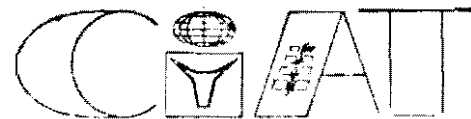


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EIGHTH MEETING
HELD AT THE LESOTHO SUN HOTEL
MASERU, LESOTHO
ON 5-6 MARCH, 1990



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Southern Africa Development Coordination Conference
SACCAR Private Bag 00108
Gaborone Botswana



Centro Internacional de Agricultura Tropical

Apartado A'ereo 6713
Cali - Colombia

Regional Programme on Beans in Southern Africa

Selian Research Centre
P.O. Box 2704, Tel. 057-2268
Telex 42106 CANWHEAT TZ
Arusha, Tanzania

Arusha, May 18th, 1990

Dear

Please find attached draft Minutes of the Eighth Meeting of the Steering Committee of the SADC/CIAT Regional Programme on Beans in Southern Africa, held at the Lesotho Sun Hotel, Maseru, Lesotho on 5-6 March, 1990.

Yours sincerely,

DAVID J. ALLEN
Regional Coordinator

MINUTES OF THE EIGHT MEETING OF THE STERRING COMMITTEE OF THE
SADCC/CIAT REGIONAL PROGRAMME ON BEANS IN SOUTHERN AFRICA, HELD
AT THE LESOTHO SUN HOTEL, MASERU, LESOTHO ON 5-6 MARCH, 1990

Those present :

- Miss Zodwa Mamba, Malkerns Research Station, P.O. Box 4,
Malkerns, Swaziland (Lady Chairman).
- Dr. Clemence S. Mushi, Agricultural Research Institute-
Lyamungu, P.O. Box 3004, Moshi, Tanzania.
- Dr. Alex Mkandawire, Bunda College of Agriculture, P.O. Box
219, Lilongwe, Malawi.
- Dr. Joyce Mulila-Mitti, Msekera Research Station, P.O. Box
510089, Chipata, Zambia, (6th March only).
- Dr. Garry Massey, Maseru Research Station, P.O. Box 829,
Maseru 100, Lesotho.
- Mr. Simon Moima, Maseru Research Station, P.O. Box 829,
Maseru 100, Lesotho.
- Mr. E. Mosarwe, Sebele Research Station, P.B. 0033,
Gaborone, Botswana.
- Mr. Manuel Amane, Instituto Nacional de Investigacao
Agraria (INIA), C.P. 3658, Mavalane, Maputo, Mozambique.
- Dr. Dennis Wanchinga, SACCAR, Private Bag 00108, Gaborone,
Botswana.
- Mr. Trevor Sykes, CIDA/SADCC Programme, P.O. Box 2619,
Harare, Zimbabwe.
- Dr. David J. Allen, SADCC/CIAT Regional Bean Programme, P.O.
Box 2704, Arusha, Tanzania (Regional Coordinator).
- Mrs. Victoria Sutherland, CIDA/SADCC Programme, P.O. Box
2619, Harare, Zimbabwe, (Observer).
- Dr. Lloyd Strachan, 34 Foreht Crescent, Aurora, Ontario,
Canada L4G 3E8 (Observer; Team Leader CIDA/SACCAR Mid-
Term Review of SADCC/CIAT).

Absent with apologies :

- Mrs. Olivia Mukoko, Crop Breeding Institute, P.O. Box 81000,
Causeway, Harare, Zimbabwe.
- Mr. Francisco Eduardo, Faculdade de Ciencias Agrarias,
C.P. 236, Huambo, Angola.

1. Introduction

The Lady Chairman opened the meeting and introduced members, welcoming especially Mr. E. Mosarwe from Botswana and Mrs. Victoria Sutherland and Dr. Lloyd Strachan both of whom were present as observers in connection with the mid-term review of the regional programme.

2. Agenda

The Lady Chairman drew attention of members to the proposed Agenda (Appendix 1) which was duely ADOPTED. It was further NOTED that emphasis was to be given to discussing a Workplan for

the CIDA/SACCAR Mid-term review of the SADCC/CIAT regional programme, and Dr. Strachan was invited to introduce what was intended. Dr. Strachan then distributed a draft workplan and a questionnaire (Appendix 2), requesting that the latter be returned completed to him the following day. Trevor Sykes reminded members of discussion held at the 7th SC (See Minutes p.5, viii) that a two phase review had been considered but found impracticable : the first phase had been reduced to attendance of the 8th SC by the team leader, to circulate a questionnaire, to finalize the work plan and to see the operation of the SC. This was reiterated by Victoria Sutherland. Dennis Wanchinga asked if SC members were aware of the project document and David Allen confirmed that they were : Mr. Kwalambota had drawn attention to this document at the 7th SC. The Lady Chairman ended the discussion by confirming that a slot would be reserved in the Agenda at the beginning of proceedings the following morning.

3. Minutes of the 7th SC Meeting

Dr. Alex Mkandawire proposed that these Minutes be accepted as a true and accurate record, and this was seconded by Dr. Clemence Mushi ; they were duely ADOPTED.

4. Matters arising from those Minutes

(i) p1 : Mr. Mosarwe apologized for missing the last meeting, saying that had not been his intention.

(ii) p 3 (viii) : Dr. Mkandawire asked what was the status of the small bundle thresher expected from Lesotho. Allen said that Massey had had a change of heart over the thresher which had not been shipped to Malawi. This was later confirmed by Massey.

(iii) p.4 (xvi) : Dr. Mushi asked the RC for the status of the publication of the Breeders Workshop Proceedings. Allen replied that they were now complete and publication could be expected within about one month.

(iv) p.4 (xviii) : Mkandawire asked Allen about the position regarding recruitment of the Regional Breeder to be based in Malawi. Allen replied that a nomination had been sent by CIAT to SACCAR in about Sept. 1989 and, to his knowledge, SACCAR had approved the candidate whose credentials had been forwarded to Malawi sometime in Oct. 1989. Mkandawire said that neither he nor his Chief Agricultural Research Officer was aware of this. There was need for urgency in filling this post ! Wanchinga confirmed that SACCAR had indeed approved the nomination which had been forwarded to Malawi; he would follow-up on this on return to Botswana.

(v) p.4 (iv) : Zodwa Mamba said that none of the Regional Scientists had yet visited Swaziland as requested. Since the Rural Sociologist's survey was planned for April, it was vital that atleast the Economist visit Swaziland urgently. Massey added that he hoped this visit would be linked to a visit also to

Lesotho. The RC agreed to follow-up on this (The Economist was scheduled to visit both countries in the approximate period 12-21 March).

(vi) p.5 (v) : Massey said that the drought nursery had never been received (and no request had been received in Ethiopia for such a nursery in 1989 : DJA). Mkandawire confirmed that enough seed of entries was available in Malawi; future requests (copied to the RC) could be made direct to Mkandawire.

(vii) p.5 (vii) : Allen confirmed that the Regional Agronomist did visit Angola in January 1990.

(viii) p.5 (vii) : Mkandawire asked if the Regional Economist had yet visit Zimbabwe. The RC agreed to investigate this (Scheduled to arrive in Zimbabwe on 21 March : DJA).

(ix) p.5 : Mkandawire told the members that On-farm research was now starting up in Malawi. He would welcome the Regional Agronomist's input to a meeting, scheduled for 9-10 April, in which priorities are to be set. This request was noted by the RC. (Visit now arranged : DJA).

(x) p.6, second para : In the absence of Dr. Mulila-Mitti, Allen remarked that he understood that two graduates on the Food Legume Research Team in Zambia were to be posted to Northern Province, as part of a decentralization. This is a welcome step that is likely to strengthen bean research in the North where the bulk of the crop is grown.

(xi) p.6, sixth para : Mushi confirmed that RP assistance is needed to strengthen OFR in the Southern Highlands of Tanzania. Allen remarked that in view of the imminent withdrawal of Nkobole as TA in Lesotho (where his salary is paid by the LAPIS Project, which is soon to wind up), Nkobole would soon be available to fill such a position in Tanzania. Dr. Mushi was asked to liaise with the Director of Uyole Agricultural Centre over such a placement.

(xii) p.6, last para : Mushi reported that the Tanzania NP was now starting to introduce germplasm direct via Kilimanjaro to TPRI, where the RP has helped to improve their close quarantine facilities. Grace Olotu has now left from the Quarantine Station to go on training at CIAT.

(xiii) p.6, last para : Mushi added that housing for the NP remains a major problem. Allen said that there now seems some chance that construction of houses at Selian might become part of a new CIDA Project now under discussion as a successor to the current Tanzania-Canada Wheat Project. Sykes confirmed that this was the case, adding that CIDA recognizes the need for housing at Selian.

(xiv) p.7, first para : Zodwa Mamba reported that on-farm trials in Swaziland were jeopardized by a failure of seed multiplication at Big Bend. She now intends to multiply in the lowveld during the main season (March). But this then raises seed storage problems, from harvest (June). Mushi added that seed increase for OFT is also a problem elsewhere; the choice of a suitable site is vital. He suggested that the RP should look into off-season seed multiplication. Massey said that NPs seldom have the mechanism for such seed increase. How might CIAT help in making Governments more aware of the seed production bottleneck ? Allen said that CIAT recognizes the importance of seed production and has growing commitment to small scale pilot schemes for bean seed multiplication on-farm. Massey encouraged CIAT to write a letter to emphasize the importance of seed production to Governments, copying the letter to technical aid projects. Sutherland added that it should also be copied to SACCAR, with reference to regional operations. Sykes suggested the inclusion also of SADCC Food Security, to whom the topic is pertinent.

(xv) p.8 (ii). It was NOTED that Mr. Mitti's intercropping sub-project had been revised

(xvi) p.8 (iii). Allen drew to the attention of members the draft agreement. It was AGREED to discuss this later on the Agenda.

(xvii) p.9 (i). Allen summarized the current status of short-term training at CIAT, confirming that Olotu had already left. Offers for training with effect from Sept 1990 had been made to Mamba and Nleya, and for early 1991 to Gregorio Gongolo. Mrs. Abdullahs' visit was now scheduled for August 1990.

(xviii). p.9 (ii). Mosarwe emphasized that training courses in the region for graduates be encouraged.

(xix) p.10, fifth para : Allen, who confirmed that sufficient funds were available to two more masters degrees, reported the personal withdrawal of Norman Simelane's MSc candidature. The Chief Research Officer in Swaziland had requested that the slot be kept open for one month for another candidate from Swaziland, and this was ACCEPTED by the committee, with the proviso that simultaneously new applicants are sought from elsewhere.

(xx) p.11 (iv) : The RC confirmed that the CIAT/IITA Legume Virus Working Group meeting, and the joint Cropping Systems and Soil Fertility Working Groups, had all been convened. Preliminary reports/recommendations are appended (Appendix 3 and 4, respectively) and full proceedings will be published in due course. Massey was asked if he had drafted a proposal for a weeds workshop, as he had been asked to do. Discussion led to the identification of sources of relevant information (e.g. Strategy for Integrated Pest Management and Weed Control in SADCC Countries, C.R. Namponya (Ed.), SACCAR 1989; A weeds training

course in Uganda, (CIAT) as well as to the decision that the proposal be shelved, atleast until the return of Emmanuel Pomela to Lesotho.

(xxi) p.11 (v) : Allen reported that the monitoring tour of the Kagera Basin had been a great success and had stimulated joint work on soil fertility (Report in Appendix 5).

