	18.75 c
3.	IT81D-1007	7.75 c	14.50 dc	17.00 c
4.	IT86D-47	8.50 c	26.50 bc	25.50 c
5.	IT84S-2246-4	8.00 c	10.25 d	13.00 d
6.	Local check	62.50 a	37.00 ab	59.00 b
7.	IT85F-2205	6.25 c	6.50 e	12.00 d
8.	IT81D-1137	9.50 c	19.25 c	39.50 b
	CV(%)	30	29	23

Conclusions

In this study, the variety IT86D-534 proved to be susceptible and it was worse than the local variety in terms of egg deposition, adult survival, and the seed damage (number of holes per seed).

On the other hand the varieties IT81D-1007, IT84S-2246-4, and IT85F-2205 showed the least number of eggs, adults and damage (number of holes). The causes of their resistance needs further study and their agronomic properties need to be determined.

At least one of the three resistant varieties identified in this study should be released to farmers for practical field assessment if their agronomic and cooking qualities are at all adequate. If these varieties give a good field yield then they should be immediately released to growers for assessment and further promotion. Even a relatively poor field yield may be acceptable if the lines survive well in farmers' stores. Further resistant lines should be sought from IITA if progress is made with their other agronomic properties, including resistance to field pests.

C. The Use of Plant Products for the Control of Callosobruchus Maculatus on Cowpea.

The use of plant products were tested in several parts of the world for the control of bruchid beetles. Several oils such as sunflower oil, corn oil, and neem seed oil have been found to be effective when mixed with the seed. A limited study on these lines had previously been conducted in Somalia but the results were inconclusive. Therefore this study was aimed at testing different materials for the control of bruchids which are easily available and economically cheap for the poor farmers.

The trial consisted of 5 treatments each of which were replicated 4 times. The treatments were:-

1. Groundnut oil 5 ml/kg cowpea seed,
2. Sesame oil 5 ml/kg cowpea seed,
3. Neem seed oil 5 ml/kg cowpea seed,
4. Banana ash 200 g/kg cowpea seed,
5. Untreated control.

The treatments were applied to a bulk of the seeds and samples put into jam bottles. A single bottle was the experimental unit.

Material and Methods

A stock of callosobruchus maculatus was reared on newly harvested cowpea seeds in wide mouthed jam jars in the laboratory. The adults were left 4 days for egg deposition and were then removed. The emergent new generation was used as the source of infection for the trial.

Newly harvested cowpea seeds were used for the trial. Bulks of these seeds were mixed with groundnut, sesame, and neem seed oils at the rate of 5 ml of oil per kg of seed for each treatment. The treated seed was then put into the experimental bottles.

For the ash treatment, the banana ash was sieved using a 1mm mesh to eliminate all large particles, it was then added to the test materials at the rate of 200 g/kg. The mixture was shaken steadily to distribute the ash throughly with the seeds, and was then added to the test bottles.

For each experimental unit, 100 grams of the treated seed was put into a separate bottle. Equal numbers (10) of unsorted (by sex) newly hatched adults were introduced into the bottles. The bottles were then covered with perforated lids to maintain good aeration. The trial was started 29/9/89.

The insects were allowed to lay eggs; during the deposition period, egg counts were taken three times for each bottle of the trial. Egg counts started on 17/10/89 with further counts on 28/10/89 and 5/11/89 i.e. 18, 29, and 37 days after the initial infestation. A sample of 100 seeds were checked each time and the mean number of eggs were determined. The numbers of adults were also determined in three separate counts on 10/10/89, 17/10/89, and 18/10/89 i.e. 11, 18, and 50 days after the initial infestation. The number of holes per 100 seeds was determined in all the test materials on three occasions 5/11/89, 11/11/89 and 25/11/89 i.e. 37, 43, and 57 days after the initial infestation. The data gathered was transformed into log (x + 1) and the means were compared using Duncan's multiple range test (DMRT).

Results

Egg Counts

The first count made showed that, the ash treated sample was significantly the lower for the mean number of eggs (Table 9); this could be explained if the oviposition was hindered or the eggs has been laid on the ash particles and were lost. The untreated seeds showed the highest number of eggs in the trial but the difference was not statistically significant at the first time of sampling.

Table 9: Mean Number of Eggs per 100 Seeds Assessed at Three Times After Infection.

Treatment	Time after infestation 18 days	 29 days	 37 days
Groundnut oil	25.10 a	69.00 b	80.25 c
Sesame oil	20.33 a	70.00 b	81.50 c
Neem seed oil	29.50 a	80.25 a	140.25 b
Banana ash	14.50 b	50.75 c	343.75 a
Control	34.01 a	84.75 a	284.50 a
CV (%)	9.7	9.3	13.0

Treatments followed by the same letter were not significantly different at the 5% level following the application of the DMRT to the transformed data.

A greater number of eggs was found for all treatments at the time of the second sampling compared to the first sample. However, the neem seed oil and the untreated treatments showed the highest number of eggs. The grains admixed with the ash had significantly lower number of eggs than all the other treatments implying that the adults had difficulty in egg laying in the ash treatment (Table 1). Treatments using sesame oil and groundnut oil showed an intermediate number of eggs.

By the third count (37) days after the start of the trial), the number of eggs had increased tremendously in the neem seed oil, the ash and the control treatments. The ash admixture had the highest number of eggs and that this happened was probably due to the fact that the ash particles settled down as time passed and the seeds in the upper layers became exposed to the infestation. Likewise, the untreated grains showed a significantly higher egg count than the other treatments. Groundnut oil and sesame oil showed the lowest number of eggs among all the treatments.

Numbers of adults

Table 10: Mean Number of Adults per 100g Cowpea Seeds

Treatment	Time after infestation		
	11 days	18 days	50 days
Groundnut oil	4.50 a	2.00 a	0.25
Sesame oil	4.50 a	1.50 b	0.25
Neem seed oil	4.00 a	3.50 a	4.50
Banana ash	0.00 b	1.20 b	3.25
Control	3.50 a	2.50 a	2.50
CV (%)	5.0	23.0	- *

Treatments followed by the same letter were not significantly different at the 5% level following the application of the DMRT to the transformed data. * No significant treatment differences were found.

The number of adults were counted three times and are shown in table 10. At the initial sampling, the groundnut oil and the sesame oil treatments had shown a high number of adults, but this reduced considerably in the subsequent counts; at the time of the final count the number of adults in these two treatments was considerably lower than the untreated control treatment. By low adult count which increased greatly in later samplings.

The untreated control maintained a high number of adults through out the duration of the trial.

Seed damage

Table 11 The Mean Number of Holes per 100 Seed on 3 Occasions

Treatment	Time after infestation		
	37 days	43 days	57 days
Groundnut oil	4.60 b	4.00 c	3.00 b
Sesame oil	3.25 b	8.00 c	4.75 b
Neem seed oil	6.00 b	19.00 b	4.50 b
Banana ash	19.75 a	73.00 a	28.25 a
Control	15.25 a	67.00 a	17.00 a
CV (%)	40	30	33

Treatments followed by the same letter were not significantly different at the 5% level following the application of the DMRT to the transformed date.
Damage can be measured by the number of holes per seed. The number of holes per 100 seed were low for all the oil treatments showing that these treatments reduced the bruchid damage to the cowpea seeds. Sesame and groundnut oils showed a significantly lower number of holes than the control (Table 3). Following the seem seed oil treatment a sgnificantly lower number of holes was seen than with the control, but it was associated with a greater number of holes than the other oils.

Ash treated seeds incurred a similar level of damage with that of the control. The average number of holes for both control and ash at all three sampling dates was about 37 per 100 seeds compared with an average of about 6 for the oiled seeds.

Discussion and Conclusion

In this study the same oil and groundnut oil proved to be effective in Callosobruchus Maculatus control. They reduced the egg deposition which resulted a reduced level of damage. Similar results were obtained in different countries Africa, for instance Pere, Magoya, & VanRheenen (1985) reported that sunflower oil can effectively control the bruchids with the very low rate of only 2 ml/kg which gave complete control. In our trials, oil was applied at 5 ml/kg and this gave satisfactory control of the bruchids.

Although various products of the neem tree have been reported to control insect pests in a variety of conditions, the neem seed oil treatment in this trial seemed to be less effective than the sesame oil and the groundnut oil when used similar rates.

The ash stopped the initial egg deposition but the egg laying increased in the later samplings and this resulted a huge population by the nd of the experiment. It may be that the ash treatment was not as effective as it would be in practice because the experimental material was frequently disturbed by the various samplings; in this connection it is worth nothing the low counts of eggs and adults in the first sample.

There for sesame oil and groundnut oil may prove to be suitable for recommendation to the small holding farmers. Further work is required to define the reates of oil to be used.

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Preliminary Studies on Biological Nitrogen Fixation by Haricot Beans on two Soil Types in Hararghe, Ethiopia

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Introduction

In Ethiopia, haricot bean (*Phaseolus vulgaris*) performs better in altitudinal ranges of 1400 - 200 m.a.s.l. as sole crop in the Riftvalley or intercrop in other areas. It is considered as a cash crop and protein source. Economically, it is important export commodity. The yield level is estimated to be 650 kg/ha (Amare, 1987). This is attributed among others to the cultivation of beans on soils poor in nutrients which as been previously used for growing other crops. However, the benefit occurred was not realized in terms of the role of nitrogen fixation and improvement of the fertility of the soil. More over the native strains are ineffective for nitrogen fixation (Amare, 1987; NSSP, 1989).

In Ethiopia haricot beans are planted on any type of soil, however the yields are lower since the crop requires high fertility. The same has been reported in Uganda (Mukas, 1970), and beans nodulate poorly (Stephens, 1967; Acland, 1971; Anderson, 1973). Previous studies on inoculation in Ethiopia were not based on nodulation in Ethiopia by farmers is non existent except for research. The need for inoculation and the benefits of symbiotic nitrogen fixation is realized by farmers in East Africa. However this was not verified for different cropping systems in East Africa in general and Ethiopia in particular.

These experiments were therefore initiated in 1989 to study the role of nitrogen fixation by haricot bean in different cropping systems in the context of bean improvement in East Africa with the following specific objectives.

1. Study the effect of bean on yield of sorghum
2. Study the effect of sorghum on yield of beans
3. Compare yield of intercrops with yield of sole crops
4. Compare natural nodulation aspects under either sole of intercrops systems.
5. Compare the nodulation capacity of different strains of Rhizobium for subsequent inoculation trails.
6. To study the effect of nitrogen an nodulation and yield of beans.
7. To investigate the nodulation capacity and yield of different varieties of beans.
8. To conduct nodulation survey on farmers' fields.

Materials and Methods

Nodulation Survey on Farmers' Fields

Twenty five farms (Map 1) were surveyed from August 21 to 31, 1989. The farms were selected randomly to represent different agro-ecological zones and soil conditions. From farms that cultivate haricot beans six plants were randomly dug with a shovel and the soil particles carefully separated from the roots. Nodules were examined for position on roots, color, size and number. Scoring was made according to the Methods Manual (CIAT, 1988).

Field Trials

Four trails were conducted in the field in the 1989 crop season. The trials were conducted at Alemaya and Hamaressa site with the following soil characteristics (Table 1).

Rain fall distribution of the area is bimodal where the small rains begin in February extending to the first week of May. A dry spell ensues towards May and the whole of June before the big rains start in July. Long term averages show that the annual total rainfall to be 810 mm. Sixty percent of this falls in the month of July, August and September. Temperature variation are encountered in the area that need to be taken into consideration. In valley bottoms low temperature result in frost attacks which might damage sensitive varieties of haricot beans that are late maturing (personal observation).

Intercropping

Four varieties of haricot beans (Mexican 142, Ex-Rico, Black Dessie and a local variety) and two varieties of sorghum (ETS, 2752 tall, is 9333 short) were intercropped on a Rhodustalf. The sorghum were planted on April 29, 1989 and beans three weeks later. Sorghum plants were planted in rows of 80 cm and 20 cm between plants. Haricot beans were planted in alternate rows of 40 cm with 10 cm between plants. Sole and intercrop plot size used was 4.5 m x 4.4 m. The trial was laid in RCBD replicated three times. Nodulation was examined at mid flowering on six plants that were carefully dug by a shovel. Nodule color, size, number and volume was recorded according to the Method Manual (CIAT, 1988). At maturity the beans and sorghum were harvested on an equal area basis. The data was subjected to statistical analysis.

Effect of Nitrogen

Three trials were conducted on three soul types using different levels of nitrogen. In two of the trials (on a Rhodustalf and Pellustert) four levels of nitrogen viz: 2, 23, 46, 69 kg/ha respectively were used. Nitrogen was applied under the seed during planting ensuring seed and fertilizer separation. Clean seeds of *Phaseolus vulgaris* variety alemaya white were planted in rows of 40 cm and 10 cm between plant in plots of 4.5 m x 4.4.m. The trial was laid in RCBD replicated three items, Nodule number and volume was recorded every ten days from six plants. The data collected was subjected to ANOVA. Another set of trial was conducted using nine varieties of haricot beans which are in the National Yield Trial stage. The varieties were tested with and without nitrogen. Starter does of nitrogen at a rate of 23 kg/ha was applied all at planting. Plot size used was 4.5 m x 2 m with 40 cm rows and 10 cm between plants. Data on nodule number, volume, and color of six plants was recorded every 10 days.