(xxii) p.12 (12) : Allen reported that nominations for the 1989 prize had been forwarded to CIAT headquarters where the winner would be selected. Dr. Mushi asked if SACCAR had been informed. The RC replied that SACCAR was not involved in this case, because funds were CIAT core, independent of the RP (SACCAR is automatically informed of all activities, through membership of the SC and its Minutes : DJA). The winner has not yet been named.

(xxiii) p.13 (i) : it was NOTED that there had been no applicants for opportunities advertised by the Social Science Research Council.

(xxiv) p.13 (iv) : Allen said that there was current discussion at a high level among the IARC's on the standartization of per diem rates. Wanchinga said that he considered this was an SC decision; at SACCAR, UN rates are applied and found acceptable. The greater financial freedom is itself an incentive to workshop participants.

5. Regional Collaborative Research Sub-projects

(i) Reports from sub-projects in progress.

Dr. Mushi presented an interim report (Appendix 6) received from Dr. J. Cuthbert on the Nematology sub-project. Since it was noted therefrom that all samples had been processed, it was important to seek data in a full technical report at the time of the Second SADCC regional bean workshop, in Morogoro in September. The SC further requested that a financial report be presented at the 9th SC (also in Morogoro in Sept. 90).

With regard to the BCMV sub-project, Allen mentioned that at the recent Legume Virus Working Group meeting, it had been noted that the linkages between Prof. A.F. Lana's sub-project and that of Dr. S.P. Owera's (at Makerere Univ., Uganda) were unlikely to develop owing to the latter's departure. However, links within the SADCC region, especially with Zambia, were strengthening. It was AGREED that Lana be invited to report on progress at the Sept. Workshop in Morogoro. Ms. Mamba mentioned the recent visit of Dr. D.G.A. Walkey to Swaziland, as part of a survey of the IHR/CIAT Special Project (i.e separately funded, by ODA) to identify BCMV strains : she eagerly awaits their report.

From discussion on the intercropping sub-project, the SC NOTED that the questionnaire had been drafted with input from

many sources, pre-tested widely, then changes had been incorporated. The final format had been reached. Respondents were to be individual farmers, perhaps with a sample size of 50 per country. After long discussion, it was CONCLUDED that the questionnaire be adopted in its present form for surveys of Malawi, Zambia and Zimbabwe (50 farmers each) in the current season, and in Tanzania (preferably 3 clusters of 50 farmers each, in view of the large and diverse areas of bean production involved) in the long rains season of 1990. Other countries (Lesotho, Mozambique, Swaziland) should proceed in drafting plans (and a budget to cover enumerators if necessary) for a start to be made next season. Discussion concluded with the observation that not all parts of the questionnaire would prove applicable to all areas.

Dr. Mkandawire presented reports on research progress (Appendix 7) and a financial report (Appendix 8) on the drought sub-project. The former was ACCEPTED by the SC who AGAIN REQUESTED that financial reports should follow the format given in the budget as in the approved proposal (see also Minutes 7th SC, p. 7). Mkandawire mentioned the drought work was linked to a special project supported independently by the German and Israeli Governments; this was a source of equipment. Sowing is planned for June/July. One component of the drought sub-project is a study of the effect of cropping systems on drought, under Tanzania coordination. On being asked of its status, Dr. Mushi said that the questionnaire had been suspended in the absence of Ndakidemi, but it would now be taken up by Dr. Emil Mmbaga. Mkandawire reminded the Committee that a third component of the drought sub-project is the drought nursery (ABDREN), distributed from Ethiopia. The nursery received in Lesotho had been frost damaged and that in Zimbabwe had succumbed to excessive drought. Zimbabwe has now received another nursery and one is enroute to Swaziland. This component is coordinated by Zambia (Kanenga and Mulila-Mitti). The last component, also coordinated by Zambia under Mr. Martin Mbewe, focusses on breeding for drought tolerance (Appendix 9), a proposal for which was submitted by Mulila-Mitti. It was NOTED that promising drought tolerant materials had been given to Mbewe by Mkandawire for crossing in Zambia. A budget of US\$ 6000 had been drawn, and this was APPROVED, on the understanding that the technical content of the proposal be scrutinized by three "referees" selected by the RC.

Dr. Mkandawire then presented a statement (Appendix 10) on the finances of the angular leaf spot sub-project which, it was NOTED by the Committee, also did not follow the required format. Mkandawire was asked to ensure that financial reports in future followed line items as given in the approved budget. Otherwise, expenditures were impossible to interpret. It was also mentioned that promising materials, both local and those received from CIAT-Colombia and the Great Lakes (presumably Zaire) were currently in the field. Some selections had been sent to Zambia and they can be made available for Tanzania.

With regard to the sub-project on biological nitrogen fixation, it was NOTED that since the departure of Mloza-Banda for further studies, little work had been accomplished on this sub-project which had received funds only for its first year. Dr. S.K. Mughogho was said to have considered preparing an all-embracing BNF proposal for consideration at the Soil Fertility Working Group, but apparently this had not been among the topics discussed. Some follow-up is required.

Dr. Mulila-Mitti then drew attention to the aphid sub-project, coordinated from Zambia but with strong links with Malawi. Aphid population build-up had been monitored on 23 lines at several sites (including Dedza), samples collected and the species identified. The aphid training course run at Bunda College had been most successful, though it was NOTED that the budget for the course had been overspent by US\$ 1,000. A report on the course is attached (Appendix 11).

Dr. Mushi then reported on the status of the sub-project on breeding for resistance to beanfly, coordinated by Tanzania. Mushi said that among seed imported from CIAT, 128 lines had been released by the National Plant Quarantine Service only in November 1989, after some delay. As a result, the progress made by the sub-project was behind schedule.

(ii) Revised proposals

On behalf of Mrs. Mukoko, Allen submitted the revised proposal for a sub-project on bean storage and bruchids, prepared by Dr. Denash Giga from Zimbabwe (Appendix 12). Long discussion ensued; the main points that emerged were the following :

- Mkandawire asked for information on the working of funds for Pan-Africa sub-projects, with links outside the SADCC region, and Wanchinga supplemented this question by asking for CIDA's opinion on the accountability in shared activities across regions, since it was obviously important to ensure that funds intended for SADCC were indeed deployed therein. Allen replied that the SADCC/CIAT RP provided support only to the components within SADCC. In this sub-projects' case, work in Somalia and Ethiopia was supported by CIAT's RP for Eastern Africa. Victoria Sutherland added that it was possible to pro-rate (e.g. number of participants from a given region) for shared activities, and this indeed is what is done.

- Some amendments are needed to the countries cited to be involved. It was NOTED and AGREED that, in the absence of Lillian Pomela from Lesotho, that Lesotho's commitment be shelved until her return. Amane expressed interest that Mozambique become involved, and Zodwa Mamba wanted to add Swaziland. Mkandawire said that Malawi's entomologist would like to be involved too, but without financial implications for the sub-project. And Mushi noted that among the three Tanzanian entomologists included, additional funds would be required to support the entomologist at Uyole.

- While noting much interest had been expressed in this topic, some awkward debate centred on whether or not some funds be awarded to Giga so that a start could be made. Eventually, the SC AGREED WITH REGRET that this was not acceptable, because of several important defects in the proposal in its present form. These were : that the methods described are much too imprecise; that the objectives are insufficiently clear; that a clearer breakdown of the budget was required; and that the format of the proposal should follow that agreed upon for regional sub-projects.

- Sykes suggested that techniques used by germplasm botanists in sampling could be usefully applied to sampling in this study. Giga should be encouraged to contact Helen Moss in the Dept of Crop Science in the University of Zimbabwe in this regard.

Finally, it was CONCLUDED that independent opinions be sought from three specialists who would review the proposal; meanwhile Allen should obtain a copy of the proposal on bruchids approved by the Eastern Africa RP.

(iii) Sub-project reporting

The Lady Chairman, on turning to this item on the Agenda, asked the RC to outline his intent. Allen said that, at previous meetings of the SC, mention had been made of the desirability of reports on sub-projects being submitted by leaders on technical progress at Regional Workshops and on financial status at SC meetings. Was this formally accepted and should this then be properly enforced ?

Discussion led to the Committee's ACCEPTANCE of this in principle, with the following proviso. It was NOTED ALSO that it was desirable to supplement financial reports with the essential elements of technical progress, so as to better assess its merits in terms of extension of financial support. Sutherland said that CIDA does like to see expenses reported under items of the original budget approved, so as to see whether expenditures are in line, and Wanchinga added that SACCAR is concerned that a standardized format for reporting is adopted. He requests that the RC makes clearer the budget position, and this was endorsed by the SC. Allen confirmed that he would liaise with CIAT headquarters to ensure that in future the current balance for training, sub-projects and NP equipment was routinely presented to the SC. The present position of the RP budget is given in Appendix 13.

(iv) Sub-project agreements

The Lady Chairman drew attention to a draft agreement (Appendix 14) that had been prepared by CIAT, inviting comments. Victoria Sutherland said that she had examined the draft and

found it "wishy-washy"; it was unlikely to be useful because there were too many dangling clauses and the content should be pinned down more precisely. Legal advice should be sought. This inspired a counter argument, led by Massey, essentially to the effect that were lawyers to be involved in agricultural research? Iron-clad restrictions are liable to be counter-productive. Sutherland retorted that research can be done within certain bounds : if the SC does not want a legal contract, don't make the agreement look legalistic !

Wanchinga then presented SACCAR's Research Grants Agreement (Appendix 15). After an interval in which to examine this document, Sutherland confirmed that she found this preferable to CIAT's draft. There were no pretensions to be legal and it could easily be modified to meet our current needs, although in neither CIDA nor SACCAR's opinion was there urgency to put in place such an agreement, noting that the SC CONDONED the use of some such control. Allen was asked to modify the SACCAR document and resubmit the draft to the 9th SC.

6. Training

(i) Status of short-term training.

It was NOTED that all previously approved training had been catered for : Olotu was now at CIAT; Thandiwe Nleya and Zodwa Mamba had been made offers of training at CIAT in the period 17th Sept - 30 November, 1990 (Appendices 16 and 17)); that Mrs. R. Abdulla's visit had been rescheduled for August 1990; and that Gregorio Gongolo had been accepted at CIAT for a (Spanish language) multidisciplinary training course early in 1991.

It was further NOTED that the aphid identification training course held in Malawi had been highly successful (Report Appendix 18). Zodwa Mamba remarked that Swaziland would be interested in future opportunities for such training of entomology technicians, but neither proposal nor commitment was made. Dr. Mushi referred to the report (Appendix 18) and questioned the choice of participants whom, he noted varied substantially in qualifications. Dr. Mkandawire replied to a specific question concerning technicians from Uyole that Mr. D. Kabungo had assisted their selection.

The status of the Graduate training course on bean cropping systems was discussed briefly. It was NOTED that there remained a few further vacancies on the course, and it was AGREED that further applications such be submitted to the RP urgently.

(ii) New proposals for short-term training.

Dr. Mkandawire presented a proposal for a training course to be conducted in Malawi. Substantial discussions led essentially to the following conclusions :

- That the need to improve the quality of technical support to the NP in Malawi is acute, and that the calibre of existing research assistants is generally too low to have enabled them to take part in the training courses offered by SADCC/CIAT to date. An in-country course is warranted.

- That Bunda College possesses a strong team of well-qualified scientists that could be called upon as resource persons for the course.