Green House Experiment

Nineteen strains of Rhizobium from CIAT were used to inoculate seeds of *Phaseolus vulgaris* variety A-422. A nitrogen deficient soil sample (Alemaya series, degraded Haplustaf) weighing 4 kg was carefully placed in earthen pots with drainage holes. A basal dressing of P_2O_5, KC, MgO, Borax and $ZnSo_4$ was applied in powder and solution form respectively. The soil was equilibrated with sufficient water to ensure uniform moisture. Subsequent watering was made by taking representative weight of pots. Moisture was kept at 775 percent of field capacity. Five clean seeds of A-422 were planted in a circular manner. Inoculation was done at the three leaf stage. One teaspoonful of peat based inoculants was applied nearer to the growing plant and covered with clean sterile sand. The trial was laid in RCBD with four replications. Nodule volume and number of three plants was taken at fifty present flowering. The tops were harvested, fresh weight taken and dried at 60°C for 48 hours and dry matter weight recorded. Total nitrogen was determined by the Kjeldahal method. Tremendous variability was observed on nodule size, color, and position on roots. Small medium and large nodules were found on the same plant. The position of the larger nodules was on the taproots. The smaller and medium nodules mostly appeared on root hairs, and except on very few fields nodules were white in color. Where pinkish nodules are observed they were relatively large.

The local Rhizobium were able in all case to infect the host plant but their effectiveness was not high enough to produce leghaemoglbin. Despite the presence of strains, the variation in population and infectivity of the various strains would influence the number, size and effectiveness of the nodules. Although the farms surveyed were continuously used to grow haricot beans, inoculant have never been used before. previous studies (Amare, 1987) have indicated the yield increase of haricot beans by proper inoculation. However, inoculation alone without adequate phosphorus and micronutrient will not result in substantial nitrogen fixation (MaCarthey and Watson, 1966 Stephens, 1967; Keya, 1977).

The low degree of effectiveness of the local Rhizobium could be either to adverse edaphic factors or to their genetic make-up which has been also observed by other investigators in East Africa (Donarie, 1968; Souza, 1968). In high rainfall areas the haricot beans were showing deficiency symptoms of zinc and molybdenum whereas in soils with high P^H values lime induced iron chlorosis was observed.

Besides adverse soil conditions, and variations in weather, biological factors also influence nodulations and nitrogen fixation. Parasites, predators, antibiosis and the possibility that other organisms that affect the symbiosis should be considered. In some fields where rootknot nematodes were observed, nodulation was poor. This could be due to interference and competition for nodule sites. Earlier reports confirm the prevalence of nematodes on haricot bean (Nugndo, 1973, 1987).

Green House Experiment

Nodulation

Inoculating *P. vulgaris* variety A-422 different strains of Rhizobium showed a statistically significant (P=0.01) difference in nodule number and fresh weight of the tops (Table 3). Some Rhizobium strains produced more number of nodules than the others. Tap and lateral roots of the inoculated plant were effectively nodulated as compared with uninoculated plants were were produced comparatively high number of ineffective white nodules. The ineffectivity may be due to the presence of antibiotics that inhibit, the ability of the local strains from producing pink nodules (NBSp, 1989(. The exotic strains produced effective nodules although the number varied tremendously. This clearly indicates that inoculation with the right strains will eventually improve nitrogen fixing ability of haricot beans in the regions. Fresh and dry matter weight and total Nitrogen yield.

The strains produced statistically significant (P=0.01) difference of fresh weight of the tops. Uninoculated plants produced the least fresh weight. Fresh weight of the plants was improved by 30 percent when inoculated with strain 2774 as compared with uninoculated plants. Similar observations were make in Kenya (Bumps, 1957). It is evident that there is no much difference between the dry matter produced by the different strains. The strain which gave the least number of nodules produced 47 percent more dry matter over the uninoculated. Like wise total nitrogen of the tops was to significantly different, but strain 632 fixed more than 200 percent total nitrogen as compared with that of uninoculated plants. This shows the producing profuse nodules may not result in substantial increase in the amount of nitrogen fixed in the host plant (Keya, 1977). However, the nitrogen fixed in the soil after nodule senesence and excretion has to be considered in plants with high number of effective nodules.

Intercropping

Nodulation

Intercropping haricot beans with sorghum (Table 4) did not produce significant difference in the number and vole of nodules. All varieties were infected, but the nodules in all cases were ineffective. Black Dessie produced the highest number and volume of nodules in both sole and intercropped systems. Intercropping Ex-Rico with tall sorghum gave the lowest number and volume of nodules, low light intensify might have restricted N_2 fixation.

Dry Matter and Yield

Statistically significant (P=0.01) difference was observed in dry matter yield (Table 4) in the different cropping systems. Black Dessie produced comparatively the highest dry matter when planted in association with tall sorghum. On the either hand M142 did not show difference when grown sole or intercropped with short sorghum. This shows that Black Dessie which is a late maturing variety relatively tolerates shading by the tall sorghum. M142 which is an early variety performed better in relatively low shade condition.

The grain yield of intercropped varieties of haricot beans (Local, Ex-Rico and M142) was markedly low as compared to that of the sole crop (Table 5), with the exception of Black Dessie which performed better when intercropped with short sorghum. This suggests that varietal difference exist in their suitability for intercropping. Yield of the sorghum varieties is also lower and this may be attributed to completetion for nutrients, water, light or rooting space (Kurtzetal, 1952; Pendeltoneetal, 1963; Enyi, 1973).

The intercropped systems have produced comparative yield advantages over the sole cropping as indicated by the high yield equivalent ratio (LER). Combining Black Dessie with short sorghum has the highest LER, indicating the competitive ability of this variety with the combined crop.

The advantage to be occurred from nitrogen fixation by the beans was not realized in terms of yield increase by the local strains of Rhizobia. However, previous works (Agboola and Fayemi, 1972; Chowdhury and Misavgu, 1979) with inoculated legumes have shown that nitrogen fixed by the legume could be used by the cereal thereby increasing yield. Other studies (Henzell, 1970) show that there is no appreciable direct flow of nitrogen from legumes to associated crops. Cereals will not benefit from associated beans that are sown at the same time, unless the nodules are formed early, sense and die to release the fixed nitrogen. Future studies of intercropping systems need to consider aspects of inoculation, planting dates of the associated beans, rotations and sequential cropping to understand the benefits of nitrogen fixation.

Effects of Nitrogen on Nodulation and Yield

Nodulation

Highly significant (P=0.01) difference were observed in nodule number and volume at 45 and 55 days after planting (DAP) when haricot bean was grown on Hamaressa Alfisol (Table 6). Increased level of nitrogen resulted in deceased number of nodules. All treatments have produced the highest number of nodules upto 35 DAP thereby decreasing. Nodulation was not inhibited even at high levels of nitrogen but the nodules in all cases were not effective. Nodulation on Vertisols (Table 7) was comparatively high although non significant except the nodule volume at 40 DAP (P=0.01). Nitrogen application has decreased the number of nodules but did not altogether curtail nodulation. Unlike on the Hamaressa Alfisols haricot beans produced maximum number of nodules at 60 DAP. This indicates nodulation to continue during the growth cycle, with most senescing intime. When different varieties of haricot beans (Table 8) were grown on degraded Alfisol there was significant difference (P=0.01) in nodule number at 40 DAP with fertilizer and at 30, 40, 50 and 70 DAP when grown with out fertilizer. The number was high in the non-fertilizer plots although the nodules were all ineffective.

The varieties show significant difference (P=0.01) in nodule volume (Table 9) at 40 and 80 DAP when grown with out fertilizer and 14 40, 50 and 60 DAP with fertilizer.

Bean Yield

There was not significant difference in yield (Table 6 & 7) due to the application of nitrogen. However, the average yield of haricot beans grown on the Vertisol was higher by 48 percent as compared with the yield obtained from Hamaressa Alfisols. With out application of nitrogen, the yield on Vertisols was higher by 50 percent. This indicates that the Vertisols have a higher potential for supplying nutrients than the Alfisols. However, successive increments of nitrogen was shown on the Alfisols, which declined at higher levels, on the other hand there was a continued response to nitrogen upto 46 kg/ha on Vertisols. These preliminary studies indicate the need for fertilizer application if haricot bean production is to be successful in Hararghe particularly on sole cropped systems. Grain yield of the nine varieties (Table 8) was not significantly different. However, nitrogen has increased the yield substantially. The highest yield increase (48%) due to nitrogen application was obtained from A-62. Mulato-A show the lowest yield response (7%). Difference in the yielding ability of these varieties with fertilizer confirm the need for nitrogen fertilization. Not with standing this, inoculating the varieties and testing their potential to fix nitrogen will be beneficial in improving the nitrogen status of the soils. Subsequent trials need to include some of these varieties for inoculation trials under sole and intercropped systems.

Recommendation and Future Research Needs.

These preliminary results have indicated the need for inoculating beans in the region. A few of the promising Rhizobium strains will be tested under a field condition in a monoculture and intercropped system. Selected bean genotype will be intercropped under a uniform canopy of sorghum to evaluate their nodulating capacity to be advanced for future inclusion in the intercrop trials. Green house experiments will be continued to study the effect of different nutrients on nodulation and nutrition of haricot beans. These trial will be subsequently carried for the coming two years.

Budget and Work Plan for 1990/91

The current project which was initiated in June, 1989 will be continued for consecutive have the following financial requirement for 1990/91 crop season for the specific objec the original proposal.

Item	Cost in US$
Chemicals	3,000.00
Desk Calculator (Programmable)	1,000.00
Camera	1,000.00
Travel expenses	1,000.00
Labour Cost	3,500.00
Perdiem	1,000.00
Reprints, Publication, Photocopy	400.00
T o t a l	10,900.00

Work Plan (refer attached calendar)

1. Field planting of intercropping trial April - May
2. Green house experiment March - May
3. Nodulation survey on farmers' fields July - August
4. Fertility trails on beans July - September
5. Sampling and laboratory analysis April - September
6. Data collection, analysis and interpretation - periodic

[References and some Tables are omitted from this version]

Table 1. Characteristics of the Trials Sites.

Site	Soil Type	Texture	O.M. %	p^H (in water)	P(PPM)	AWC mm/cm
Alemaya	Typic Pellustert	Clay	1.6	7.9	7.5	42.8
	Haplustaf (degraded)	Sandy Loam	1.5	6.8	3.1	27
Hamaressa	Rhodustalf	Clay	2.4	6.2	1.8	32

Table 3. The Effect of Inoculating variety A-422 with different inoculants on nodule number, volume, total N and dry matter yield in green house

Inoculant No.	Nodule Number	Nodule Volume	N	Dry matter (g/3 plants)	Fresh weight
274	591.50	8.80	0.154	14.09	82.15
348	572.00	2.27	0.175	12.99	74.26
876	536.75	9.22	0.126	13.95	78.45
57	536.50	10.05	0.161	14.74	79.54
151	492.00	8.52	0.140	13.00	75.95
uninoculated	473.50	8.27	0.061	8.02	57.20
113	466.00	6.25	0.123	14.53	113.53
899	448.75	8.68	0.119	14.72	72.20
112	435.75	6.75	0.129	13.95	70.07
5	405.50	6.25	0.108	13.59	76.85
639	398.50	7.60	0.119	14.17	81.77
613	393.25	6.75	0.105	13.89	73.43
45	392.75	6.62	0.126	12.39	65.19
166	395.75	7.02	0.126	14.12	74.39
2	375.25	6.05	0.119	11.43	62.22
144	375.00	6.27	0.119	13.11	68.66
640	356.50	7.40	0.115	13.00	35.69
652	347.50	6.47	0.109	14.48	78.02
7001	345.50	5.32	0.122	14.00	66.40
632	227.25	6.85	0.198	15.03	79.04
LSD 5%	63.1	NS	NS	NS	6.32
1%	88.4				8.8
SE (±)	40.96	0.93	0.022	1.15	4.41
C.V.(%)	19	6.36	35.2	16.60	11.0

NS = Non significant

Table 4. The Effect of Intercropping Haricot Beans with Sorghum on nodulation and dry matter yield.

Treatment	Nodule Number	Nodule Volume (ml)	Dry matter g/6 plants
Black Dessie sole	187	3.03	18.1
x 2752	163	3.60	39.3
x 9333	86	1.70	9.0
Ex-Rico sole	99.3	2.53	17.34
x 2752	49.6	0.46	12.46
x 9333	131.3	1.60	13.53
M142 sole	81.6	1.60	15.80
x 2752	77.3	1.23	21.10
x 9333	61.6	1.36	25.00
Local sole	96.6	1.60	14.90

(conti. Table 4)

x 2752	104.0	1.43	14.50
x 9333	141.3	1.50	10.41
LSD 1%	NS	NS	3.6
5%			4.7
SE ($\pm$)	8.67	0.63	5.5
CV (%)	18.7	61.0	24.3

NS = Non significant

Table 5 The Effect of Intercropping Four Varieties of Haricot Beans and Two Sorghum Varieties on Yield of the Associated Crops.

Variety	Sole	Intercropped with Short	Tall	Sorghum Short	Tall	LER Short	Tall
Local	1652.8	775.3	1561.5	1093.0	1740.7	1.23	1.75
Ex-Rico	2998.8	2222.7	1854.3	1252.6	1930.5	1.61	1.51
M142	2823.0	2725.3	2556.3	1150.7	1989.5	1.76	1.82
Black Dessie	1656.4	2334.2	1385.6	1033.1	1768.5	2.13	1.65
Short sorghum	1445.0						
Tall sorghum	2165.5						

Table 6. The Effect of Different Levels of Nitrogen on Nodule Number Volume and Yield (kg/ha) of Haricot Beans grown on Hamaressa Alfisol.

Nitrogen kg/ha	Days after Planting 25	35	45	55	65	75	mean	25	35	45	55	65	75	mean	Yield
	Number							Volume (ml)							
0	80	83	77	72	63	41	69	0.4	0.70	0.77	0.70	0.50	0.40	0.57	1056
23	48	64	53	46	43	33	47	0.2	0.43	0.57	0.50	0.30	0.20	0.33	1407
46	36	37	33	25	20	15	27	0.1	0.33	0.30	0.20	0.20	0.20	0.21	1334
69	12	19	17	11	8	5	12	0.1	0.27	0.20	0.20	0.10	0.10	0.15	1210
Mean	44	50	45	38	33	23	38	0.2	0.43	0.46	0.40	0.27	0.22	0.33	1251
LSD (00.1)			54.9	37.9					0.36		0.4				
(0.05)	37.3	36.2			NS	NS		0.17				NS	NS		NS
SE (+)	12.8	10.9	5.24	7.0	5.2			0.05	0.07		0.06	0.01	0.01		

NS = Non significant

C-3.b

1. SURVEY, BIOLOGY AND CONTROL OF AGROMYZID BEANFLIES IN COMMON BEANS (PHASEOLUS VULGARIS L) IN KENYA

J. H. NDERITU & G. N. KIDATA

2. SUMMARY

The common beans are the most widely grown pulses in Kenya. They are intercropped with such crops as maize, sorghum, cassava, in high and low potential areas. They are consumed as green leaves, green pods and dry beans and form an economic source of protein to the bulk of Kenya population. However, despite their importance as a major source of protein, their yields are varible for a number of reasons. One of the major limitations to obtaining high yields include insect pests. Among the pests of the beans, certain agromyzid beanflies have been reported to cause heavy losses to beans in Kenya. The control measures for the beanflies include mainly seed treatment with aldrin or dieldrin. However, these insecticides are being withdrawn because of their persistence in the environment. Therefore, the objectives of the research project are as follows:

1. 1) To map the distribution of beanflies in bean growing areas in Kenya in four cropping seasons.
   2) To identify the losses of common beans due to beanflies in farmers fields in four seasons.
   3) To relate the biology of beanflies to the growth stages of the common beans grown in the field for two seasons.
   4) To detemine the affectiveness of the insecticides and natural enemies in the control of beanflies on common beans grown in the field for four seasons.
   5) To investigate the incidence of beanflies and its natural enemies in different cropping patterns of common beans grown in the field for four seasons.
   6) To evaluate soil, seed, foliar and spray treatments for control of beanflies.

The project will evolve an integrated control strategy of beanflies for the poor resource farmer. The results will be obtained by undertaking a survey in farmers fields, field and laboratory experiments at the research centres.

The cost for all the research activities will be US & 12,588

The project is expected to take two years.

3.1 PHYSICAL ENVIRONMENT

The survey of the pest will be carried throughout the bean growing areas of Kenya. These are mainly Eastern, Central, Western and Rift Valley Provinces of Kenya. These covers the most densely populated areas in Kenya. These areas have good roads as means of communication. The distribution and reliability of rainfall varies from region to region. But, otherwise, the rainfall in most cases is enough for high bean production. These areas have mixed farming, where livestock and crops are maintained by the farmers. These areas are major bean producing ar in the country.

3.2 SOCIOL-ECONOMICS

The areas covered in the study are densely populated. They have mixed farming systems. The land acreage per family is small and labour is mainly provided by the members of the family. Beans are mainly grown for home consumption. Any surplus is sold to National Cereals and Produce Board or in the free market. Farme are reluctant to sell the beans to the NCPB because in the free mar they get more money. There are no provisions for credit facilities for beans and the acreage under bean production per farmer is low. The crop is mainly grown as a mixed crop.

3.3.GOALS

1) to help produce adequate bean supplies at costs farmers can afford.

2) To increase the economic source of protein to the bulk of the Kenya population.

3) To help raise the income base and therefore the quality of life of the poor resource farmer.

3.4 AVAILABLE INFORMATION AND GAPS

3.4.1 BIOLOGY OF BEANFLIES

In East Africa, Greathead (1969) studied the taxonomy of agromyzidae beanflies infesting bean plants. He reported that they are Ophiomyia phaseoli Tryon, Ophiomyia spencerella Greathead and Ophiomyia centrosematis(de Meiji). O. spencerell and O. phaseoli had earlier been considered as one species (O.phaseoli) before Greathead's study.

O. spencerella and O phaseoli were both usually found in a bean crop. However, O. spencerella was reported as the most abundant and damaging species of beanflies. Spencer (1973) has discussed in detail the various taxonomic characters that can be used to distinguish the two species.

Greathead (1969) described the biology of O. spencerella. The biology of O. phaseoli has been reported by various researchers:- Wallace (1939) and Greathead (1969) in East Africa; Hassan (1947) and Ali (1957) in Egypt; Quesales (1918) in Phillipines; Taylor (1958) in Rhodesia; Kleinschmidt (1970) in Australia; Singh and Beri (1971) in India and Kato (1961) in Japan. However, the biology of the beanflies has not been related to the growth stages of the crop in the field. It is not known how long the various immature stages take in different parts of the bean plant. This is essential in deciding the time to have chemical control and the target part of the plant.

3.4.2. THE AGROMYZID BEANFLIES: PEST STATUS AND NATURE OF DAMAGE

Among the pests of the beans, certain agromyzid beanflies have been reported to cause heavy losses to beans in many parts of tropics and warm temperate regions (Spencer, 1973). Heavy losses of common beans due to beanflies have been reported from Rhodesia (Taylor, 1958); East Africa (Wallace, 1939; Swaine, 1968); Egypt (Hassan, 1947); Australia (Davis, 1969) and Asia (Ho, 1967).

Beanflies infest a wide range of leguminous plants in East Africa (Le Pelley, 1959; Greathead, 1969). They have been reported on cowpeas, green and black grams, garden peas, pigeon peas and soyabeans. Okinda (1979) reported infestation of beanflies almost every year in Kenya. The beanfly larvae tunnel through the leaf and subepidermal stem tissues to the lower stem below the ground level. The effect of larval feeding is serious with young plants frequently being totally destroyed. There is a calloused growth around the injury of the stem where the larvae have pupated. The distribution of beanflies in bean growing areas in Kenya has not been investigated. The losses experienced by farmers due to beanflies has not been estimated.

3.4.3. AGROMYZID BEANFLIES OF COMMON BEANS IN KENYA

The early reports of beanfly in Kenya are by Wallace (1939) and Le Pelley (1958). They have reported the occurrence of the beanflies and the extent of damage. Survey of pests in mixed cropping systems have shown beanflies to be major pests of beans in Kenya (Karel and Mueke, 1978; Khaemba and Khamala, 1978; Khamala at al. 1979).

The beanflies were found on all the farms where beans are grown. They indicated that beanfly infestation was serious and that some afforts should be made to prevent the damage caused by them as they reduce beans more than any other bean pest. Mueke (1979) screened bean varieties for beanfly resistance. He mentions that bean varieties resistant to beanflies, if available, would certainly be most welcome to the small scale farmers in intercropping systems, especially since most of them cannot afford to buy insecticides. Okinda (1979) and Kibata (1980) studied the population dynamics of the beanflies under field conditions. The highest incidence of beanfly tends to coincide with short rains season and crops may suffer considerably. The effect of cropping pattern of common beans on the incidence of beanflies and its natural enemies has to be thoroughly investigated.

3;4.4. Control of beanflies on common beans.

Various methods have been used to control beanflies on common beans in East Africa. Walker (1960), Swaine (1968), Pury, (1968), Okinda (1979), Kibata (1980) and Matee and Karel (1983) have indicated various insecticides which can be used for controlling beanflies on common beans. Endosulphan seed treatment, Carbofuran furrow application or dimethoate foliar application can effectively control beanflies in a bean crop. A number of these chemicals are not environmentally safe and have negative effects on parasites which are highly important in the control of beanflies in East Africa. Cultural control methods have been recommended by Bohlen (1973), Hill (1975) and De Lima (1976). Recommendations such as early planting time to avoid peak infestation period, elimination of host plants, rotation with non-host crops; hilling or soil moulding to encourage adventitious root formation in the stem are highly advocated. The parasite complex associated with beanflies are widespread in East Africa and plays an important role in the control of beanflies.

Insecticides which have minimum effects on parasites complex associated with beanflies should continously be screened.

4. JUSTIFICATION

The present control measures of the beanflies include mainly seed treatment with aldrin or dieldrin. The ineffectiveness of chemical control and the danger of the chemicals has been reported. The price of the chemicals have steadily been increasing to the level where the poor resource farmer cannot afford. With that in mind, it is intended to evolve an integrated control strategy of beanflies for a poor resource farmer; where there will be use of effective natural enemies, insecticides and recommend cropping pattern for beans that will reduce beanflies and increase natural enemies in the field. Before the control strategies are recommended the distribution of beanflies in the country and the losses incurred by farmers will be essential information.

5. OBJECTIVES

The objectives of the research project are as follows:-

(1) To map the distribution of beanflies in bean growing areas in Kenya in four cropping seasons.

(2) To relate the biology of beanflies to growth stages of the common beans grown in the field in two seasons.

(3) To determine the affectiveness of thenatural enemies in the control of beanflies on common beans grown in the field for four reasons.

(4) To investigate the incidence of beanflies and its natural enemies in different cropping patterns of common beans grown in the field for four seasons.

(5) To determine the losses of common beans due to beanflies in farmer's field in four seasons.

(6) To evaluate soil, seed and foliar spray treatments for control of beanflies.

6. MATERIALS AND METHODS

6.1 SURVEY ON THE DISTRIBUTION OF AGROMYZID BEANFLIES IN THE FARMER'S FIELD

Visits will be made to twenty farmer's fields in the area indicated on the map. In each field, samples of 20 bean plants will be uprooted at random and placed in polythene bags. The age of the bean crop and bean cultivar (where possible) will be indicated.

The samples collected from the field will be brought to the laboratory. The sample plants with symptoms of damage will be rated on a score of 0=no damage 1=little damage 2=medium damage 3=severe damage. The sample of bean plants will be dissected the number of beanflies larvae and pupae per plant, as well as the number of infested plants for a given sample will be recorded. The per cent infested plants per sample, the proportion of different agromyzid beanflies species and their mean number per attacked plants will be determined.

Farmers grow beans during long rains season and short rains season. On every season two field trips will be made to the areas indicated in the map. This will be on 4th and 8th week of the growth of the bean crop. Each field trip will take 14days. In a given field trip the areas to be covered will be as follows(see

(i) Nyeri/ Murang'a/Embu/Kiriyaga/Machakos/Meru/Loitoktok/ Taita Districts.

(ii) Nyandarua/Nakuru/Kisii/Bungoma/Trans Zoia/Laikipia Districts.

Thus two field trips to the same area will be made per season. The survey will take two years and provide information on:-

(a) distribution and population levels of the agromyzid beanflies on bean crop in some bean growing areas.
(b) seasonal incidence of agromyzid beanflies in farmers fields in some of the bean growing areas.
(c) the extent of infestation in different areas.
(d) losses the farmers are experiencing due to the agromyzid beanflies.
(e) natural enemies complex [illegible] [illegible]lies [illegible] farmer's field.

6.2 THE NATURAL ENEMIES COMPLEX OF BEANFLIES

One bean cultivar will be used in the experiment. It will be grown in a plot size of 20m x 20m, with an inter-row spacing of 50 cm and within-row spacing of 10cm. A samples of 20 randomly collected bean plants will be uprooted on weekly basis. The lower five inches of the plants will be cut off and placed in kilner jars with a nylon mesh top. When the beanflies emerge and after emergence each plant will be dissected and all the unemerged puparia examined. The identity, distribution and importance of each parasite will be recorded.

6.3 LIFE CYCLE OF THE BEANFLIES

Two hundred bean seeds of one cultivar will be sown in trays.

Immediately after germination they will be placed in a room, where temperature and humidity are controlled. The life cycle of the beanflies will be monitored avery 24 hours.