- That it is vital that the course was practical and field orientated; and for this reason it was desirable to utilize previous trainees from the SADCC/CIAT courses as trainers, to supplement instruction given by the Bean Team scientists. Suitable people would include Mr. Kennedy Muimui (from Zambia, currently a student at Bunda), Mr. Peter Chilembo (at Msekera, Zambia) and Mr. C. Kapunda (Malawi).

- That it was essential that there be continuity between the various courses for research technicians supported by SADCC/CIAT, so that a common 'language' among bean researchers in the region be fostered and that standardized methods be taught. For this reason, it would be desirable to involve CIAT's Regional Training Officer in helping to organize and instruct in the course.

On these bases, the RP was AUTHORIZED BY THE SC to proceed in supporting the initiative. A revised proposal is attached as Appendix 19, outlining tentative plans for a week's course in August 1990.

The need for a graduate training course in breeding was discussed. It was AGREED by the SC that Drs. Mulila-Mitti and Mushi be charged with the responsibility of drafting a proposal for submission to the 9th SC. The RP would cover the costs of Mushi's travel to Zambia (perhaps meeting in Mbala, or in Chipata) for discussion.

Dr. Mushi said that Miss. Ruth Kamala, bean breeder at Lyamungu, needs more exposure to field techniques especially with regard to breeding for disease resistance, and requested that she be accepted for training at CIAT. Mr. Amame mentioned that he had received a request from SEMOC who had requested that their agronomist, Ms. Antonieta Francisco Bias be offered training at CIAT early in 1991. The COMMITTEE ACCEPTED both these applications, the latter on the understanding that SEMOC provides her return-airticket; the RP would cover subsistence costs en route and at CIAT. Allen to fix mutually convenient times.

Miss Mamba requested that Mr. Hlophe (nominee subsequently withdrawn and replaced by Mr. Samuel Thwala) be offered training in on-station and on-farm trial management and data collection. Dr. Mushi immediately extended an invitation to the technician to train this coming season in Tanzania, and the SC AGREED that his training in northern Tanzania should proceed accordingly.

(iii) Status of academic scholarships

As had been raised in matters arising from the previous Minutes (see 4 xix), the slot for the MSc reserved for Mr. Simelane was again vacant. The Chairlady then asked the Regional Coordinator if the vacancy could instead be converted into a PhD, if no further applicant from Swaziland was put forward. Allen replied that this might be possible if it was ratified by the SC and that the student enrolled at a local university : funds would be insufficient for an overseas PhD (note : subsequent commitment made to the current academic scholars, including unexpected claims for spouse travel, have endangered the remaining 'slot' and care will have to be exercised by the SC before making this final award - DJA). Much discussion ensued, centring on the advantages and disadvantages of regional universities. The overwhelming reaction among national coordinators was that local universities were unpopular, in part because of poor supervision and in part because of the frequent delays in completion of degrees. The view was expressed that supervision could be supplemented by scientists on the RP, and that research work was liable to have greater relevance. It was AGREED by the COMMITTEE that a good compromise in principle was for postgraduates to do coursework at overseas universities with research conducted in the region.

Dr. Mkandawire asked whether reports were received by the RP on academic scholars' progress and Allen replied that such reports were usually received. Some discussion then centred on Mr. Mloza-Banda (PhD student at Iowa State from Malawi) who, it was noted, was deviating from the topic originally approved. The SC EXPRESSED CONCERN that such shifts in research emphasis be carefully monitored, and it was suggested that scholars should be bound by the original agreement : students who do not adhere to SC-agreed terms could be threatened with withdrawal of funds. Discussion then led to consideration of the duration of support, including the possible need to cease funding after a given period, providing for some flexibility. Victoria Sutherland commented that it was good the SC were considering such points.

(iv) Workshops and working groups.

A preliminary report of the CIAT/IITA Legume Virus Working Group meeting (Appendix 3) shows that several of the invitees from the SADCC region were unable to participate, including Mrs. O. Mukoko (ZW), Dr. Coy Hachiwa (ZA), Miss B. Motalaote (BD) and Ms. P. Ngwira (MW).

Noting the recommendations developed by the cropping systems and soil fertility working groups (Appendix 4) the COMMITTEE REQUESTED that National Coordinators give this information to their agronomists, as a source of potential new initiatives.

Discussion on the status of plans for the 2nd SADCC Regional Bean Workshop which, it was NOTED and ACCEPTED by the SC, would be held this year in conjunction with the 9th SUA/CRSP Bean Research Workshop in Morogoro during 17-22 September, 1990. A second draft of the proposal is attached (Appendix 20). Since the workshop would be held before the next SC, it was AGREED that further decisions would be left to an organizing committee comprised of Prof. James Teri (CRSP, Sokoine Univ. Agric.), Dr. M.J. Silbernagel (CRSP, Washington State Univ.), Dr. C. Mushi (National Coordinator, TZ) and Allen (CIAT). The SC set guidelines as follows :

- Participants from the SADCC region approximately limited to AN (2), BD (2), LO (2), MO (3), MW (7), TZ (20), ZA (12) and ZW (3), including those expected to be self-financing. Five places should be allocated to eastern Africa.

- Papers should be either keynote addresses (max one/session), invited papers or offered papers, allocated 30, 20 or 15 minutes, respectively. No participant should present more than 2 papers.

As part of the report on progress with the nematology sub-project (Appendix 6), a working group meeting with a training component on joint methodologies for nematode pathogenicity and screening for resistance is proposed. As this was not further discussed, the RC suggests that the sub-project coordinator be invited to present a detailed proposal to the 9th SC (DJ). There were no further new proposals.

(v) Monitoring tours

A report of the Kagera basin monitoring tour (or 'travelling workshop') is attached (Appendix 5). There were no new proposals.

7. National Programme Needs

(i) Germplasm.

Status and requests are summarized in the following table :

Country	Material /Nursery	Source/Remarks
BD	ABDREN AFBYAN 11	From Mkandawire (MW) by Nov. 90 From Kirkby (ET) by Nov. 90 (import permits necessary)
LO	ABDREN AFBYAN 11	From Mkandawire, soonest From Kirkby, soonest

Country	Material /Nursery	Source/Remarks
MW	AFBYAN II	From Kirkby (by Nov. 90 ?) (ABCM will send seed import permit)
	VEF 90 ?	From Kornegay (CO). ABCM to discuss and advise decision on whether required.
MO	TZ GPLASM	From Mushi (TZ) by Dec. 90
TZ	ABDREN IBABN ABFRN	From Mkandawire by Jun, 90 From Gridley (UG) or Kornegay (CO) From Kornegay (CO), Import permit sent.
WD	ABDREN AFBYAN II IBNHB	From Mkandawire (by Oct. 90 ?) From Kirkby (" ") From Mushi (" ") (import permits and invoice of seed value necessary)
ZA	REG. NURSERY ENTRIES (REQUESTS FORTHCOMING)	From Nat. Progs (By May 90) From CIAT ? (" Oct. 90)

Wanchinga asked what strategies the RP was employing with regard to germplasm introduction. Allen replied by describing the decentralized model that is now developing toward a "genetic devolution", in the form of regional nurseries a structure for which was drawn up at the breeders' workshop in Lesotho in January, 1989. Wanchinga commented that the SADCC/ICRISAT sorghum and millet improvement program had remained centralized. Sutherland said that she liked CIAT's decentralized model which might be more sustainable.

It was NOTED by the SC that seed clearance at airports was often difficult and SACCAR's help (eg. through appropriate targeted letters) was sought. It was further NOTED that the SADCC gene bank was to establish a task force to investigate such bottle-necks.

(ii) Visits by Regional Scientists.

Requests made by National Coordinators are as follows :

Country	Reg. Scientist	Purpose/Timing
LO	ECON	To give general economic advice, Feb/Mar.
MW	C.S. AGRON	OFR Planning Meeting, 9-10 Apr.
MO	ENT	To visit Lichinga to see Ent/Breeding trials; one day in Maputo, late April.
TZ	BREED RC/PATHOL ENT	To guide crossing prog, to assist disease scoring, to ident BF species & guide scoring, respectively.
WD	ECON	To advise Malaza in survey work, March/Apr.
ZA	RC	To visit Msekera to advise on screenhouse/seed store, early Apr.
	RC	To visit Mbala to assess OFR progress and meet with NORAD Rep, early May.
ZW	ECON RC/PATHOL	Advise Mukoko on survey Mar/Apr, Advise Mukoko on PhD progress, Apr.

(iii) Equipment Needs

The status of approved orders and the budget position are summarized in Appendix 21. New requests made by NP's are summarized as follows :

Country	Item	SC Recommendation
MW	Landrover spares Motor for oven	Approved ceiling USD 1500 Mkandawire to fax proformas in both cases to Arusha. Items available in Lilongwe.
	Small bundle thresher	RP to proceed.

Country	Item	SC Recommendation
MO	Seed storage jars (Lichinga)	1500 x 2 kg jars, available within region. Discuss during Regional Entom visit.
WD	Seed storage jars	500 x 2 kg jars, available locally at \$ 1.50 ea.
	Other storage facilities (Bulk thresher, requested at 7th SC)	Mamba to investigate other NP facilities before formalizing requests.
TZ	Another precision balance. ELISA (for TPRI)	RP to proceed. RP to proceed, after discussion with TPRI (Olotu).
ZA	Screenhouse renovation : mesh, polythene outer cladding, tube for extra benches and tube lighting for security.	Approved; Mulila-Mitti to submit quotes to KC; RP then to proceed.
	Seed store : Building modification, metal shelving; airconditioners and one dehumidifier.	Mulila-Mitti to present estimates to 9th SC.

Dr. Wanchinga made a plea to National Coordinators that in future they came to SC meetings armed with specifications and quotes for the supply of the equipment they required. Allen requested that NCs notified the RP once equipment had been received : otherwise, items risk being lost without being able to trace nor to claim insurance on them.

8. Mid-term Evaluation of the RP by CIDA/SACCAR

The Lady Chairman invited Dr. Strachan to present his Draft Review Workplan (which had been circulated among SC members), drawing attention to specific portions of the document. The ensuing discussion is not recorded in these Minutes as it was an informal briefing for the review to be held in June 1990.

9. Election of Chairman and venue for 9th SC.

The COMMITTEE NOTED that by convention now established, it was the turn of the representative from Lesotho to serve as Chairman. Mr. Simon Moima was duly elected. The COMMITTEE also unanimously ACCEPTED that the 9th SC be held in MOROGORO, TANZANIA on 24-25th September, 1990, immediately following the 2nd SADCC/9th SUA-CRSP Bean Research Workshop (17-22 Sept.) (Note : the newly establish SADCC/IITA cowpea research project is now contemplating holding their first SC meeting in Morogoro, 26-27th Sept; DJA).

10. Any other business

The Lady Chairman asked if members had any other items for discussion.

(i) Allen raised the idea, at the request of the SC and Regional Coordinator of the Eastern Africa bean programme, that a Pan Africa steering committee be established, perhaps with two representatives from each of the three RPs, meeting at intervals of 1-2 years with effect from late 1990. The objectives of a Pan Africa SC might include giving advice to CIAT on its continental strategies, on Pan African research priorities and collaborative research sub-project coordination across RP's. Wanchinga replied that he believed CIAT was going the wrong way about this. Although Pan African activity is welcome and should be encouraged, the SC was not the appropriate linkage, because it is essentially a management committee. A scientific committee might be established at CIAT's own initiative, but the SC should not be involved. There was a danger implicit in too many linkages, with risk of losing focus. The RC agreed to refer these ideas back to the Eastern Africa SC.