6.4 INCIDENCE OF BEANFLIES AND ITS NATURAL ENEMIES IN MONOCROP AND INTERCROPS

A randomized complete block design with four replications will be used. One treatment will be beans intercropped with maize and the other one will be beans as a monocrop. The plot sizes will be 10m x 10m. Population samples of beanfly larvae and pupae will be taken at the 4th week after germination. Unemerged puparia will be kept in separate containers for the emergence of parasites.

6.5 CHEMICAL CONTROL

The following pesticides will be evaluated in CRBD experiments replicated 4 times. Application will be done as seed dressing, furrow treatment or foliar sprays.

(A) SOIL AND SEED TREATMENTS

	Product	Rate
1.	PP 993 0.5% G (Tefluthrin)	2 gm/m Row
2.	Furadan 5G (Carbofuran)	1 gm/m Row
3.	Astifon 62.5% WP (Dichlofenthion 37.5% Thiram 25%	5 gm/kg seed
4.	Aldrin 40 WP	5 gm/kg seed
5.	Fernasen D (Y BHC 20% + Thiram 25%)	5 gm/kg seed
6.	Vydate 10 G (oxamyl)	0.5 gm/m Row
7.	Counter 5 G (Terbufos)	1 gm/m Row
8.	Dacamox 5 G (Thiofanox)	1 gm/m Row
9.	Furadan 35 ST (Carbofuran)	7.1 gm/kg seed
10.	Marshal 25 STD (Carbosulfan)	10 gm/kg seed
11.	Murtano (20% Lindane 26% Thiram)	3 gm/kg seed
12.	Oftanol 30 DS (WP) (isofenphos)	5 gm/kg seed
13.	Pirimicid 50 EC (Pirimiphos ethyl)	5 ml/kg seed
13	Untreated check	
15.	Baythroid 100 ES (Cyfluthrin)	150 ml/100 kg seed (1,5 ml/kg seed)
16.	Thiodan (Endosulphan 50% E C)	10 gm/kg seed

(B) FOLIAR SPRAY TREATMENTS

1.	Dimethoate 40% EC	1.5 ml/litre of wate
2.	Diazinon 60% EC	1.5 ml/litre of wate
3.	Ripcord 5% EC (Cypermethrin)	1 ml/litre of water
4.	Decis 2.5% EC (Deltamethrin)	1 ml/litre of water
5.	Fenthion (Lebaycid) 50% EC	1.5ml/litre of water

6.	Ambush CY 5% EC (Cypermethrin)	1 ml/litre of water
7.	Dipterex 50% SL (flowable) (Trichlorphon)	2ml/litre of water
8.	Brigade 2.5% EC (Biphenthrin)	1 ml/litre of water
9.	Baythroid (Cyfluthrin) 5% EC	1 ml/litre of water
10.	Karate 2.5% (L-cyhalothrin)	1 ml/litre of water
11.	Danitol 10% EC (Fenpropathrin)	1 ml/litre of water
12.	Sumithion 50% EC (Fenitrothion)	1.5 ml/litre
13.	Trigard 75% WP (cyromazine)	1.5 gm/litre
14.	Dursban 4E (48%) (Chlorpyrifos)	2 ml/litre
15.	Metasystox 2.5% EC (Oxydemeton-methyl)	1.5 ml/litre
16.	Control	
17.	Baythroid FC45 2.5% EC (Cyfluthrin)	0.5 ml/litre

7. OUTPUT

(1) Basic information of biology of beanflies

(2) Control of beanflies by use of natural enemies and pesticides.

(3) Recommendation of cropping pattern to reduce beanflies.

(4) IPM evolved for beanfly.

8. INPUTS

(1) Transport

(2) Travel and accommodation expenses

(3) Technical assistant and casual labourers.

(4) Interlinkages and collaborators (sec 10)

(5) Sites - NAL and Thika Horticultural Research Centre.

9. BUDGET (US [illegible])

Operational costs

(1) Transport and maintenance	-	
(a) Petrol	-	[illegible],100
(b) Maintenance of Vehicle	-	1,[illegible]
(2) Travel and accommodation		
(a) Driver	-	[illegible]
(b) Technical assistant	-	1,000
(c) 2 Researchers	-	[illegible]
(3) Purchase of laboratory equipments		200
(4) Farm inputs		
(a) 4 bags DAP fertilizer	-	60
(b) Diesel for tractor	-	200
(c) Seeds	-	100
(d) Land preparation, planting, weeding and harvesting by casual labourers	-	[illegible]
Total (US [illegible])	-	12,500

10. Inter-linkages and collaborators
    - (a) National Horticultural Research Centre
    - (b) National extension service
    - (c) Farmers
    - (d) CIAT
    - (e) National Universities

REPORTING AND DISSEMINATION OF RESULTS
    (1) Reports to CIAT
    (2) Publications.

11. Project evaluation
    1. Verifiable indicators
    - (a) Intergrated beanfly management in farmer's field
    - (b) Means of verification.
        1. Effective control of beanflies as a result of identificatio of natural enemies and cropping pattern.
    - (c) Important assumptions
        1. Effective control of beanflies increases the yield of beans.
        2. Farmers respond to the new control strategy
        3. Efficient marketing system of beans.

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STUDIES ON STORAGE INSECT PESTS OF BEANS IN UGANDA

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1. Introduction:

The common beans, *Phaseolus vulgaris*, are widely grown in Uganda and are a major source of protein for the majority of people. About 400,000 ha. of beans are grown annually in the country and the yield is estimated at 600 kg/ha (FAO quoted in Sengooba 1987). This level of production is very low. With better production and management techniques the levels could easily be increased using the existing cultivated land (Baliddawa 1986). One way of increasing yields of bean, while using the same area of land, is to prevent post harvest losses.

It is believed that significant losses in weight of beans are caused by storage insect pests of beans (Rubaihayo et al. 1980; Overa, 1987). The most important damage to stored beans in Uganda is due family Bruchidae, especially the been seed beetle *Acanthoscelides obtectus* and *Zabrotes subfasciatus* (Nyiira, 1978). The extent of damage caused by these pests on beans is great. For example, Davies, (1962) and Hall (1970) in Uganda estimated that 38% - 69% of beans were bored after storing for six months. Davies (1970) and Byaruhanga (1973), estimated that this damage resulted in 10% - 22% loss in weight of beans stored for over three months. This loss is great and requires reduction.

Earlier attempts to control the storage insect pest of beans in Uganda emphasized the use of insecticides. For example as early as 1953 application of equivalent of 1.5 Ibs of 0.04% & BHC, malathion and lindane were tested and recommendations made for control of storage pests of beans (Anon, 1953, 1961, 1962, Davies 1962). These recommendations, as pointed out by Sengooba (1987), are observed by few people in Uganda. Furthermore use of chemicals has not, in a majority of cases, solved the problem of storage pests on bean (Van Rheeman et.al. 1983). In Uganda this would appear to be due to the bruchids developing resistance against the chemicals. For example Evans (1985) found that samples of *Callosobruchus maculatus* and *Zabrotes subfasciatus* from Uganda were resistant to Malathion and Lindane. Besides the chemicals have other environmental hazards associated with them. They are, also, so expensive that most peasant farmers cannot afford them. There is, therefore, need to look either for new chemicals or for alternative means of controlling storage pest of beans. Promotion of traditional means of protecting beans offers such alternative.

A number of materials are used by peasant farmers in Africa to protect beans against storage insect pests (CIAT, 1986). These include use of ash, banana juice, termite - mound soils, pepper, vegetable oil. Research elsewhere has indicated that some of these are very efficient in controlling storage pests (Schoonhoven, 1976; CIAT, 1986). In case of Uganda and East Africa in general the following observations can be made regarding use traditional protectants:-

1 No attempt has been made to evaluate the effectiveness of various traditional methods of controlling storage pests.

2 In cases where it is clear that certain methods are effective, farmers have not adopted these methods, ash is a case in point. This suggests that there sociological problems associated with the methods, thus requiring sociological studies.

3 In addition to the above (2), traditional methods have not been worked on to produce uniform formulations and application rates that could be recommended through out the region as it is done for industrial chemical.

The other method, which in my view is also traditional, and has not received great attention is drying under sunshine. In a recent survey, it was clear that some farmers depend on frequent exposer of stored beans to sunshine to control the bean bruchid. This method has not been thoroughly investigated. It appears with proper research, use of solar energy to disinfect beans against bruchid could be greatly enhanced.

There is therefore need to evaluate the various traditional methods used, in Uganda, to protect beans against storage pests with a view of developing control strategies for the country at large.

In order to develop an efficient control strategy for any pests, it usually requires thorough knowledge of ecology and biology of the insect pest. Most storage insect pests of beans originate from the field and their population increases tremendously in stores. Review of literature, however, indicate that little is known about field ecology of storage pest. The factors which influence field colonisation are also not known. Furthermore the interaction between field and storage population is not known. As Southgate (1978) indicated, field ecology is important in storage pest control, and should be studied.

In view of the above, there are still many areas that require detailed investigations and these include:-

1 The efficacy of different traditional (including use of solar energy) methods in controlling bean bruchids.

2 The ecology of bean bruchids in the field.

3 Appropriate formulations for traditional protectants.

The proposed experiments aim at addressing themselves to the above challanges.

PROJECT NO. 1/SP_01_1990

2.1 TITLE: EFFECT OF ENHANCED SOLAR HEATING AND TRADITIONAL PROTECTANTS ON POPULATION DENSITY OF BEAN BRUCHIDS AND THEIR DAMAGE TO STORED BEANS.

2.2 Objectives:

(i) To determine the effects of different methods of solar heating of beans on bean bruchids and their damage to beans.

(ii) To determine the efficacy of 7 different traditional protectants on bean bruchids and their modes of action.

(iii) To develope formulations based on traditional protectants which may be recommended to farmers in Uganda.

2.3 Justification:

A preliminary survey, in Uganda has indicated that farmers in different parts of the country use various methods to protect their beans against storage pests. These mainly included use of plant materials/extracts and frequent exposer of the stored beans to solar energy.

A total of 7 traditional protectants, including ash, were found in use in different parts of Uganda. The efficacy and mode of action of these protectants however, have not been studied. Furthermore amounts of these protectants which are appropriate for applying to stored beans have not been worked out. Because of these limitations, a common stand on their use has not been established.

Periodic exposure of stored beans to solar energy was another common method of protecting beans against bruchids which was found in many parts of Uganda. This method however has also not been thoroughly investigated. For instance it is possible that if solar energy is concentrated on the beans (enhanced heating) by use of appropriate covering materials and designs, would kill all stages of the bruchids and hence disinfect the beans completely. This would subsequently reduce the need to frequently expose the beans to solar heat.

The proposed study therefore wishes to address its self to the problems of (i) establishing efficacy and mode of action of protectants, and determining appropriate quantities that could be used to protect beans against bruchids, and (ii) developing the best ways of disinfecting beans using solar energy.

2.4 Project Duration: 24 months

2.5 Research Team: Dr. Samuel Kyamanywa Ph.D
Laboratory Assistant.

2.6 Methodology:

All the propased laboratory work will be conducted at Makerere University, ~~and~~ while "on-farm" trails will be conducted in the main growing areas and marketing centres of beans. These will include Masaka Districts, Mpigi Mubende, and Jjija Districts.

2.6.1 Effect of traditinal Protectants on Storage insect pest of beans

In addition to the seven materials already collected, more materials will be collected and screened for effectiveness aga against bruchids. The effect of these material on bruchid oviposition, population development and damage to beans will be studied. Then/those materials found effective, further /for studies will be undertaken to determine the effects of formulations and rates of application on bruchid control. All treatments will be replicated five times and repeated once. Data will be collected on the following :-

- -Population development
- -loss in weight in a period of 6 months
- -number of eggs laid
- -number of holes per bean
- -longevity
- -ability to emerge

Having selected protectants which are effective, on-farm trials will be conducted to determine thier performance under real storage conditions. 10 farmer and 10 middlemen will be ~~conducted~~ involved in this exercise, and will be selected from three main bean growing areas of Uganda.

While on-farm trials will be going on, behavioral experiments will be conducted to determine the influence of the protectants on orientation and settling, and ovipositional responses. These experiments will require choice chambers and olfactometers.

Having established materials which are effective, there will be need to identify the active ingradients. These studies will have to be conducted in an advanced laboratory with appropriate facilities.

2.6.2 <u>Bruchid control using solar energy</u>

Different methods of covering beans during solar heating to disinfect bean will be studied. The solar treatments will include use of the following as covering materials:-

- Black polthene paper
- Black muslin cloth
- Sisal/jute cloth
- No covering at all as control.

Before exposing the beans to the above treatments, a known percentage of beans will be infested with bruchids. Data will be taken on factors already mentioned above in section 2.6.1. The influence of solar treatments on germination and coocking time will als be studied. It is proposed that middlemen xxx who store bean for long period will be graetly involved in these studeis.

2.7 Budget proposal for the on influence of traditional protectants and solar energy on bruchid populations.

ITEMS	COST (USH.)
Salary:	
For one laboratory assistant at cost 15,000/= per month for 12 months.	180,000
Honorarium for scientist at 30,000/= per month for 12 months	~~360,000~~ 1,200,000
Subtotal (a)	~~540,000.00~~ 1,380,000
Equipment:	
5 Kilner Jars - (rearing Bruchid colonies) @ 1000/=	5,000
4 Entomological sieves of varying mesh @ 2,000/=	8,000
- grinder	60,000
- mixture	60,000
- Polythene paper	60,000
- Muslin cloth	18,000
- 10 m of fine nylon mesh @ 2,000/	20,000
- Choice chambers	60,000
- entomological sieves	20,000
- glass/plastic vials (20 dozens)	100,000
- perspect material for chambers	50,000
Sub total (b)	461,000.00
Expendables:	
- 40 Kgs of different varieties of beans @ 400/=	16,000
- Ethyl acetate 2.5 litres	25,000
- Insecticides for storage	20,000
- Filter papers	4,000
- stationery	20,000
Sub total (c)	85,000.00
Contingency	108,600
Subtotal (d)	108,600.00
GRAND TOTAL	~~1,194,600.00~~ 2,034,600.00

3.1 TITLE: POPULATION DYNAMIC OF FIELD POPULATION OF BEAN BRUCHIDS; AND THE RELATIONSHIP BETWEEN FIELD AND STORE POPULATIONS

3.2 Principle. Investigator: Dr. Samuel Kyamanywa

3.3 Objectives:

(i) To determine time when infestation start taking place under field conditions.

(ii) To determine cultural practices which affect field populations of bean bruchids.

(iii) To determine seasonal incidence of field populations of beans.

3.4 Justification:

The population dynamics and biology of bruchids under laboratory or storage conditions have been studied extensively. Also workers have concentrated on how to protect beans in store against bean bruchids. Little attention, however has been given to field population of bruchids which infest the bean while still in the field. It is also not clear how the field population is maintained season after season. Furthermore ecological aspects (distribution, time of infestation, etc) have not been well studied under field conditions due to this knowledge gap, we are not able to think of ways of manipulating field populations in order to reduce damage in store.

3.5 Plan of work:

Experiments will be conducted at Makerere University Research Institute Kabanyolo (MAURIK) and around areas where beans are stored in great quantities, like around Uganda Produce Marketing. In these experiments effects of different varieties, time of planting, cropping system of beans on field and store bruchid populations will be studied.

Experiments will be conducted in two phases:-

Phase 1: Effect of varieties and time of planting on field population of bruchid.

About ten bean varieties and three planting dates will be used. The experimental design will be split plot in which the planting dates will be in main plot and varieties in sub plots.

Phase 2 Effect of different cropping systems and insecticide application on field bruchid populations.

4 varieties will be selected from Phase 1 (2 very susceptible and the others relatively resistant), for further work. These will be intercropped with maize to determine the influence of the mixture on population density of bruchids. The effect of insecticide application on field bruchid population will also be studied.

3.6 Data:

Data will be collected on the following:-

(i) Time of infestation:

When the bean pods will be approaching maturity, bean plants will be caged at different intervals until beans have dried off. The cages will exclude in coming bruchids. Thus data on caged plants will indicate infestation during the previous interval.

Pods from each cage interval will be kept in cages to observe adult emergence and hence determine population densities.

(ii) Level of field infestation at time of harvesting.

(iii) Level of bruchid damage and infestation on beans from different cultural practice, after storage for a period of 3 months.

3.7 Budget proposal for experiments to study the ecolog: bruchids.

ITEMS	COST (USH.)
SALARY:	
(i) 2 field assistant at cost of shs.15,000/= per month for a period of 12 months	360,000
(ii) Honorarium for 1 scientist at 30,000 per month for 12 months	360,000
Subtotal	720,000.00
EQUIPMENT:	
10 tiny nylon mesh cages constructed from wood (1 x 1 x 1 metre) @ 20,000	200,000
Glass vials 20 dozen	100,000
Sub total (b)	300,000.00
Stationery, Data analysis, etc.	150,000
Sub total (c)	150,000.00
CONSUMABLES:	
-10 kgs seeds @ 400/=	4,000
- 3 twines sisal strings	4,500
- 1000 Pegs	6,000
- 120 cloth bags	60,000
- Sub total (d)	74,500.00
Contingency	112,450
- Subtotal (e)	112,450.00
Total (a+b+c+d+e)	1,356,950.00

BEAN SEED MULTIPLICATION PROJECT

BACKGROUND

The work of breeders, agronomists and others (persons and institutions) are conducting experiments at National and International levels to test new varieties. These tests require a dynamic process of sending and interchanging seed.

It is essential that these seeds be free of deseases such as Bean Common Mosaic Virus (BCMV), Anthracnose (<u>Colletotrichum lindemuthianum</u>), Angular leaf spot (<u>Isariopsis griseola</u>), Halo blight (<u>Pseudomnas phaseolicola</u>) and common bacterial blight (<u>Xanthomnas phaseoli</u>) are transmitted by seeds. So it is a great important of clean seed production .

Ethiopian National Bean Program (ENBP) has been producing clean seeds for African Bean Yield Adaptation Nurser (ABYAN) since 1987. However, it was found that it is expensive to continue doing that using ENBP budget and there is a need of fund to continue the programme.

Melka Werer Research Centre (MWRC) with altitude 750 m. above sea level, has black soil and good irrigation facility. The centre is about 250 km away from Nazret Research Centre (NRC), National Bean Program Coordinated from here. Therefore MWRC is found to be ideal place for the bean sedd multiplication for the Eastern African Region.

<u>OBJECTIVE</u>

To multiply clean seed for national research programes of Eastern Africa Region.

<u>LOCATION OF THE PROJECT</u>

The project central activity will be carried out in MWRC for seed multiplication and NRC for cleaning, preparing, packing and distribution of seeds and technical personel support.

ESTIMATED BUDGET OF THE PROJECT

Item	estimated expenditure (BIRR)
A. Equipement	
- Irrigation pump	7000
- Seed counter	3000
- Protective gears (for chemical)	200
SUB TOTAL	10200
B. Expendible supplies	
- Chemicals (herbecides, Insecticides)	1200
- Fertilizers	400
- Paper bags (different sizes)	2000
- Cloth bags	1000
- Sisal bags	500
SUB TOTAL	5100
C. Travel	
- Technical assistant perdem (3 months)	1620
- Transport 2500 km to be covred (0.60x2500)	1500
SUB TOTAL	3120
D. Labour	
- Land preparation ($\approx$ 2 ha)	600
- Planting	250
- Weeding, cultivation and roughing	800
- Irrigation	1000
- Harvesting, seed cleaning and seed preparation	1000
SUB TOTAL	3650
GRAND TOTAL	21070

REGIONAL SUB-PROJECT PROPOSAL: KENYA, 1990

W. K. Rono, Msc (Plant Breeding & Genetics)
Plant Breeder,
N.S.F.R.C.-Katumani,
P.O. box 340
MACHAKOS, KENYA

Screening in Kenya imported CIAT, material for adaptation to bean growing enunonments in Eastern Africa with particular emphasis on adaptation to high altitude.

Introduction

Beans in the East African Region are cultivated in a wide range of agro-ecological zones at altitudes ranging from 800m to 2,300m. Many national breeding programmes in the region rely (to a greater or lesser) extent on the import of CIAT nurseries from Colombia for supplies of genetic variation. Effective and efficient use and selection of the material in these nurseries requires screening in the range of environments that beans are cultivated.

Justification

Kenya is a major bean producer and has a well established multi disciplin national research programme with a network of research centres and testing sites in differing agro-ecological zones; in particular two high altitude sites at Matanya (1800m) and Kalalu (200m). This provides a unique network in the East African region for screening introductions in a wide range of environments at altitudes covering all production zones. This material emerging from such screening should be adopted to similar environments in other countries in the region.

Modus Operandi

In the first season nurseries imported from CIAT will be first multiplied at treatment research centre and screened for general adaption. In the second season all adapted lines will be distributed in non-replicated screening nurseries for evaluation as follows:

Site	MASL	Rainfall	Character evaluation
Kalalu	2000m	Low	Cold tolerance, high altitude adaptation drought stress anthracnose, ascochyta
Matanya	1800m	Low	(as for Kalalu)
Katumani	1600m	Low	Drought stress, CBB, Rust charcoal rot

Site	MASL	Rainfall	Character Evaluation
Thika		Medium	CBB, Halo-blight, Rust, anthrainose
Kakamega		high	Rust, ALS, CBB

In the third season beans selected from screening at the five sites will be available for distribution to other national programmes in the region requiring material adapted to similar agro-ecological zones. In particular the screening will make available material adapted to high cool altitudes which will be of value to high altitude bean cultivation areas in Uganda and Ethiopia.

Budget

1st Season: Katumani

Activity	Cost(KShs)
Labour: Planting weeding, harvest, seed packaging	15,000.00
Material: Plot labels, seed packets, harvest bags	6,500.00
Fertilizer	500.00
Chemicals (Ambush, Actellic)	1,000.00
	23,000.00

2nd Season:

Transport of Seed	250.00
High altitute sites (Kalalu Matanya)	5,000.00
Low altitude sites (Katumani, Thika, Kakamega)	35,000.00
	40,250.00
Travel: Petrol, 2 visits each station, 560 litres	5,600.00
Perdiems (Scientist)	3,600.00
Perdiems (driver)	1,800.00
	11,000.00
GRAND TOTAL	74,000.00

DEVELOPMENT AND TESTING OF DRIS FOLIAR NORMS FOR BEAN (*Phaseolus vulgaris* L.) PRODUCTION

By J. Kisakye and C. Wortmann,
Kawanda Research Station.

Proposal submitted to the steering committee - March 1990.

Introduction

The Diagnosis and Recommendation Integrated System (DRIS) has proven to be a useful tool for the identification and correction of nutrient limitations in plants. The system comprises an integrated set of norms representing calibrations of growth factors, such as, plant composition, soil composition, environmental parameters, and farming practices, as functions of yield of a particular crop (Evanylo et al., 1987). While all these factors can be included, usually the norms are estimated using the nutrient: nutrient ratios or/and nutrient products only. The derived norms are used as standards with which to assess the condition of the crop. Higher yields of the crop can be obtained by optimizing those factors which are discovered to be limiting growth and production.

Tissue DRIS norms have been developed for corn (Sumner, 1981), rubber (Beaufils, 1957), wheat (Sumner, 1981), sugarcane (Beaufils and Sumner, 1976), potatoes (Meldal et al., 1980), peaches (Sumner, 1985), soybean (Hallmark et al., 1984), and alfalfa (Walworth et al., 1986), but not for beans. DRIS norms have been found superior in accuracy to other commonly used diagnostic tools like the critical nutrient value and the sufficiency range systems (Walworth and Sumner, 1987). These two systems use standards which are specific for particular stages of growth. DRIS norms, however, are not much influenced by the stage of growth of the crop. DRIS's improved accuracy is expected to improve diagnosis to enable better understanding of the problem and corrective management in the future. As soil deterioration is an ever increasing problem in most parts of Africa, there is an urgent need to provide information on nutrient status which can be used by producers in the region to increase bean yields.

Objectives

1. To estimate DRIS norms for beans using foliar tissue analysis results and associated yield data collected from bean researchers throughout the world.

2. To test the validity of the norms in diagnosis by determining their efficiency in predicting responses to applied nutrients.

Methodology:

Results of tissue analysis and yield data will be collected from researchers throughout the world by writing to them to request the data. The collected data will be stored in a data bank to be used in calculating DRIS norms.

The measured parameters will be calibrated in terms of bean yield by expressing foliar nutrient parameters as ratios, for example, N/P, N/K, Ca/Mg, or as products, such as, N x Ca, so that the most meaningful and discriminatory forms of expression can be identified.

The mean, standard deviation, and variance for each form of expression within each subpopulation in the data bank will be computed. The means of the forms of expression for the high yield population comprise the calibrated norms and represent "optimum" nutrient balance conditions.

A nutrient index is a mean of functions of all ratios containing a given nutrient. The components of this mean are weighted by the reciprocals of the coefficients of variation of the high yielding populations from which the ratio optima or norms are developed. DRIS indices are calculated as follows, for nutrients A through N:

$$\text{A index} = \frac{[f(A/B) + f(A/C) + f(A/D) \ldots\ldots + f(A/N)]}{z}$$

$$\text{B index} = \frac{[-f(A/B) + f(B/C) + f(B/D) \ldots\ldots + f(B/N)]}{z}$$

$$\text{N index} = \frac{[-f(A/N) - f(B/N) - f(C/N) \ldots\ldots - f(M/N)]}{z}$$

where, when $A/B \geqslant a/b$,

$$f(A/B) = \left(\frac{A/B}{a/b} - 1\right) \frac{1000}{CV}$$

or when $A/B < a/b$,

$$f(A/B) = \left(1 - \frac{a/b}{A/B}\right) \frac{1000}{CV}$$

in which A/B is the value of the ratio of the two elements in the plant being diagnosed, a/b is the optimum value or norm for that ratio, CV is the coefficient of variation associated with the norm, and z is the number of functions comprising the nutrient index. Values for the other functions, such as f(A/C), f(A/D), are calculated in the same way as f(A/B), using the appropriate norms and CVs. The DRIS indices have negative and positive values that sum to zero as they measure the relative balance among nutrients. The order of soil requirement is determined by the value of the indices; the most negative index indicates the most required nutrient and vice versa. Those nutrients having negative index values are considered relatively insufficient, while those having positive values are relatively excessive.