There being no further business, the Lady Chairman closed the meeting.

D. J. ALLEN
Regional Coordinator

ZODWA MAMBA
Lady Chairman

Appendix 1.

DRAFT AGENDA 8TH SC MEETING, LESOTHO SUN HOTEL

1. Introduction (Zodwa Mamba in Chair)
2. Agenda 8th SC
3. Minutes 7th SC
4. Matters arising
5. Regional collaborative research sub-projects
 - a. Report from sub-projects in progress
 - b. Revised proposals
 - c. Sub-project reporting (technical/financial)
 - d. Sub-project agreements (proposals from SACCAR and CIAT)
6. Training
 - a. Status short-term training
 - b. New applications short-term training
 - c. Status academic scholarships
 - d. Workshop/working group reports
 - e. New proposals for workshops
 - f. Monitoring tours
7. National programme needs
 - a. Germplasm
 - b. Visits/technical
 - c. Equipment
8. SADCC/CIAT Mid-term evaluation by CIDA/SACCAR
9. Venue/elections 9th SC
10. AOB
11. Field visits

Q.4 QUESTIONNAIRE FOR STEERING COMMITTEE MEMBERS

This questionnaire is designed primarily for Steering Committee (SC) members that are also National Research Programme (NP) representatives. Other SC members are welcome to complete the form, but may find several sections inapplicable.

The questionnaire is part of a current review of the SADCC/CIAT Regional Programme on Beans in Southern Africa. The objective of the review is to strengthen the programme and to assist in decisions on future activities. Your frank and prompt response to this questionnaire is important. The information you provide is necessary to complete the review, but all answers will be considered confidential. Thank you for your cooperation.

The Review Team

Note: If you are a recent SC member, you may have difficulty responding to all of the questions below. Please answer all that you can with certainty.

Q.4 QUESTIONNAIRE FOR STEERING COMMITTEE MEMBERS

1. Name
2. Institution/Country
3. Title/Specialization
4. Length of time on the Steering Committee (began ___/___)
mo yr

General Assessment:

5. What specific contribution(s) has the SADCC/CIAT Regional Bean Programme (RP) made to bean research/production in your country?

6. Generally speaking, do you feel that:
 - a. The major bean research and production problems in your country are being addressed by the Programme? Yes No (please circle one)
If No, please explain:

 - b. Programme resources are being distributed equitably between countries? Yes No (circle one) If No, please explain.

7. What are the principal limitations of your national research programme (NP) in taking full advantage of the technical assistance offered through the Programme?
 - a.
 - b.

8. If the limitations are financial, and recognizing that the Programme has limited funding, are other funding sources available?
Yes No Don't Know (circle one).
Has your NP been able to access other funding to supplement Programme funds? Yes No
If yes, from what sources?

9. Do you think the RP should be assisting you in accessing supplemental funding? Yes No Explain.

Programme Management:

10. How would you rate the following groups in terms of their contribution to good Programme management: Circle one of the following numbers, where 1 represents the lowest value, and 5 the highest value.

a. The Programme staff in Arusha	1	2	2	4	5
b. SACCAR staff	1	2	3	4	5
c. CIAT headquarters staff	1	2	3	4	5
d. CIDA officers	1	2	3	4	5
e. The NP representatives on the SC	1	2	3	4	5

If you have rated any lower than 3, please explain.

11. What specific suggestions do you have for making the Coordinator's work easier, more efficient?

12. Has your NP had adequate participation in Programme decision-making on issues such as the annual workplan, the budget, research sub-project selection, trainee selection? If not, please list cases where this participation was not satisfactory and suggest what changes should take place.

13. What suggestions do you have for making the work Steering Committee easier, more efficient?

14. Should the donor (CIDA) be represented on the SC as it is at present? Yes No Why?

15. Have there been SC meetings that you unable to attend? If so, please list:

a. Date Reason

b. Date Reason

Should all NP representatives be expected to attend all SC meetings?
Yes No Why?

Training

16. Has the selection of academic scholars proved satisfactory?
Yes No Explain

17. How do you rate the various other training opportunities the Programme offers? (On a scale of 1 (little use) to 5 (excellent)).

a. Short term training at CIAT	1	2	3	4	5
b. Short term training in Africa	1	2	3	4	5
c. Monitoring tours	1	2	3	4	5
d. Workshops	1	2	3	4	5

Please take time to comment on your rating:

a.

b.

c.

d.

Research Activities

18. Has the selection and funding of sub-project research been equitable? Yes No Why?

19. What suggestions do you have for strengthening the sub-project activity?

20. Has the project put sufficient emphasis on:

a. Basic applied research? Yes No Explain

b. Transfer of technology? Yes No Explain

c. Other problems related to bean production (eg markets)?
Yes No Explain

21. Please provide additional suggestions for strengthening the Programme, including changes that you think should take place in your own NP.

SADCC/CIAT REGIONAL PROGRAM ON BEANS IN SOUTHERN AFRICA (RP)

REQUEST TO STEERING COMMITTEE MEMBERS RE DISTRIBUTION OF
PROGRAMME REVIEW QUESTIONNAIRES

Enclosed are two sets of questionnaires for training participants in the RP, along with a list of names of participants that we would like to have complete the questionnaire. Please personally deliver the questionnaires and arrange to have them returned to you by April 15 AT THE VERY LATEST. Then please forward them immediately to the Canadian High Commission in Harare, by DHL COURIER IF POSSIBLE.

Ms. Victoria Sutherland
First Secretary (Development)
Canadian High Commission
45 Baines Avenue
P.O. Box 1430
Harare, Zimbabwe

Telex: 24465 Canada ZW
Fax: 735071
Telephone: 735071

1. Trainees at CIAT

- a.
- b.
- c.
- d.
- e.
- f.
- g.

2. Short Term Training in Africa

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.

Thank you

The Review Team

NOTE: Please make a copy of all questionnaires and file them in your office in the unlikely event that the originals get lost in shipping.

PROGRAMME

CIAT/IITA WORKING GROUP MEETING ON VIRUS DISEASES
OF BEANS AND COWPEAS IN AFRICA
HELD AT THE INTERNATIONAL CONFERENCE CENTRE
(COMMITTEE ROOM C), KAMPALA, UGANDA, 17-21 JAN 1990

OBJECTIVES:

To bring together virologists, and breeder/pathologists concerned with virus diseases, from within eastern and southern Africa to focus attention on recent advances made in the identification of viruses naturally infecting legumes in Africa, with particular reference to beans and cowpeas; to establish priorities and a programme for future research; and to develop a network for collaborative research in the region.

BACKGROUND:

Recent work on the distribution of strains of bean common mosaic virus shows, on the one hand, that necrotic strains predominate in Africa and, on the other hand, there are areas (e.g. Ethiopia) where this is apparently not the case (Morales, unpublished; Vetten & Owera, pers. comm. 1989). The origin of necrotic strains remains obscure, but work (Lana et al., 1988) on relationships among strains of BCMV and strains of the closely related blackeye cowpea mosaic virus may possibly prove relevant. Field surveys of beans in Africa also indicated that potyviruses possibly distinct from BCMV are also occasionally found in natural infections.

Cucumber mosaic virus and cowpea mild mottle virus are also commonly identified in natural infections of beans throughout the region (H.J. Vetten, unpublished). Together, these preliminary findings suggest the need for a review of their possible implications for effective virus disease management in both beans and cowpeas and their related viruses.

PROGRAMME:

The meeting was designed in such a way as to maximize free discussion and debate from which a clearly defined plan of action should be encouraged to emerge. The format, which follows previous CIAT Pan African Working Groups, comprised eight Sessions, as shown below, each with a Lead Discussant and Rapporteur.

Thurs a.m. 18th Jan	{ Session 1:	Introduction : participants, programme and objectives	Samson Odera David Allen/ Hennie Rossel
	{		
	{ Session 2:	Virus detection in plant and seed.	
		Lead Discussant :	Gaylord Hink
		Rapporteur :	Femi Lara
Thurs p.m.	Session 3:	Virus identification and geographical distribution in Eastern & Southern Africa	
		Lead Discussant :	Jopp Veltien
		Rapporteur :	Nicola Spence
Fri a.m. 19th Jan.	Session 4:	Virus strains : origins and implications	
		Lead Discussant :	Francisco Morales
		Rapporteur :	David Allen
Fri p.m.	Session 5:	Virus ecology and economic importance	
		Lead Discussant :	Hennie Rossel
		Rapporteur :	Howard Gridley
Sat a.m. 20th Jan	Session 6:	Virus epidemiology : vectors, seed and weeds	
		Lead Discussant :	Femi Lara-Mile-Hu
		Rapporteur :	J. Dijkstra
Sat p.m.	{ Session 7:	Development of an action plan : Virologist's perspective	
	{		
	{		
	{	Lead Discussant :	David Allen
	{	Rapporteur :	Gaylord Hink
	{		
	{ Session 8:	Development of an action plan : Breeder's perspective	
	{		
		Lead Discussant :	Howard Gridley
		Rapporteur :	John Taylor
Sun a.m. -	Field trip to Kawanda Research Station and Bukalasa.		

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Appendix 4

RECOMMENDATIONS
FOR
CROPPING SYSTEMS
AND
SOIL FERTILITY RESEARCH
WITH BEANS

PREPARED BY WORKING GROUPS

FOR CROPPING SYSTEMS AND

SOIL FERTILITY RESEARCH

ON BEANS

NAIROBI, KENYA 12-14 FEBRUARY, 1990

**THE ROLE OF THE CROPPING SYSTEMS
AND SOIL FERTILITY: PAN AFRICAN WORKING GROUPS.**

INTRODUCTION

The working groups revised terms of reference adopted during the bean "Workshop on Soil Fertility Research for Beans Cropping Systems in Africa, Addis Ababa, Ethiopia 5-9, 1988" and expanded on them as follows:

Functions

1. a) Advise on research projects relevant to address specific problems and gaps and identify training needs for improving the capability and capacity for performing relevant research on beans.
b) Coordination with the regional and national research teams on the one hand and with other organisations with similar objectives e.g. CIMMYT, ICRAF, UNEP, IGADD, AFNET, SECAP on the other.
2. The mode of operation:
 - a) It is recommended that both groups will meet annually to identify research needs and make specific recommendations.
 - b) Monitoring tours.
 - c) Study progress reports. To facilitate this, extracts from relevant reports reprints, reviews etc. should be sent to members of the working groups for distribution to bean researchers.
 - d) Attend workshops on related activities.
 - e) Respond to invitations by the steering committee as deemed necessary.
3. Logistical support:
 - a) The working group recommended that steering committee sponsor members for seminars, conferences, workshops, etc.
 - b) Payment of a honoraria to members of the working groups should be considered.

CROPPING SYSTEMS WORKING GROUP

RECOMMENDATIONS

A. 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 participating country : 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 participating countries : Ethiopia, Malawi, Mozambique, Tanzania and Uganda.

3. Despite the obvious advantages of the Guie system it was noted that the system results in losses in soil physical and chemical properties 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 of grass high in phosphate and/or bringing in inorganic phosphate (e.g. rock phosphate) be initiated.

Lead country : Ethiopia
Other participating countries : countries in the 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.

B. CEREAL BEAN CROPPING SYSTEMS

1. With regards to relay cropping, 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 increasing seed yield by the use of climbing beans as opposed to the bush type (with cereal stalks providing support).

Lead country : Tanzania
Other participating countries : Kenya, Malawi, Mozambique and Uganda.

2. Investigations on fertilizer requirements under intercropping situations should be carried out.

Lead country : Zimbabwe
Other participating countries : Ethiopia, Great Lakes, Kenya, Malawi, Tanzania, Uganda and Zambia.

3. In Ethiopia it has been observed that beans intercropped with sorghum either show 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

C. 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 (e.g. in Kagera region of Tanzania) 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 participating countries : Tanzania and Rwanda.

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 participating countries : Uganda and Tanzania.

3. Work on monitoring banana weevils and nematodes in banana/bean associations should also be conducted.

D. 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.

Participating countries : 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's 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, Zambia).
 - b. Mechanism of tolerance to low P (lead institution not identified)
 - c. Mechanism of tolerance to low N (lead institution not identified). (a,b,c would use seeds of IBSAN for this work)

- d. Sustainability of climbing bean systems (Rwanda).
- e. Studies on P - fixation (Sokoine University, Tanzania).
- f. Nutrient balances and interactions, especially with Ca : Mg : K (Makerere University, Uganda).
- g. Regression studies of factors limiting yield.

It should be 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 :
 - a. Al toxicity in South Kivu, Zaire and Zambia;
 - b. Low P stress at Misamfu in Zambia and either at Uyole or Hai district in Tanzania, provided importation of germplasm to Tanzania is eased.
 - c. Low N stress at Melkassa in Ethiopia and Bunda College of Agriculture, Malawi.
7. It is recommended that there should be regional sub-projects to screen varieties for tolerance to :
 - a. Al toxicity
Lead countries : Zaire and Zambia
 - b. Low P
in Misamfu, Zambia and either Uyole or Hai district (Tanzania)
 - c. Low N
in Melkassa, Uganda and at Bunda College of Agriculture, Malawi.
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 Zimbabwe and Malawi on farmers' fields.

It is assumed that the principal investigators of the various research projects will assume responsibility for pursuing funding, whether it be from CIAT Regional Programmes or from other sources.

LIST OF PARTICIPANTS

NAME	WORKING GROUP
<p>1. Mr. Andre, Sebahutu Soil Chemistry/Fertility Institut des Sciences Agronomiques du Rwanda (I.S.A.R.) I.S.A.R.-Rubona, B.P 138 Butare Rwanda.</p>	Soil Fertility
<p>2. Prof. Edje, T. Oghenetsavbuko Cropping Systems Agronomist SADCC/CIAT Regional Programme on Beans in Southern Africa P.O. Box 2704 Arusha - Tanzania.</p> <p>Tel: 2268 Telex: 42106 CANWHT TZ</p>	Cropping Systems
<p>3. Dr. Eylands, J. Val Agronomist/Team Leader Rwanda FSRP ISAR/USAID Farming Systems Project B.P. 625 Kigali - Rwanda</p> <p>Tel: 250 - 85706 Fax: 250 - 85706</p>	Soil Fertility
<p>4. Mr. Kamoni, T. Peter Agriculture Research Officer I (Surveys and Land Evaluation) National Agriculture Research Laboratories Kenya Soil Survey P.O. Box 14733 Nairobi - Kenya</p> <p>Tel: 02 - 48620, 48211/2/3 Ext: 216 or 283</p>	Soil Fertility
<p>5. Mr. Kavuma, B.K. John Senior Research Officer Office of Secretary for Research Ministry of Agriculture Entebbe Ministry of Agriculture P.O. Box 2 Entebbe - Uganda.</p> <p>Tel: 042 - 20805</p>	Cropping Systems

NAME	WORKING GROUP
<p>6. Mr. Kullaya K. Ignace Agricultural Research Officer Agricultural Research Institute Lyamungu P.O. Box 3004 Moshi - Tanzania.</p> <p>Tel: 055 - 4411 Telex: 43000 COBOT</p>	Soil Fertility
<p>7. Mr. Lunze, Lubanga Soil Fertility, Head INERA (Institut National pour l' Etude et la Recherche Agronomique INERA - Mulungu D.S. Bukavu Zaire.</p>	Soil Fertility
<p>8. Dr. Mmbaga, M. Emil T. Senior Agricultural Research Officer (SARO) A.T.I. Lyamungu, P.O. Box 3004 Moshi - Tanzania.</p> <p>Tel: 055 - 4411 Telex: 43000 COBOT</p>	Cropping Systems
<p>9. Dr. Mughogho, K. Spider Senior Lecturer University of Malawi Bunda College of Agriculture P.O. Box 219 Lilongwe - Malawi.</p> <p>Tel: 721 - 455</p>	Soil Fertility
<p>10. Mr. Teshome, Regassa Assistant Research Officer Institute of Agricultural Research Nazret Research Center P.O. Box 436 or 1290 Nazret - Ethiopia.</p> <p>Tel: 01-112186</p>	Cropping Systems

NAME	WORKING GROUP
<p>11. Dr. Semoka, M.R. Johnson Senior Lecturer Sokoine University of Agriculture Department of Soil Sciences P.O. Box 3008 Morogoro - Tanzania.</p> <p>Tel: 056 - 3999 Telex: 55308 UNIVMO TZ</p>	Soil Fertility
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NAME	WORKING GROUP
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Appendix 5

CIAT PAN AFRICA MONITORING TOUR REPORT : KAGERA BASIN OF W. TANZANIA, UGANDA AND RWANDA

12 - 21 November, 1989

C. Wortmann, D.J. Allen, O.T. Edje and D.R. Laing

Objectives

To bring together national and regional scientists concerned with bean-banana systems and agroforestry to cover the main research sites and contrasting farming systems in this small, densely populated and important area of bean production based on bananas as a staple, spanning three countries at peak season; and to discuss and devise strategies by which to increase productivity of beans in a low input, sustainable manner.

Itinerary

- Sun 12 Nov. Participants assemble in Bukoba at Lake Hotel.
- Mon 13 Nov. Visit Agricultural Research Institute, Maruku; on-farm trials in Bukoba District.
- Tue 14 Nov. To Regional Agricultural Development Office; tour of Muleba District.
- Wed 15 Nov. To District Agricultural Development Office, Kayanga, Karagwe; on-farm trials in Karagwe District; Kituntu research sub-station; Rakai District Agricultural Office, Kyotera; Masaka (La Nova Hotel).
- Thur 16th Nov. To Kamenyamigo District Farm Institute, Masaka; Mbarara (Pelican Hotel for lunch); Kabale (Highland Hotel).
- Fri 17 Nov. To Kachwekano District Farm Institute, Kabale to visit on-station bean trials and ICRAF/AFRENA agroforestry trials.
- Sat 18 Nov. Muko market; Kalengyere, Kisoro, Cyanika, Ruhengeri to Gisenyi (Hotel Izuba Meridien).
- Sun 19 Nov. Kinigi, Parc National des Volcans.
- Mon 20 Nov. Ruhengeri, Base and ISAR-Kwerere; on-farm trial at Nyamugale nr Base; to Butare (Hotel Ibis).
- Tue 21 Nov. Visit ISAR-Rubona; participants disperse.

Distances (km)

Kawanda-Bukoba 333; Bukoba-Karagwe 98; Karagwe-Masaka 221;
Masaka-Kabale 287; Kabale-Gisenyi ? : Gisenyi-Butare 314.

Participants

Dr. Clemence Mushi, Bean Breeder/National Coordinator beans,
ARI Lyamungu, P.O. Box 3004, Moshi, Tanzania.

Mr. A.S.S. Mbwana, Nematologist/National Coordinator banana
research/Director, ARI Maruku, P.O. Box 127, Bukoba, Tanzania.

Mr. Leonard Mukandala, Bean Agronomist, Maruku.

Mr. Wilberforce Sakira, Agronomist/National Coordinator banana
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Mr. Victor Ochwoh, Senior Lecturer, Dept Soil Science, Makerere
Univ., P.O. Box 7062, Kampala, Uganda.

Dr. Ekow Akeampong, ICRAF, Gitega, Burundi

Dr. John Lynam, Economist, Rockefeller Foundation. Eastern &
Southern Africa, Nairobi, Kenya.

Dr. Douglas R. Laing, Deputy Director General, CIAT, A.A. 6713,
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Dr. Charles Wortmann, Bean Agronomist, CIAT, P.O. Box 6247,
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Dr. O.T. Edje, Bean Agronomist, SADCC/CIAT, P.O. Box 2704,
Arusha, Tanzania.

Dr. David J. Allen, SADCC/CIAT, Arusha.

People Met

Mr. F. Barozi, District Agricultural Development Officer,
Kayanga, Karagwe, Tanzania.

Mr. Chris Bosch, Farming Systems Project (Royal Dutch
Institute), ARI Maruku, Bukoba, Tanzania.

Mr. S.K. Masinde, Regional Development Director, Bukoba, Kagera
Region.

Mr. Lamik Tungu, Agricultural Development Officer, Bukoba.

Mr. B. Kweka, Officer-in-charge, Kituntu sub-station, Karagwe.

Mr. John Mallya, Technical Assistant, SADCC/CIAT, Karagwe,
Tanzania.

Mr. Emmanuel Mwanga, Principal, Kamenyamigo District Farm Institute, Masaka, Uganda.

Dr. Swai, District Livestock Officer, Karagwe.

Ms. Josephine Zizinga, District Agricultural Officer, Rakai.

Dr. Don Peden, ICRAF, P.O. 311, Kabale, Uganda (Tlx 68032 KBUB).

Mr. C.S. Rugwiza, Principal, Kachwekano District Farm Institute, Kabale.

Mr. Dominik , CIP Field Assistant, Kalengyere.

Dr. Bonaventure Ukiriho, Chef du Station, ISAR-Rwerere.

Dr. Val Eylands, Agronomist/Soil Scientist, USAID Farming Systems Project, Rwerere.

Dr. Urs Scheidegger, Agronomist/Regional Coordinator, CIAT-ISAR, Rubona.

Mr. Willi Graf, Agronomist, CIAT-ISAR, Rubona.

Dr. Louise Sperling, Anthropologist, CIAT-ISAR, Rubona

Dr. Kurt Steiner, Rubona.

Observations in Bukoba and Muleba Districts, Kagera Region, Tanzania

Banana is the main staple food and mainstay in local life : it is used as a thatching material, an animal feed, as mulch, for drink and in making "matoke". The crop has declined over the last 1-2 decades, in part because of increasing damage by the banana weevil and the nematode (*Fratylenchus gonolepis*) and in part because of declining soil fertility. Misuse of pesticides including dieldrin and carbofuran has exacerbated the problem, and economic decline has put their purchase beyond the reach of most farmers. Soil fertility problems are apparently attributable to two main factors. These are : (1) the concomitant decline in cattle holdings, itself a consequence of disease (rinderpest at one time; now also East Coast Fever), and therefore scarcity of farm yard manure; and (2) the increasing reliance upon 'rweya' grassland rather than former forest with which to develop new 'kibanja'. Rweya soils are cultivated only for bambarra groundnuts (*Vigna subterranea*) by women (whose mounds must be built vertically down the slope if she is not to lose her husband, according to local superstition), and these are followed by a crop of cassava in the second year before reverting to grass (*Hyparrhenia* and *Eragrostis* spp.) fallow for 8-12 years. But the rweya is a vital source of grass for mulching bananas in the kibanja, and this source is also thought to be declining, because of mounting land pressure. Beans are the principal crop

beneath bananas in the kibanja and they constitute a vital food locally, usually mixed in matoke.