To test the validity of the norms, factorial fertilizer experiments from the data bank will be utilized. In addition to that, the results of nutritional screening trials already being conducted in the East African region will be used. Leaf samples will be taken during flowering, and the predicted responses will be compared to the actual responses.

Duration of the research: one year

Date of initiation: 1990

Expiry date: 1991

Proposed budget:

Item	Cost (US $)
A. Computer supplies	300
B. Nutritional screening trials (60 trials)	
1. soil analysis @ $7 x 60	420
2. foliar analysis @ $8 x 60	480
3. Trial inputs	
Field books	50
Plot labels	200
Harvest bags	400
Balances	150
Fertilizers and lime	150
4. Travel	
Per diem	
S.O. 3 visits/season x 5 locations x 2 seasons x $35	1050
F.A. 2 visits x 5 x 2 x $18	360
Allowances for extensionists $10 per trial x 60	600
Vehicle operation 8000km @ $30	2400
C. Correspondence, stationery, secretarial	250
	$7230
Contingency 10%	723
Total	$7953.00

Agricultural Research Corporation
Hudeiba Research Station
P.O. Box 31,
Ed-Damer
Sudan

-

RESEARCH PROPOSAL

Screening different common Bean Genotypes for tolerance to soil Salinity and sodicity

Introduction

Soils of the Northern Region of the Sudan may be classified into three main groups :

a) Gurier or Gerfland soils: These are alluvial deposits of recent origin. Soils which are confined to the main River Nile banks are light in texture, non-saline, non-sodic, with no limitation for plant growth except that they are subject to annual floods and may therefore not be suitable for perennial crops.

b) Karu Soils: These are adjacent to the first group and characterised by having higher clay content (40-50%) and no to moderate salinity and/or sodicity problems. Sodium chloride and sulphate are the major common soluble salts. Almost 95% of agricultural activity in the region lies on this soil type.

c) High terrace soils: These are saline-sodic soils that can not be used for agricultural production without further reclamation.

For the last twenty years bean yields obtained at Hudeiba Research Farm (Karu soil) ranged between 95 to 2600 kg/ha with an average of about 1300 kg/ha. Low yields result from high early losses in plant stand. In attempt to identify the main possible causes of these losses a series of experiments were conducted. Results indicated the following :

a) Early losses in plant stand were mainly attributed to sodium toxcity injury. Leaf burn and gradual death of the plant (at the trifoliate stage) were the characteristic symptoms of injury. Symptoms were associated with high sodium accumulation in the leaves.

b) Symptoms were more pronounced during periods of hot dry weather than during cool humid periods.

c) Inter-varietal differences in susceptibility to sodium toxicity injury were recorded. Among tested varieties, Top crop, Contender, Extender and Tender green were rated as most sensetive; Pinto and Red Mexican as tolerant and variety Ro/2/1 (a local selection) as intermediate. Tolerance to sodicity was associated with sodium compartmentation in the root.

Objectives:

The objective of this proposal is to screen different bean genotypes for tolerance to soil salinity and sodicity.

Methodology

A collection of different bean genotypes (about 2000 enteries) will be grown in two soil types, a) a non-saline non-sodic soil and b) a moderately saline sodic soil, to detect the performance of these lines in order to select for tolerance to saline sodic conditions.

Cultural practices and pest control will be as recommended.

Data to be taken:

a- Soil and tissue analysis
b- Germination counts, sodium toxicity symptoms, phenology .... etc.
c- Dry weight at 50% flowering date.
d- Seed yield and yield components.

Location: Hudeiba Research Farm and a farm of Gurier soil

Duration : Two to three seasons starting 1990/91 winter season

Scientist in charge : Dr. S.H. Ahmed - soil scientist Hudeiba Research Station.

Cooperating Scientist : Dr. Salih H. Salih - Plant Breeder, Hudeiba Research Station.

Requested Budget

Item	Amount (in Sudanese pound*/season/ha)
Land Preparation	500
Casual Labour	3,000
Lab. supplies	3,000
Field supplies	1,500
Stationary	500
Contingencies	500
Total	9,000

An area of three ha will be needed

* Official Exchange rate is follows·

US $ 1 = 4.5 Sudanese pounds

A Summary of Recommendations from the Africa Bean Entomologists Working Group Meeting.

The Meeting was attended by Entomologists from Ethiopia, Somalia, Uganda, Kenia, Burundi, Tanzania, Zambia, Zimbawe, and Swaziland. Country reports highlighted the entomological constraints to bean production in the different countries. Nearly all countries cited Beanfly, Bruchids and Aphids as the principal insect pests of beans. The status of other pests eg. Ootheca spp., Podbugs, Podborers, etc. varied among countries. The Meeting therefore recommended that collaborative research networks be set up across the regions (namely Eastern Africa, Great Lakes and (SADCC) to tackle these problems jointly and suggested areas of emphasis in research on the different pests.

1. Aphids

The Meeting observed that Aphids per se may not cause direct production losses but may do so indirectly through the transmission of BCMV. The Meeting therefore, approved of the Regional Collaborative Research Sub-project on "Aphids and their role in BCMV spread" and recommended that emphasis be place on :

a. Species composition of aphids in bean fields and their population dynamics in relation to BCMV incidence.

b. Determine the species of aphid vectors of BCMV.

c. Assessment of losses directly due to aphids and indirectly through BCMV spread.

d. To generate basic information on BCMV epidemiology in relation to aphid activity.

Participating countries in this network are Zambia, Malawi, Tanzania with Burundi (Dr. A. Autrique) acting as a consultant.

2. Bruchids

The meeting observed that work at CIAT on host plant resistance to bruchids was very much advanced and there was no need to start screening for sources of resistance in the region. The meeting supported the set up of the proposed sub-project on bruchids and recommended that it should be linked with an ongoing one in Somalia and a post-graduate work in Ethiopia.

In general the meeting suggested that bruchid research should focus on :

a. Species distribution.
b. Small farmer storage practices and losses due to bruchid in small farmer storage systems.
c. On-farm testing of bruchid control methods.
d. Host plant resistance [illegible]

base on materials emerging from CIAT.

The cooperating countries in the bruchid network are : Zimbabwe, Somalia, Ethiopia, Lesotho, Burundi, Kenya and Tanzania.

3. Beanfly

The meeting recognised beanfly as the principal insect pest of beans in Africa and recommended that the following areas be emphasised in research on beanflies :

i. Distribution, species composition and population dynamics of beanflies and parasites associated with them. All countries should participate in data collection on these aspects.
ii. Identification of sources and mechanisms of resistance (collaboration between BP, EI, BB and TZ).
iii. On-farm assessment of losses due to beanfly. It was suggested that this be developed as a postgraduate research project perhaps in collaboration with the ICIPE African Regional Postgraduate Programme in Insect Science (ARPPIS).

4. Other Recommendations

- Research on cultural control of beanflies as well as on other pests such as Ootheca, podborers and podbugs should be undertaken directly by National Programmes with support from the Regional Programme.

- Effort should be made to develop linkage between National Programmes and also with other specialised institution of experts both within and outside the region.

- Funding support for short term training and consultancy needs for sub-projects should be made separately from the approved sub-project grants.

- Another meeting should be convened after 2-3 years to assess where we are .

CROPPING SYSTEMS WORKING GROUP

RECOMMENDATIONS

TRADITIONAL CROPPING SYSTEMS

1. It was noted that due to human population pressure coupled with the slow regeneration rate of indigenous tree species which are cut and burnt in the Chitemene system, this system can no longer be sustained. It was therefore recommended that work on fallow enhancement by introducing fast growing nitrogen fixing trees that will replace the Chitemene system be initiated.

   Lead country : Zambia
   Other participants : Tanzania

2. After noting that the usefulness of the Mambwe system is limited by the use of slow growing grasses of low nutrient contents, it is recommended that the efficiency of the system be improved by introducing fast growing legumes into the Mambwe system.

   Lead country : Zambia
   Other participants : Tanzania, Malawi, Mozambique, Uganda and Ethiopia.

3. Despite the obvious advantages of the Guie system it was noted that the system results in losses in soil physical and chemical propeties and reductions in organic matter. It is therefore recommended that investigations into alternative methods (to the Guie system) of seedbed preparation that improve aeration and permeability of vertisols/hydromorphic soils coupled with incorporation grass high in phosphate and/or bringing in inorganic phosphate (e.g. rock phosphate) be initiated.

   Lead country : Ethiopia
   Other participants : Great Lakes

4. Studies on identifying, monitoring and documenting other low input traditional systems of improving soil fertility which are not currently known to the researcher should also be carried out.

   Participants: Undergraduate University and/or Postgraduate students based on need/demand.

CEREAL BEAN CROPPING SYSTEMS

1. With regards to relay cropping investigations, it is recommended that emphasis be put on:

   (a) Investigating the potential of extrapolating existing relay cropping systems (with modifications) to areas and/or countries with similar conditions and,

   (b) The potential of emphasizing on the use of climbing beans as opposed to the bush type (with cereal stalks providing support).

   Lead country : Tanzania
   Other participants : Malawi, Mozambique, Uganda and Kenya.

2. Investigations on fertilizer requirements under intercropping situations should be carried out.

   Lead country : Zimbabwe
   Other participants : Kenya, Malawi, Tanzania, Zambia, Great Lakes, Uganda and Ethiopia.

3. In Ethiopia it has been observed that beans intercropped with sorghum either shows poor establishment or/and growth. It is therefore recommended that the causes of poor bean performance (e.g. effects of allelo-chemicals) in sorghum/bean intercropping systems be investigated.

   Lead country : Ethiopia

4. A study of the disease, insect pest and weed complex in intercrops is also recommended.

   Lead countries : Zambia - diseases
   Tanzania - pests
   Uganda - weeds

BANANA/BEAN, BANANA/BEAN/COFFEE CROPPING SYSTEMS

1. It was noted that the organic matter content and soil nutrient levels in banana/bean cropping systems are on the decline. It is therefore recommended that investigations into strategies aimed at raising or maintaining a high organic matter content in the system be carried out. Associated studies should include monitoring and quantifying nutrient removal from the system and how P and K can be introduced from outside the system.

Lead country : Uganda
Other participants : Rwanda and Tanzania

2. Bush bean types which are lower yielding than the climbing types are grown in most banana/bean systems. However, the introduction of the latter bean type might result in heavier nutrient demands on an already fragile system. It is therefore recommended that studies on the sustainability of intercrops incorporating climbing beans be carried out.

Lead country : Rwanda
Other participants : Tanzania and Uganda.

3. Work on monitoring banana weevils and nematodes in banana/bean associations should also be conducted.

ALLEY CROPPING AND OTHER FORMS OF AGROFORESTRY

1. It was noted that some successful agroforestry related systems have been developed. In such cases it is recommended that they be taken to farmers' fields. For more basic studies collaboration with ICRAF with emphasis on projects that meet the farmers' needs while at the same time sustaining nutrient availability and reducing soil degradation is recommended.

Participants : Countries with specific problems related to Agroforestry systems.

RECOMMENDATIONS OF THE SOIL FERTILITY WORKING GROUP

1. It is recommended that each Region sponsor a regional sub-project to identify and characterise benchmark sites. This would involve sending the leading investigator from each region to IBSNAT as a visiting scientist for 4 weeks to study:

   a) IBSNAT approach to identification and characterization of benchmark sites.

   b) Techniques used in characterization.

   c) The use of the crop growth simulation models, such as BeanGro.

   Upon return this person would identify benchmark sites in the region and characterize these, in collaboration with other national programme scientists.

2. The Fertility Capability Classification (FCC) System is being evaluated for its use as a diagnostic tool by determining its efficiency in predicting responses to applied nutrients. However, its effectiveness could be more rapidly and thoroughly evaluated if data from more trials such as fertilizer use research projects could be contributed to this work.

   It is recommended that data from fertilizer use trials in Kenya and Malawi be integrated with data collected from nutritional screening trials. Alternatively, such projects as FURP/Kenya could evaluate FCC independently using results of their trials. Follow up to be done by Dr. Wortmann.

3. It is recommended that bean researchers in Africa routinely analyze for exchangeable Al and Mn, for ECEC and pH in KCl when doing chemical analysis of low pH soils.

4. A regional sub-project (or a thesis topic) should be proposed to relate nutrient needs of intercropping to those of the component crops in pure stand, using the maize-bean system. This work should be done in Zimbabwe and/or Kenya.

5. Higher degree training on soil fertility constraints is recommended. Research topics include studies of :

a. Mechanism of tolerance to Al toxicity (University of Zambia).

b. Mechanism of tolerance to low P

c. Mechanism of tolerance to low N
(a,b,c would use IBSAN for this work)

d. Sustainability of climbing bean systems (Rwanda).

e. Studies on P - fixation (Sokoine University).

f. Nutrient balances and interactions, especially with Ca : Mg : K (Makerere University).

g. Regression studies of factors limiting yield.