All is not well in this area where the agricultural system that has evolved is itself threatened. In the longer term, it may become necessary for the people to shift to a staple other than the banana but, in the shorter term at least, there seem to be opportunities for sustaining the existing system. At Maruku, there is a range of breeding trials and banana Kibanja has been established for the evaluation of beans under banana. In Bukoba district 20 on-farm variety trials have been established with assistance from Mr. C.H. Bosch of the of the Tanzania/Netherlands Farming Systems Research Project at Maruku.

Observations in Karagwe District, Kagera Region, Tanzania.

Karagwe is the most important bean producing district of Kagera Region, from where perhaps about 30% of Tanzania's crop is produced. Here, land is less limited, of better fertility, at higher altitude (up to about 1700 m) and receives much less rainfall (approximately 1000 mm) than Bukoba and Muleba districts. Some 300,000 people occupy the 4 divisions of the district where farm size is about 1.5 - 2.5 acres/family. Kituntu is the research sub-station (of Maruku) that serves Karagwe. Bananas are again the principal crop associated with beans but maize-bean associations are found as well. Banana weevil is absent in Karagwe where only nematodes are important.

Bean breeding trials are now well-established at Kituntu and a useful range of on-farm trials are in progress in the district. Climbing cultivars may have potential here and a wider range of germplasm, perhaps as a tailor-made VEF containing material of appropriate seed type, should be tested at Kituntu in future seasons, including not only the short rains but also the largely unexploited long rains (March-June). The reason why the long rains are not used for bean production is not clear but it could be due to competition for light and nutrients as banana matures during May/June. Evaluation within a banana kibanja at Kituntu might be useful.

Soil fertility management in Kagera Region (CW)

Descriptions of soils and land use patterns are taken from a report by the Tanzania/Netherlands Farming Systems Research Project, Lake zone (1989) and given in Appendix 1, and are only briefly supplemented here.

Soil pH and texture were noted in most fields visited. pH was generally between 5.3 - 5.5, and soils were sandy, but judging from soil color, organic matter appeared to be >1% to 60 cm depth or more. The banana fields were heavily mulched with crop residues, coarse grasses cut from the surrounding grasslands (rweya), and livestock manure. Judging from soil texture and organic matter, the available water holding capacity of the soil is probably between 0.04-0.06 cm water per cm soil depth,

suggesting that moisture stored in the mulch may be important to carrying the banana crop through the June-August dry season. Harvesting of the bananas appears to be seasonal, and according to farmers visited, much of the fruit is harvested in June and July. Because of this, prior to planting beans in September and October, the banana plants are pruned, opening the canopy allowing light to reach the bean crop. Moberg (1972) reported that the ferrasols of eastern Bukoba district developed under high rainfall from quartz-rich sandstone, and are low in all plant nutrients except for iron, manganese, and copper. P, Zn, Ca, Mg, K and N need to be supplied to sustain permanent cultivation, and are now applied in organic manures. Liming to correct pH could result in deficiencies of Mg, K, Zn and possibly other micronutrients. K application could result in Ca and Mg deficiencies. P application could induce Zn deficiency. N application is likely to increase the rate of decomposition of organic matter and nutrient release. Still, the increase of crop production will depend on greater importation of nutrients, and it appears that the existing grasslands may not be able to give up nutrients at a greater rate and still remain sustainable. Alternative means of managing soil fertility are needed to increase production.

Discussion

1. Alternative crops. The future production of bananas in the Region is threatened, as indicated above: Tuber crops, including sweet potatoes, yams and cassava are increasing in importance, but it is doubtful that sustainable tuber crop production systems will be adequately productive. Under banana stands, there is little disturbance of the soil and temperatures are lower than outside the banana stands (Kibanja). Mulch decomposes relatively slowly because of the lower temperatures and lack of mixing soil with the mulch. Applied mulch persists longer, slowly releasing nutrients, holding and conserving moisture and preventing erosion. With the cultivation of annual or short lived perennials, the rate of decomposition of the organic manures will be much higher and soils will be more exposed to erosion, to leaching, to higher temperatures, and to extremes of wetting and drying. In the western parts of Bukoba and Muleba districts, and in Karagwe district, tuber crop systems may be sustainable if frequent, although small, applications of mulching materials with a low N:C ratio (0.02) are made. Sustainability of such systems is less likely in eastern Bukoba district, because of the higher rainfall and more weathered soils.

Possible intervention. Conduct research on the sustainability and organic matter management of tuber crop/bean cropping systems in the lower rainfall, more fertile areas in the Region. Deep rooted grasses and/or trees may be needed in such systems to recycle nutrients and to supply mulch. *Cassia spectabilis* and *Sesbania sesban* that have high potassium in their biomass could be tested in view

of their high potassium content. N-fixing trees may not be desirable if low N:C mulch is preferable. Importation of N and other nutrients from the rweya grasslands is essential. Fixation of N by lightning probably supplies enough N to the grasslands so that other nutrients are more limiting (N supplied to grasslands should be determined).

2. Liming. Response to lime is not likely to be great as soil pH was generally above 5.3. When exchangeable Al is high, addition of small amounts of lime to displace the Al with Ca may be beneficial.

Possible actions. On soils with pH below 5.3, study crop response to the displacement of exchangeable Al with Ca.

3. Rock phosphate. Minjingu rock phosphate applied in large quantities in the planting holes when planting bananas appears to be of promise on soils with low P. Moberg (1972) found low P levels, except in the north-western part of Bukoba district. Minjingu rock phosphate should be adequately reactive in these low pH soils to supply P, and it should also supply some Ca. Concentrating the RP around the stool may result in Zn adsorption in that zone but it should be available at its normal levels in the surrounding soil. Of some concern is that the increased P may inhibit Zn translocation from the roots to the leaves (Singh et al, 1988).

Possible actions. Evaluate the response of beans (pure stand) to Minjingu rock phosphate at Maruku to test the reactivity of the RP. Compare MRP at 50 kg P₂O₅ / ha to similar rates of TSP and to a control. If the crop responds well to the MRP, then its use in the bean banana association can be investigated. How can it be applied in established bananas? In probe holes made around the stools, applying 150 kg P₂O₅ / ha equivalent to supply P for several years?

The RP deposit at Muleba should be studied if it is of sufficient quantity. It is not among the 12 deposits mentioned by Mtui (1986).

- a. Composition
- b. Reactivity at varying soil pH
- c. Effects of processing on reactivity - beneficiation, partial acidulation, etc..
- d. Response of beans in pure stand to the treated or untreated RP
- e. Its use in the bean-banana association.

4. Agroforestry. Agroforestry may be an option in the lower rainfall areas that have more fertile soils, such as in western Bukoba and Muleba districts and in Karagwe district. In Muleba and Bukoba districts, farmers are not likely to

plant trees with their bananas, but if technically sound, the probability of adoption on the marginal lands and the grasslands should be reasonable. Also, if farmers shift from bananas to tuber crops, the feasibility of agroforestry will increase. In eastern Bukoba and Muleba districts, soil fertility levels in the grasslands are too low to expect good tree performance, which probably explains why the climax species are grasses rather than trees, despite good tree growth in the more fertile niches.

The value of N fixation by trees needs to be considered, at least for Bukoba and Muleba districts. N is probably not the most limiting nutrient in the present system, and low N:C ratios in the mulching material may be important.

On steeper slopes in Karagwe district, micro-contour lines of trees with a grass, such as Guatemala grass or Vetiver grass, may be sound, to reduce erosion and to supply nutrients through mulch.

Possible Actions. Study the various areas more closely.

5. Forage legumes. The introduction of forage legumes to form grass-legume mixtures in the more fertile grasslands was discussed during the tour. If N is not the most limiting nutrient, the legume probably will not result in increased dry matter production. The carrying capacity may increase, however, as the improved protein content of the diet would allow better utilization of the low protein grasses. The sustainability of the grasslands may be threatened with increased harvest of nutrients. The impact of the legumes would have to be dramatic, as it would have to result in a switch from communal grazing to a controlled grazing system: rweya improvement would have implications for current land ownership.

If the grasslands do have greater capacity for sustained supply of nutrients, supplementing cattle diets with urea may be feasible in the near future. Tanzania has plans to produce urea. This could be transported in bulk to Bukoba town, mixed with molasses from the nearby sugar estate, and supplied to cattle owners. Increasing protein equivalent of the ratios with urea may enable cattle to utilize the coarser forage, and to import more manure and nutrients to the crop plant. Mixing the legumes with Guatemala grass for zero grazing is a possibility, though reports of rapidly declining grass yields after a few seasons of cropping raise concern.

Possible action. The effects of varying intensities of harvesting the grasslands on sustained grass yield, with no fertilization, with N fertilization, with RP fertilization and with N plus RP fertilization, should be determined to see if the system is sustainable with higher levels of nutrient harvest, with and without N and P fertilization.

Regular soil sampling should be done to determine effects of the harvesting intensities on soil nutrient ratios and levels and to identify optimal nutrient ratios for the grasslands. The same could be done with Guatemala grass on the more fertile lands. Depending on the results, a study of the performance of forage legumes grown with native grass and Guatemala grass on the more fertile grasslands, and their effect on animal carrying capacity, may be justified.

6. Optimal soil nutrient level ratios for bean production. Adequacy levels of soil nutrients have been estimated for beans. These can be misleading, however, when the native soil fertility is low as interactions between nutrients are more likely to occur. Nutrient level ratios, or indices of all ratios, may better indicate fertilization needs than adequacy levels on the Bukoba soils.

Possible action. Check literature to see if the information is already available. If not, collect soil samples from all on-farm trials at planting time. Dry and store until trial yields are available. Analyze samples from trials which are in upper 10% for overall yield and study the association of yield with soil nutrient levels and ratios. A minimum of 30 high yield samples with probably be needed, but more if the variances are large.

7. Nutrient and mulch management in the bean-banana systems. The effects of mulches of varying N:C ratios, together with inorganic fertilizers and soil amendments, on nutrient levels, ratios and interactions should be studied in a nutrient budget experiment. Bananas have been planted at Maruku Research Institute, and the site may be suited for such a study. The site was not, however, used for permanent cultivation of bananas and apparently was grassland before the research station was established. It may not therefore be representative of land used for permanent banana (kibanja) cultivation.

Possible actions. Observe the soil of the banana trial site at Maruku to determine if it is representative of kibanja soils. If so, the site should be used to investigate the effects of management practices on soil OM, moisture, leaching, nutrient interactions and bean and banana productivity. An incomplete factorial or complete factorial design with fewer reps could be used to study the effects of: N:C ratios - 3 to 4 levels; soil applied N, P, K fertilizer; and possibly, 2 bean crops per year, versus one crop planted in September-October.

8. The decline in cattle populations and availability of farm yard manure has given a filip to local investigation on human 'night soil' and studies are being undertaken on suitable latrine designs. This seems worth encouraging.

Recommendations

1. Evaluate response of beans in pure stand to Minjingu RP at Maruku.
2. Begin studies on the agronomic and economic feasibility of the use of Muleba RP.
3. Routinely collect soil samples from all on-farm trial sites, and analyze those of sites with high yields to study the importance of soil nutrient levels and ratios to bean yield.
4. Do a nutrient cycling study of the bean-banana system with mulches of varying N:C ratios, and with differing fertilization regimes. This should complement a similar study being planned for Kawanda.
5. Do a nutrient cycling study of the bean-tuber crop (cassava or sweet potatoes?) association.
6. Solve the weevil and nematode problems of bananas.
7. Encourage someone to look at mycorrhizae on bananas and possibilities for improvement.
8. Study the sustainable nutrient yield potential of the grasslands.
9. Apply for a post-doc in soil science or cropping systems agronomy to undertake some of the above activities.

Observations in Rakai and Masaka Districts, Uganda

Here, people have adjusted to risk, having faced civil war and now confront AIDS at its national epicentre. Many houses are boarded up and kibanjas are abandoned. Masaka - a once flourishing and beautiful town - is decimated.

Soil fertility levels and average land productivity is much higher here than in Kagera Region, though nutrient levels are probably lower in the sandy loams around Kyotera than in the Masaka area. Soil pH is generally above 5.3. FYM and mulch are used but less so than in Bukoba. It appears that agroforestry should have much potential in this area, to increase N in the system and to mine nutrients from the lower soil horizons. It would be of interest to know which nutrient deficiencies are most limiting to yield. CARE is working with the Masaka District Forestry Officer on agroforestry, at Kamenya-amigo District Farm Institute where a range of national bean yield trials were visited.

Recommendation:

1. Investigate opportunities for collaboration with CARE in agroforestry research.

Observations in Kabale District, Uganda.

Most of the beans here are produced on slopes of 4-50%, between 1600-2300 masl and with an average rainfall of 950 - 1000 mm per year. Results of exploratory trials show yield increases of 50% with only 30kg N and 30kg P₂O₅. The National Bean Programme plans to begin nutritional screening trials in 1990 to identify the most liming nutrients. pH is generally not seriously low, but it was observed to be about 5.0 to 90 cm of depth on the steep cultivated slopes adjacent to the Impenetrable Forest. Apparently, this low pH is a constraint to bean production, as peas are widely grown at this place. ICRAF and AFRENA are conducting research at Kachwekano to screen species and to study alternative management packages. CARE is assisting with on-farm forestry and agroforestry activities in the district (unfortunately, we missed seeing the CARE person in charge on this trip). Leucaena trees planted in October, 1987, at the foot of a terrace bund at Kachwekano, have done well.

Agroforestry and grass contour lines. Farmers are interested in planting trees, primarily for building materials and firewood. Trees planted at the foot of terrace bunds would generally occupy the poorer soil in the field, and give little competition to adjacent crops, but still mine nutrients from the subsoil, fix nitrogen and capture nutrients which may leach from the fertile soil accumulated in the bund. The farmers' objectives need to be considered in managing the trees, especially planting density and pruning. Opportunities for collaboration exist with ICRAF and CARE.

Dr. Don Peden of ICRAF told us of AFRENA (agroforestry research network for Africa) and its division into agroecozones: the highland zone (1000 - 2500) with bimodal rainfall (> 1000 m) serves not only Uganda but also Kenya, Rwanda and Burundi, with possible future extension into Ethiopia. The highlands of Tanzania seem neglected. Trials have been laid out at Kachwekano but there is pressure to move agroforestry research to Kalengyere. However, ICRAF's trials at Kachwekano seems in need of rethinking : too many variables and insufficient attention to estimation of soil loss. There is need to partition the effects of returning green manure to the land from the effects of the trees alone.

Farmers are not yet cutting and carrying grass for cattle but zero grazing for dairy animals is likely to be common in the future. The planting of grass strips at the top of, but at edge of, the bunds should help to stabilize these, to sift out sediment in runoff water and to utilize the nutrients accumulated there. Near the compounds, the grass should be nutritious and palatable to livestock (Guatemala grass), but on the upper

slopes, and quite far from the compounds, a less palatable grass which is more effective in erosion and runoff control (Vetiver grass?) could be used.

Recommendations for Kabale district: soil fertility management

1. Collaborate with CARE and ICRAF in agroforestry research and the use of grass contour lines.
2. Conduct nutritional screening trials in Maziba sub-county, near Kachwekano and near the Impenetrable Forest.
3. The University should continue with research on the utilization of Tororo RP.
4. Apply for a pre-doc or post-doc agricultural anthropologist to participate in the soil management work in the district, possibly through the determination of farmers' perspectives, resources and constraints in soil conservation and soil fertility management, to work with agroforesters to devise systems in the light of farmers' objectives, to establish trials and demonstrations on-farm and to evaluate farmers' response to these efforts.

Kachwekano is one of the major testing sites of the National Bean Programme who are running a full range of trials here, including several on ascochyta blight. Disease (ASCO, ANTH, ALS, HB) pressure not very uniform. Heavy HB in a soil fertility trial.

Observations in Muko market, near Kalengyere, revealed range of bean seed types, predominantly multicomponent mixtures: Canadian Wonder, large purples, a few Calimas and Kablanketi, Tostado, Sugar beans, Canarias, a Zebra striped type and a large yellow-buff.

A brief stop at Kalengyere (2380m) where CIP (under Dr. Sika) has extensive potato trials. This site is being upgraded to a research station for which a director (Mr. T. Mafulira) has been appointed.

Approaching Kisoro, it was noted that native bamboo (zone approximately 2200-2400m) cut and carried, uses include climbing bean stakes. Obvious that soils more fertile here, indicated by absence of grass fallow. Basalt-strewn bean fields, on broad ridges with the basalt (source of P and S) cleared into banks.

Observations in Rwanda

Agroforestry and liming research at Rwerere is encouraging. The economics of lime use by small farmers on high fields should be studied. Trees planted at the base of terrace bunds on the least fertile soil, rather than on top in the most fertile soil, are likely to be more easily accepted by farmers. Grass strips should be used with the trees.

In the highly populated area near Butare, farmers are concentrating their manure on small parts of their land, which is of low fertility, and growing climbing beans. CW wonders if foliar applications of nutrients to climbing bean would be feasible. By doing so, the manure could probably be spread over a larger area, more climbing beans grown, and limiting nutrients could be applied with one or two timely foliar applications. Problems of nutrient losses to leaching and fixation and of nutrient imbalances would be lessened. Appropriate composition of nutrient mixtures would have to be determined for each zone. These could be sold in dry form in packets sufficient to treat 100 sq m. The quantities of material needed would be less than with soil application of fertilizer or lime. Transport of water to high fields may be a problem and some type of rain water catchments may be needed to make water easily available for the spraying of fields.

Recommendations. On paper, study the probable economics of foliar fertilization at R5-R6 and again at early R7 when available manure can be extended to cover 50% more land, and 100% more land. If it appears to be feasible, find a MSc student to do thesis research on the topic. Manure could be applied to cover 0, 25, 50, 75, and 100% more land than it presently covers, and nutrition supplemented with foliar applications of the most likely combinations of nutrients. The development of the research methodology to arrive at the best nutrient composition may be an important part of it, as the optimal nutrient composition is likely to vary from zone to zone. Nutrients applied should exclude N and K, and only nutrients inadequately supplied from the soil to reducing problems of leaf burning due to applied salts.

On-farm variety trials at Nyamugale, all with applied lime at 2t/ha. Eylands told us that he believes the 2 crucial factors for impact here, in the Bubaruka highlands (> 2,000 m), are lime (made available in 25kg bags) and accelerated multiplication of seed (available in bulk). Households typically own average 1.5 head of cattle which are estimated to produce 5.5t FYM per year and most of this is applied to beans grown near the homestead. CIAT should monitor the results of the on-farm trials in northern Rwanda (72 locations) to evaluate lime response at various levels of soil pH. Eylands is the person to contact on this work.

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3. Soils

The Bukoba-soils, derived from the Bukoba sandstone formation, are usually divided into four groups according to the FAO-classification. These groups are: arenosols, gleysols, vertisols and ferrasols.

The arenosols are very localised and not important for agriculture. They are in fact very sandy soils, even when undisturbed, not very fertile and very quickly exhausted if reclaimed for agriculture. Only a small part of Bukoba District is estimated to be covered by these soils. Near Bukoba town the sand is mined for construction purposes.

The gleysols and vertisols are more important. They cover a large part of the district (about 390 km² of the Ngoni River Basin alone). Gleysols are soils that have impeded drainage for a large part of the year. This is why their vegetation is grassland with islands of shrubs and trees on elevated termite mounds. The vertisols are better known as 'mbuga' or 'black cotton soils'. They are heavy claysoils, although the Kagera vertisols contain more sand than those found elsewhere. As in the gleysols, drainage is the main problem. Another problem in vertisols is their deep cracking when dry and stickiness when wet. They are very difficult to manage as tillage should be done at the right moisture content; this requires good timing.

These soils with poor drainage occupy the floodplains of the Ngoni and Kagera rivers and the valleys of the smaller rivers. Their initial fertility is good. However, all attempts at reclamation so far have failed. If large scale drainage would be possible, and suitable crops would be identified, these soils can be expected to give a good yield for some years. However, the soils will be denuded for part of each year due to the removal of vegetation. As a result, they will be impoverished by leaching and breakdown of organic matter. As nutrients are also exported with the harvested crops, yields are expected to fall after a few seasons. A combination of retention of organic matter and application of chemical fertilizer will therefore be necessary. Although it is difficult to predict what will happen if these soils are reclaimed, it is not unlikely that an irreversible ecological disaster will take place.

At present the vast areas of swampland are mainly used for seasonal grazing by herds from Uganda and Rwanda, as well as cattle owned by Bukoba citizens. Where the valleys are close to the Kibanja, grass cutting for mulch has an impact. In the smaller valleys horticulture (mchicha, cabbage, tomatoes etc.) on raised beds along the streams is rather common although on a small scale. The clay soil is also used for brick making.

The most important soils are the ferralsols on which the kibanja and rweya are found. Many authors have tried to show a basic difference between the rweya and kibanja soils, but nobody has succeeded to make a clear distinction. The determining factor for successful transformation of rweya into kibanja is soil depth. Successful banana plantations cannot be established on rweya land with a soil depth of less than 1.5-2.0 m (*)

Under virgin conditions the rweya soils are of reasonable quality. When they are used for Omusiri cultivation, grazed during the fallow period and from time to time burnt, these soils quickly become acidic. The organic matter content is reduced, nutrient levels drop, free iron is released by the decaying organic matter and this may cause formation of iron crusts and concretions. Thus they are liable to severe damage by overutilization. Erosion is one of the phenomena to be feared when the rweya is used intensively.

Soil fertility is a big problem in the ferralsols. The picture is quite complex. The nitrogen content is low; the calcium status is complicated as there exists a balance between this element and potassium and magnesium. Copper is sometimes low, though usually sufficiently available. The phosphorus content is very low and fixation is to be expected when phosphorus is artificially applied. Zinc is low and in the case of tea visible zinc deficiency is common.

Another important characteristic, the exchange capacity, is low. This means that the soil is hardly capable of absorbing nutrients and slowly releasing them later. This in turn means that nutrients available in the soil are easily leached by rain. As these soils drain magnificently and rainfall is high, potential leaching is enormous. The most practical way to solve this problem is to increase or maintain organic matter content.