It should noted that a,b,c and e be viewed as long term projects.

6. An International Bean Soil Adaptation Nursery (IBSAN) (25 varieties) has been put together and seed is being multiplied. It is recommended that the varieties be characterized for reaction to :

Al toxicity in South Kivu, Zaire and Zambia;

Low P stress at Misamfu in Zambia and either at Uyole or Hai district in Tanzania, provided importation of germplasm to Tanzania is eased.

Low N stress at Melkassa in Ethiopia and Bunda College in Malawi.

7. It is recommended that there should be regional sub-projects to screen varieties for tolerance to :

Al toxicity
in Zaire and Zambia

Low P
in Misamfu, Zambia and either Uyole or Hai district

Low N
in Melkassa and at Bunda College.

8. It is recommended that on-farm evaluation of the technical and socio-economic effectiveness and acceptability of Minjingu Rock Phosphate be evaluated in Lushoto and Hai districts in Tanzania.

9. It is recommended that the responsiveness of beans to applied gypsum be evaluated on low sulfur soils in Malawi.

10. To facilitate extrapolation of research results, Dr. P.L.G. Vlek of IFDC - Lome is to be contacted to determine if they have a soil fertility data base which may be useful to bean researchers in Africa.

11. It is recommended that the technical and socio-economic aspects of ash be evaluated in Zimbawe and Malawi on farmers' fields.

It is assumed that the principle investigators of the various research projects will assume responsibility for pursuing funding, whether it be from CIAT Regional Programmes or from other sources.

II IN-CIAT TRAINING

Candidate	Sex	Country	Time Frame	Course Title
Wilson Rono	M	Kenya	3 months 15/9 - 10/12/89	Bean Breeding
Haile Kefene	M	Ethiopia	3 months 15/9 - 10/12/89	Bean Breeding
Mengistu Lema	M	Ethiopia	3 months 15/9 - 10/12/89	Bean Breeding
Gedeon Rachier	M	Kenya	3 months 15/9 - 10/12/89	Bean Breeding
Lydia Ireri	F	Kenya	3 months 15/9 - 10/12/89	Bean Breeding

III IN COUNTRY AND REGIONAL TRAINING COURSES

Course Title	Country Benefiting	Location	Candidate	Sex	Time Frame	Remarks
Experimental Design, Analysis and M-Stat	Uganda	Makerere	1 Jane Kisakye	F	3-14 July 89	sponsors: CIAT MoA
			2 Kikoba Edmond	M		CIAT Resource person:
			3 Gumusiriza G.	M		c. Wortmann (UG)
			4 G. Ochieng-Mbye	M		H. Gridley (UG)
			5 Fina Opio	F		B. Grisley (UG)
			6 Michael Adrogu	M		with national Staff.
			7 George Bigirwa	M		Participants: Senior staff of MoA research
			8 Tenywa Moses	M		programs and Makerere University.
			9 M.W.Ogenga-Latigo	M		
			10 J.S. Tenywa	M		
			11 S. Kyamanywa	M		
			12 J.R. Ocen-Ayer	M		
			13 Lastus Serunjogi	M		
			14 Mary Mugisa	F		
			15 M.S. Musaana	F		
			16 Beatrice Kayiwa	F		
Pulses Research Methods Course for Technicians	Ethiopia	Nazreth	1 Berhanu Alemu	M	20/8-1/9/89	IAR/CIAT Training
			2 Tsegaye Gossa	M		CIAT Resource Persons:
			3 Adugna Negeri	M		R. Kirkby (ET)
			4 Bekri Ali	M		J. Mutimba (ET)
			5 Ghirmai Emun	M		H. Gridley (UG), C. Wortmann (UG)
			6 Dalu Ebrahim	M		Resource persons from Alemaya University
			7 Almaz W/Giorgis	F		and IAR
			8 Tamerat G/Yohanes	M		Participants: Alemaya University and IAR
			9 Tsehay Mulaw	F		Researchers
			10 Tsegay Ghidey	M		
			11 Habtu Lemma	M		

			12 Legesse Teshome	M		
			13 Abdulshikur Jemal	M		
			14 Belete Tsegaw	M		
			15 Akirso Choka	M		
			16 Eferem Abera	M		
			17 Shegaw Derbew	M		
			18 Kiflu Kebede	M		
			19 Woldegiorgis T/Giorgis	M		
			20 Tsegaye G/Mariam	M		
			21 Fitsum Girmay	F		
			22 Fissaha Birhane	M		
			23 Girma Assele	M		
			24 Tessema Tesso	M		
			25 Gudeta Ceneda	M		
			26 Getenesh Mitiku	F		
			27 Atkelt Gebre	F		
On-Farm Research (Experimental Phase)	Kenya Ethiopia Uganda	Harare	1 Mercy Wanjiku	F	28/8 - 9/9/89	CIAT Sponsored participants at University of Zimbabwe/CIMMYT regional training workshop.
			2 Yeshi Chiche	F		
			3 Suleiman Musa	M		
Technicians´ Research Methods Course	Uganda	Mukono/UG	1 Suleiman Musa	M	30/10 - 10/11/89	MoA/CIAT Training
			2 C. Turyahabwa	M		CIAT resource persons:
			3 Ndaula Willis	M		J. Mutimba (ET)
			4 Ssekabembe R.	M		C. Wortmann (UG)
			5 Namagembe B.	F		H. Gridley (UG)
			6 Kamya Lawrence	M		W. Grisley (UG)
			7 Mukabaranga J.	F		
			8 Kayondo G. W.	M		Plus:
			9 Malagala Z.S.	M		4 resource persons from MoA,
			10 Nyiro Julius	M		1 from Seed Project,
			11 Masamba S.	M		1 from Makerere University,
			12 Baryamujura C.	M		1 from KARI (Kenya)
			13 T. Karwemera	M		
			14 Katohire David	M		Participants: Somalia and Uganda

			15 Alajo Agnes	F		MoA researchers.
			16 Nalukenge Grace	F		
			17 Zawedde F.	F		
			18 W. Semwogerere	M		
			19 L. Nsereko	M		
			20 Ochen J. Stephen	M		
			21 Monic Munuma	F		
			22 Musoke Titus	M		
			23 Babirye Rose	F		
			24 V. Mwiseneza	M		
	Somalia		25 Omar H. Hussein	M		
			26 Adam Ali Juma	M		
Workshop on Economic Analysis	Ethiopia	Holetta	1 Kassahun Seyoum	M	22 - 26/1/90	IAR/CIMMYT/CIAT Training CIAT resource person - W. Grisley (UG) Other resource persons from CIMMYT, IAR, ILCA, ILO.
			2 Hailu Tafesse	M		
			3 Dereje Dejene	M		
			4 Mohammed Hussein	M		
			5 Aleligne Kefyalew	M		
			6 Regassa Ensermu	M		
			7 Yeshi Chiche	F		
			8 Senait Regassa	F		
			9 Tesfaye Hagos	M		
			10 Asfaw Negassa	M		
			11 Tilahun Melaku	M		
			12 Beyene Tadesse	M		
			13 Abdissa Gemeda	M		
			14 Mohammed Hassena	M		
			15 Chilot Yirga	M		
			16 Hailu Beyene	M		
			17 Kibru Mamusha	M		
			18 Abubeker Musa	M		
			19 Asmare Yalew	M		
On-Farm Research (Diagnostic Phase)	Ethiopia	Harare	1 Yeshi Chiche	F	5 - 23/2/90	CIAT sponsored participant at University of Zimbabwe/ CIMMYT regional training

IV ACADEMIC SCHOLARSHIPS

Candidates	Country	Sex	Degree	Location	Major	Entrance Date	Budget Forecast*	Remarks
Tsedeke Abate	ET	M	Ph.D	Canada/ET	Entomology	8/86	5,000	Thesis support (Beanfly in ET) completed 12/88. Simon Fraser University, Canada with IDRC support. Now returned to Ethiopia
Amos Oree	UG	M	M.Sc.	Sokoine/Arusha	Entomology	1/87	15,000	Beanfly thesis research in TZ completed 12/88. Degree awarded 2/90.
Jane Kisakye	UG	F	M.Sc.	Florida	Agronomy	8/87	25,000	Completed and returned to Uganda 31 May 89.
Amare Belay	ET	M	M.Sc.	Alemaya	Intecropping	8/87	3,000	Bean intercropping thesis support only, in ET. World Bank scholarship. Thesis supervisor: R. Kirkby
Melaku Ayele	ET	M	M.Sc.	Alemaya	Breeding	4/89	10,000	Thesis research started 3/89 at Nazreth, ET. then supplementary research at CIAT. Started
Mohammed Handulle	SO	M	M.Sc.	Wageningen	Breeding	1/90	20,000	
Ahmed H. Hussein	SO	M	M.Sc.	Nairobi	Breeding	12/90	7,500	
Senait Yetneberk	ET	F	M.Sc.	Mysore	Food Science	8/89	15,000	
Ferede Negasi	ET	M	M.Sc.	Alemaya	Entomology	8/89	12,500	Course and thesis in ET; then supplementry research at CIAT. Started Course Work Sept. 89.
Amare Abebe	ET	M	Ph.D	Colorado/ET	Breeding	8/89	40,000	Proposed thesis on drought resistance in ET Started Course Work August 89.
Habtu Assefa	ET	M	Ph.D	Wageningen/ET	Pathology	4/89	5,000	Partial support only, including thesis research in ET. Wageningen scholarship. Initial coursework completed 9/89. Scholarship funds are for 1992.

Michael Adrogu	UG	M	M.Sc.	Cornell	Agronomy	8/89	35.000	
Theresa Sengooba	UG	F	Ph.D	Wageningen/UG	Pathology	?	(15,000)	RP support for development of proposal and dissertation and external supervision. Research funds from subproject. ??
Fina Opio	UG	F	Ph.D	Sokoine	Pathology	9/89	15,000	RP support as for T. Sengooba (above). Formal acceptance dated 31/5/89. Also study visit Nebraska, USA 10/89.
Beatrice Male-Kayiwa	UG	F	Ph.D	Dar/UG	Breeding	9/89	15,000	RP support as for F. Opio (above). H. Gridley thesis superviser.
Sophy Musaana	UG	F	Ph.D	Dar/UG	Breeding	9/89	15,000	RP support as for F. Opio, H. Gridley thesis supervisor.

*

unbracketed budget forecasts indicate an RP commitment has been made.
Bracketed budget forecasts indicate no RP commitment has been made.

V(A) REGIONAL WORKSHOPS

Candidates	Country	Sex	Location	Subject	Time Frame	Remarks
1 Ferede Negasi	ET	M	Nairobi/KE	African Bean Entomologists Working Group Meeting	7-9 August 89	Sponsored by 3 regional bean projects. CIAT resource persons: K. Ampofo (TZ), B.Smithson (TZ) B. Grisley (UG)
2 Tsedeke Abate	ET	M				
3 Beatrice Tengechu	KE	F				
4 John Nderitu	KE	M				
5 Amos Oree	UG	M				
1 Teresa Sengooba	UG	F	Kampala/UG	Virus Working Group Meeting	17-21/Jan/90	Sponsored by Eastern Africa and Southern Africa regional bean Projects and IITA. CIAT resource persons: D. Allen (TZ), H.Gridley (UG)
2 Fina Opio	UG	F				
3 Samson Owera	UG	M				
4 Michael Omunyin	KE	M				
5 Wangai	KE	F				
1 Teshome Regassa	ET	M	Nairobi /KE	Cropping Systems/ Soil Fertility Working Group meetings	12-14/Feb/90	Sponsored by Eastern and Southern Africa regional bean projects. CIAT resource persons: C.Wortmann (UG),
2 John Kavuma	UG	M				
1 J.K.Mukiibi	UG	M	Mukono/UG	National On-Farm Research Orientation Workshop	13-16 Nov.89	CIAT/ CIMMYT and USAID Resource persons: R.Kirkby(CIAT) P. Anandajayasekeram (CIMMYT) Nine expatriate staff of MFAD/ USAID and other projets also participated.
2 S. Zziwa	UG	M				
3 J.M.A. Opio-Odongo	UG	M				
4 G. Gumisiriza	UG	M				
5 I. Kibirige-Sebunya	UG	M				
6 J.B.Kavuma	UG	M				
7 G.N.Otim-Nape	UG	M				
8 M.Ameny	UG	M				

9	E.Y.Baguma	UG	M
10	C.N.Ocitti P'oboya	UG	M
11	D.T.Kyetere	UG	M
12	T.Mafulira	UG	M
13	E.A.Nyakana	UG	M
14	E.V. Ssendiwanyo	UG	M
15	E.Kikoba	UG	M
16	N.J.K.Nangoti	UG	M
17	G.Turyamureeba	UG	M
18	J.Gongo	UG	M
19	G.Ochola-Etolim	UG	M
20	J.S.Ochen	UG	M
21	D.Baguma	UG	M
22	J.Imanyoha	UG	M
23	J.Ochieng-Mbuye	UG	M
24	E.K Igurwa	UG	M
25	A.R. Semana	UG	M
26	M.M. Okiror	UG	M
27	P. Nteziryayo	UG	M
28	Jane Kisakye	UG	F
29	M. Nabasirye	UG	F
30	Kataike Ndoboli	UG	F
31	G.Akao	UG	F
32	K.V. Byanyima	UG	F
33	F. Larry Adupa	UG	M
34	N.D.Bafokuzara	UG	M
35	T Arach	UG	M
36	F.N Nkakyekorera	UG	F
37	E.Wandera	UG	F
38	J.Tumúshabe	UG	F
39	J.Nyiro	UG	M
40	K. Mukasa	UG	F
41	E.M. Matovu	UG	M

1 Teresa Sengooba	UG	F	Kampala/UG	Virus Working Group Meeting	17-21/Jan/90	Sponsored by Eastern Africa and Southern Africa regional bean Projects and IITA. CIAT resource persons: D. Allen (TZ), H.Gridley (UG)
2 Fina Opio	UG	F				
3 Samson Owera	UG	M				
4 Michael Omunyin	KE	M				
5 Wangai	KE	F				
1 Teshome Regassa	ET	M	Nairobi /KE	Cropping Systems/ Soil Fertility Working Group meetings	12-14/Feb/90	Sponsored by Eastern Southern and Great Lakes regional bean projects. CIAT resource persons: C.Wortmann (UG), T. Edje (TZ)
2 John Kavuma	UG	M				
3 Peter Kamoni	KE	M				
4 Julius Zake	UG	M				
1 Benjamin A Oruko	KE	M	Nairobi/KE	Second Regional Workshop On Bean Research in Eastern Africa	5 - 8 March 1990	Resource persons from CIAT
2 P.M. Kimani	KE	M				Cesar Cardona,(CO)
3 Patrick M.Kabira	KE	M				Charles Wortmann,(UG)
4 J.H. Nderitu	KE	M				Howard Gridley,(UG)
5 A.M.M. Ndegwa	KE	F				William Grisley,(UG
6 J.G. Muthamia	KE	M				Peter Hanson,(CO)
7 S.G.S. Muigai	KE	M				Robin Buruchara,(RW)
8 Samuel T. Kanyagia	KE	M				Roger Kirkby (ET
9 Michael K.Omunyin	KE	M				Jeff Mutimba (ET)
10 Gideon O. Rachier	KE	M				Julia Kornegay (CO)
11 Hans Sieber	KE	M				
12 Isaac Mulagoli	KE	M				
13 K.B. Paul	KE	M				
14 A.D. Okoko	KE	M				
15 Amos Oree	KE	M				
16 Lydia Ireri	KE	F				
17 W.K. Rono	KE	M				
18 A. Salem Saumtally	MS	M				
19 Faizal M. Ismael	MS	M				
20 Salih Hussein Salih	SU	M				
21 Ali K. Mohamed	SU	M				
22 Abdirahman A.	SO	M				

23 Abdiasis Sheikdon Farah	SO	M
24 Kidane Georgis	ET	M
25 Teshome Girma	ET	M
26 Habtu Assefa	ET	M
27 Tenaw Workayehu	ET	M
28 Mitiku Haile	ET	M
29 Edmond Kikoba	UG	M
30 Theresa Sengooba	UG	F
31 Beatrice Male-Kayiwa	UG	F
32 Samson Owera	UG	M
33 Jane Kisakye	UG	F
34 Sophy Musaana	UG	F
35 Asinasi Fina Opio	UG	F
36 Samuel Kyamanywa	UG	M
37 Charles Mkwiine	UG	M
38 Victor Ochwoh	UG	M
39 Abdulkadir M.Abikar	UG	M

V(B) OTHER WORKSHOPS

Candidates	Country	Sex	Location	Subject	Time Frame	Remarks
Theresa Sengooba	UG	F	CIAT/CO	CIAT Bean Program Strategic Planning Workshop for 1990s	1-5 May 1989	Stayed on for additional week's work at CIAT
S.T. Kanyagia	KE	M	CIAT/CO	International Conference on Snapbean Production and Research in Developing Countries	16-20 Oct. 89	Stayed on for additional week's work at CIAT

VI MONITORING TOURS

Candidates	Tour Locations	Time Frame	Reason for Tour	Remarks
Samson Owera (UG) Abdulrazak Yusuf (ET)	Ethiopia-Arusha Hararghe, Sidamo, Rift Valley	8/89	Assess bean viruses on farm, and collect specimens for identification	
Wilberforce Sakira (UG), Victor Ochwoh (UG),	Kagera, TZ Rakai, UG	12-21/11/89	Agroforestry and Banana/bean cropping systems	Acompained by CIAT resource person: C. Wortmann (UG), D. Allen (TZ). Also researchers from Rwanda & Tanzania.
Habtu Assefa /ET	Kawanda, UG Thika, KE	12/89	Bean rust	Subproject Coordination

XIII PROJECT SUPPORT STAFF 1989

Name	Location	Speciality	Date of Employment
Kamya Erukana	Uganda	Driver	07/86
Abesha H-michael	Ethiopia	Secretary	11/86
Deneke Tsehaye	Ethiopia	Driver	04/87
Tesfaye Kassa	Ethiopia	Messenger Cleaner	07/88
Harriet Mukasa	Uganda	Financial and Admin. Assistant	12/88
Paul Kirabit	Uganda	Driver	
Suleiman Musa	Uganda	Technician (Agronomy)	
J. Nyonja	Uganda	Driver	07/89
Khasifa Kadda	Uganda	Secretary	07/89
Eskedar Kebede	Ethiopia	Accountant/Secretary	09/89
Abadi Haile	Ethiopia	Financial and Admin. Manager	11/89

XIV REGIONAL STAFF TRAVEL

Period	Staff Member	Country	Purpose
7 - 12 April/89	Roger Kirkby	Rwanda	Represent CIAT at Planning Workshop for Phase II Great Lakes Project
14 Apr - 6 May 89	Roger Kirkby	-	Home leave
13 - 21 May 89	Bill Grisley	Ethiopia	Areka diagnostic survey
4 - 9 June 89	Roger Kirkby	Uganda	Africa Regional staff meetings
4 - 9 June 89	Jeff Mutimba	Uganda	" " " "
14 - 18 June 89	Howard Gridley	Ethiopia	Prepare for planting trials
18 - 21 June 89	Roger Kirkby	Kenya	Accompany Donors Review
21 - 26 June 89	Roger Kirkby	Uganda	" " "
5 - 11 July 89	Roger Kirkby	Kenya	" " " and Egerton University
12 - 13 July 89	Roger Kirkby	Burundi	Discuss CIAT/ISABU collaboration
13 - 14 July 89	Roger Kirkby	Rwanda	Discuss CIAT/ISAR collaboration
14 - 15 July 89	Roger Kirkby	Kenya	Interview candidate for Senior Research Fellowship
19 - 24 July 89	Bill Grisley	Ethiopia	Discuss questionnaires, accompany CIAT External Program Reveiw and informal survey survey in Hararghe
24 - 29 July 89	Charles Wortmann	Thika & Kisii Kenya	Informal survey, Kisii
25 - 29 July 89	Roger Kirkby	Rwanda	Accompany CIAT External Program Review
7 - 18 August 89	Charles Wortmann	-	On leave (incl. local leave)
6 - 12 August 89	Bill Grisley	Kenya	Attend Bean Entomology Meeting and design diagnostic surveys with KARI
23 Aug - 3 Sept. 89	Howard Gridley	Ethiopia	Assist Technicians Course and visit research stations/data collection
23 Aug - 5 Sept. 89	Charles Wortmann	Ethiopia	" " " "
4 - 6 Sept. 89	Bill Grisley	Kenya	Survey preparation
2 - 8 Sept. 89	Jeff Mutimba	Tanzania	Discuss SADCC/CIAT training needs
8 - 15 Sept.89	" "	Kenya	Discuss KARI training needs; organise trainees departure to CIAT.

15 - 20 Sept. 89	Jeff Mutimba	Uganda	Prepare for technicians course
3 - 7 Oct. 89	R. Kirkby	Botswana	SACCAR - staffing for Southern Africa
7 - 9 Oct. 89	J. Mutimba	Kenya	Training organisation
7 - 11 Oct. 89	R. Kirkby	"	Coordination
11 - 13 Oct. 89	"	Tanzania	Coordination with SADCC/CIAT
15 - 22 Oct. 89	C. Wortmann	Kenya	Assist diagnostic survey
25 Oct. - 10 Nov.89	J. Mutimba	Uganda	Technicians course; arrange virology meeting
9 - 14 Nov. 89	H. Gridley	Kenya	Thika, and Muguga quarantine issue
8 - 12 Nov. 89	R. Kirkby	Kenya	Coordination
12 - 19 Nov. 89	R. Kirkby	Uganda	OFR workshop, Mukono
11 - 14 Nov. 89	J. Mutimba	Kenya	Administration
15 Nov. - 16 Dec. 89	"	Colombia	Develop training materials; CIAT review
28 Nov. - 17 Dec. 89	R. Kirkby	"	CIAT Annual Reviews & Coordination
1 - 17 Dec. 89	C. Wortmann	Colombia	CIAT Annual Reviews & Coordination
" " "	H. Gridley	"	" " "
" " "	B. Grisley	"	" " "
17 - 19 Dec. 89	C. Wortmann	USA	Cornell Univ. M. Ugen's Program
17 - 21 Dec. 89	B. Grisley	USA	IFPRI - production & consumption studies
21 - 29 Jan. 90	R. Kirkby	Sudan	Assess needs & discuss collaborative research
22 - 27 Jan. 90	B. Grisley	Ethiopia	Economics course & survey analysis
23 - 31 Jan. 90	Abadi Haile	Uganda	Administration
1 - 3 Feb. 90	"	Kenya	"
4 - 11 Feb. 90	H. Gridley	Madagascar	Assess Germplasm needs & training
7 - 10 Feb. 90	Jeff Mutimba	Kenya	Workshop preparation
11 - 17 Feb. 90	C. Wortmann	Kenya	Followup on survey; Soil fertility working group.
12 - 20 Feb. 90	H. Gridley	Ethiopia	Assist trial analysis; regional multiplication
18 - 24 Feb. 90	R. Kirkby	Kenya	ICRAF - participative OFR workshop
4 - 31 Mar. 90	"	"	Regional workshop; steering committee; coordination
3 - 14 Mar. 90	C. Wortmann	"	Regional workshop; visit research stations
3 - 14 Mar. 90	H. Gridley	"	" " " " "
3 - 10 Mar. 90	B. Grisley	"	Regional workshop
2 - 11 Mar. 90	J. Mutimba	"	" "
4 - 15 Mar. 90	Abadi Haile	"	Administration
29 Mar - 1 Apr.90	Jeff Mutimba	"	Training Organisation

N.B.
Frequent short trips to nearby locations within base country are not reported above,

XV NON - REGIONAL CIAT STAFF TRAVEL TO EASTERN AFRICA REGION

Name & Base Location	Date	Country Visited	Purpose
David Allen, Pathology Arusha	17-20/5/89	Uganda	Disease-free seed multiplication; discuss F. Opio' PhD proposal; Coordinate BCMV research.
Julia Kornegay, Breeding Cali	4-7/6/89	"	Germplasm evaluation & CIAT staff mtg.
M. Pastor-Corrales, Pathology Cali	"	"	" " " "
James Ampofo, entomology Arusha	"	"	Discuss entomology research f& CIAT staff mtg
" " "	11-18/6/89	Somalia	Work with bruchid research subproject
Douglas Pachico, Economist Cali	18/6-7/7/89	Kenya/Uganda Ethiiopia	Donors Review
Barry Smithson, Breeding Arusha	17-23/9/89	Ethiopia	Data Collection, breeding trials
Douglas Pachico, Program Leader Cali	1-4/11/89	Ethiopia	Coordination
J. Vetten, Virology Univ.Brounschweig. W.G.	12/89	Sudan	Virus disease identification
Francisco Morales, Virology Cali	15-16/1/90	Ethiopia	PPRC - Collaborative Research
J. Vetten, Virology Brounschweig W. German	16-21/1/90	"	Virology Working Group
D.Walkey, Virology Wellesbourne, UK.	"	"	" " "
N. Spence Wellesbourne, UK	"	"	" " "
" " " "	21-25/1/90	Kenya	Virus collecting
Teresa Gracia, Participative Research, Cali	13-27/2/90	Ethiopia	Develop course on participative OFR
Louise Sperling, Anthropology Rubona	14-27/2/90	Ethiopia	" " " "
Kwasi Ampofo, Entomology	4-13/3/90	Kenya	Regional Workshop; develop collaborative

Arusha			research
Julia Kornegay, Breeding Cali	"	"	" " " "
Peter Hanson, Breeding Cali	"	"	" " " "
Cesar Cardona, Entomology Cali	"	"	" " " "
Kwasi Ampofo, Entomology Arusha	13-17/3/90	Uganda	Collaborative Research on bruchids
Cesar Cardona, " Cali	"	"	" " "
Peter Hanson, breeding Cali	"	"	CIAT support in breeding