From the above it is easy to explain the popularity of cattle manure and the failure of inorganic fertilizers. Cattle manure is a fertilizer with well balanced amounts of many different nutrients. In combination with mulch, manure is capable of replacing the exported nutrients and maintaining the organic matter content. Inorganic fertilizers usually contain one or a few nutrients in high quantities. Micro-elements that are likely to be important for plant growth (e.g. Zn and Cu) are not supplied. The non-response, or even negative results of fertilizer applications can be attributed to deficiencies in trace elements, to leaching before nutrients are taken up by plant roots, and to disturbance of the balance between elements. For instance, application of phosphate fertilizers may lower yields due to induced Zn deficiency (antagonistic effect). Acidic fertilizers can completely destroy the delicate nutrient balance. But also chalking, which makes the soil less acid, may have adverse effects.

(*) The names of the various field types are explained in the chapter on land use.

Serious research, based on proper background knowledge, could open the way to use of inorganic fertilizers. However, organic matter in the form of mulch and manure will continue to play an important role in kibanja management. In the past, nutrient import from the rweya in the form of mulch and manure was sufficient to keep up the fertility of the kibanja. But with increasing population pressure, degradation of the rweya, disturbance of the balance between rweya and kibanja and the small number of farmers having access to manure, importation of nutrients from outside the system becomes unavoidable.

The above is not more than a generalized description of the soils of the area. Differences exist within the groups described. The ferralsols of Bugabo are poorer than those elsewhere in the area but contain 5-10 times more phosphate. Local differences in parent material seem to have created islands of fertility in the midst of poor kibanja soils (clear evidence in Butairuka village).

The ferralsols in the area west of Lake Ikimba give a picture different from the one sketched above. The clay content seems to be higher, possibly because these soils are derived from different parent material, or due to a difference in soil formation processes. Since they have only been occupied recently, fertility is still relatively good. While the same crops are grown as elsewhere in the district, the agricultural system differs in that rotation is practised. When banana yields drop a new plot is opened and the old one is left to fallow. This kind of shifting cultivation is possible because population pressure is low. In the long run this system will break down as soil fertility declines and population pressure will cause a shortening of the fallow period. Time will tell to what degree this system is destructive to the soils. Monitoring of the development will be useful.

At present, the only sustainable system in the area is the traditional kibanja-rweya system. It requires a considerable number of hectares of rweya to keep one hectare of kibanja productive without causing irreversible degradation of the rweya. One way to reduce the rweya:kibanja ratio would be to import nutrients from outside the system.

If soils are identified as problematic, on the basis of discoloration of plant leaves or obvious reduction of crop yield, the pH should be analysed first. If this is found to be low aluminium toxicity might be the cause of the problems. If there is no indication of Al-toxicity, analysis of trace and micro elements is justified.

Nitrogen fixation by beans, supposedly contributing to the nitrogen balance of the kibanja soils, is disputable as no definite proof or quantification is available. If there is any contribution at all, it is not likely to be substantial. In several villages farmers drew attention to the formation of laterite granules in the soil, which they claim to be a recent

phenomenon. They attribute its cause to the activity of worms. As there is no adequate explanation for this, and farmers do not distinguish worms and nematodes, no serious attention was paid to this phenomenon. As the formation of laterite is not well understood, a more serious look at the phenomenon may be justified. The formation of laterite granules as such will not cause problems, but it might be an indication of soil deterioration (e.g. breakdown of organic matter, leaching of iron, or acidification).

6. Land use

The Kibanja

The mainstay of the farming system in Bukoba is the kibanja, an area permanently planted with bananas and coffee, and surrounded by a living hedge of boundary markers, fuelwood and fruit trees. The core of every village is one or more clusters of kibanja land, situated on top of ridges, upper slopes, or at the foot of escarpments, wherever soil depth and fertility permit. Fertility is artificially maintained by manuring, mulching and the ecological soundness of the system (see below). Unlike most other African societies, Haya social structure is based on spatial rather than genealogical concepts. The kibanja is permanent; its successive occupants lie buried there. But the family is scattered at each successive generation because the kibanja can only sustain a limited number of people (Keining 1966).

The limits of the kibanja areas are sharply delimited. Although it is possible to turn rweya grassland into kibanja land, the potential for such expansion is limited by soil suitability and the high investment in labour and capital required. The degree of permanency of the system is remarkable. Area maps published by Keining (1966) and Keld (1975) can be traced without effort on 1987 air photographs. Keining mentions the similarity between a German map of 1911 and her own of 1953. It may be concluded that no substantial alterations have occurred between 1911 and 1987, at least in that particular area. The availability of 2 sets of aerial photography (1968 and 1987) will make it possible to study changes in the land use pattern in detail.

Agricultural production on the kibanja appears relatively effortless in the short run, but requires careful long term management. The sandstone based soils of Bukoba count among the least fertile in Africa, with only occasional patches of somewhat higher fertility. The kibanja areas are man made cushions of organic material that can only be maintained by constant human effort. Soil fertility in the kibanja mainly depends on four factors:

1. Natural soil fertility, depending on the parent material and the degree of leaching. The soils in the North East (Bugabo) are particularly infertile, while those in the

South west (Rubale, Katelero) are more fertile due to a richer parent material and lower rainfall.

2. The availability of manure, which is the main carrier of nutrients from outside the kibanja. There is evidence that the number of cattle in the district has steadily declined over the last century. Together with the increase of population this has led to a drop of the number of cattle per household. This may be one of the important causes of the current crisis in the agricultural system. In the older settled areas manure is essential for establishing new bananas. People have clear notions about the amounts of manure to apply per planting hole.
3. Mulching with banana residues and grass. All non edible parts of the banana trees (leaves, stems, peels) are returned to the kibanja to provide a constant soil cover conserving moisture and suppressing weed growth. Export of nutrients is therefore minimal. Grass mulch is often applied at the edge of the kibanja, particularly under coffee. It is also a form of importing nutrients from the surrounding grassland. It may be surmised that one of the reasons why it is hard to bring rweya under cultivation is that it has been mined for a long time by constant grass-cutting and burning without receiving any nutrients in return. Other crop residues are automatically added to the mulch layer, and those with enough money for transport collect coffee husks from the Bukop factory.
4. Composting. Especially around Maruku, composting to make up for the scarcity of manure has been developed to a good husbandry level. However, it is difficult to prepare adequate amounts for more than a few banana plantings at the time. The composted material is mainly collected on the Kibanja itself (weeds etc.) with little additions from outside. In the long run the system can therefore not depend on compost alone.

It should be added that the local farmers have very strong feelings against chemical fertilizers, following some bad experiences with insecticide (Dieldrin) on bananas. Some will apply fertilizers on maize or coffee, but nobody will do so on bananas.

Appendix 6.

SADCC/CIAT NEMATOLOGY SUB-PROJECT INTERIM REPORT

I understand, after consultation with Dr. David Allen, Regional Coordinator for SADCC/CIAT, that a full technical and financial report is not required at this point, but at the 2nd SADCC/CIAT Regional Bean Workshop and at the 9th SADCC/CIAT Steering Committee Meeting, respectively.

SUMMARY OF SUB-PROJECT WORK TO-DATE

Guidance notes on sampling and dispatch and an introductory letter were drawn up and posted as soon as funds became available and as contact names were received. This material has been posted to all contact names received from SADCC/CIAT headquarters.

As soon as specimen tubes for the sub-project became available, these have been/are being sent to sub-project participants requesting them, via SADCC/CIAT scientists. The specimen tubes acquired for the sub-project are not of the type requested originally for dispatch, and it is hoped that more appropriate ones can be obtained.

A literature review on *Phaseolus vulgaris* lines reported as showing some resistance to *Helicoverpa* species was completed and a seed request sent off. Seed was to be sent to Uganda first, for quarantine reasons.

The opportunity to survey in Tanzania has so far arisen only for Lushoto area (three days) and Arusha area, with some sampling in Kilimanjaro Region at intervals. Last minute arrangements made for me to sample in Kagera did not secure the necessary transport facilities within the region for doing the work. All samples collected to date have been processed.

A little of the seed requested from within Tanzania was received very late, in November 1989. There is no confirmation as yet from CIAT headquarters as to the whereabouts of seed ordered for the sub-project in April 1989.

ONGOING AND PLANNED WORK

1) Within Tanzania

After consultation with the Regional Coordinator, it is suggested that the work be pursued, as planned.

Major bean growing areas still need to be surveyed, as the opportunity for me to do so arises. Sub-project funds already earmarked for this will be necessary. I have been asked, where

time allows, to identify the full spectrum of nematodes associated with *Phaseolus vulgaris*, and not just *Meloidogyne*. This requires the use of a centrifuge (for the less motile taxonomic groups, the Criconematids in particular). There is no centrifuge at Lyamungu able to attain the required speeds. As only a small fraction of sub-project funds for equipment has so far been spent, and as existing department reagents have been used in lieu when sub-project reagents have not been forthcoming, it has been suggested that equipment and reagent funds unspent to date might be used instead to purchase a centrifuge.

Screening for resistance will be dependent on access to seed, from within Tanzania and from overseas.

2. Outside Tanzania

As mentioned, seed with known resistance to certain populations of specific *Meloidogyne* species has not as yet been received. After consultation with the Regional Coordinator, it is being suggested that scientists wishing to participate in the sub-project should continue, as already laid out in the original proposal, to identify sites with high infestation of *Phaseolus vulgaris* by *Meloidogyne* species, and send fixed samples to Lyamungu: in preparation for eventual pathogenicity and screening work. It is also being suggested that a working group meeting, with a training component, be arranged in March next year, for sub-project participants to meet and agree on joint methodologies for pathogenicity and screening (for resistance) work. In the interim, I would encourage all sub-project participants to keep infestation records for any *Phaseolus vulgaris* lines grown at *Meloidogyne* infested sites, as a preliminary screening procedure, with careful note of the site(s) involved.

Dr. J. Cuthbert
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Lyamungu, A.R.T.I
P.O. Box 3004
Moshi, Tanzania
26.II.90

UNIVERSITY OF MALAWI

BUNDA COLLEGE OF AGRICULTURE

SADCC/CIAT DROUGHT SUBPROJECT

RESEARCH PROGRESS

An experiment was conducted between July and October, 1989. The experiment, with three replicates using twenty-five (25) selected genotypes was grown in a split plot with three main plots; viz: a. well-watered throughout; b. drought-stressed during vegetative period; c. drought-stressed during reproductive period. Drought was imposed by stopping irrigation. This experiment was located at Bunda and Kasinthula in the Lower Shire. Treatments seemed to have been successfully imposed because yields were significantly reduced by drought stress. Drought imposed during the vegetative period led to significant reduction in total biomass (g/m^2), leaf area, canopy height and width, number of pods per plant and seed yield. Canopy characteristics were not affected by the latter drought period. The experiment conducted at Bunda produced similar results. Domino produced good seed yield when drought was imposed during the vegetative period whereas Sapelekedwa, A268, A286 and 8-7 produced good seed yields when drought was imposed during reproductive period. Under well-watered conditions the following genotypes gave high yields: Sapelekedwa, Diacol Calima, BAT 1387, BAT 1386, C-20, Domino, Bonus, Nasaka, Umvoti, A 344 and PVA 781.

In March/May a number of experiments will be conducted under terminal drought stress by phased planting so that the beans flower and fill seeds in dry weather. These will include the same 25 genotypes but in Randomized Complete Block Design. In May/October a number of experiments will be conducted under irrigation. The first is that using two drought tolerant genotypes of the same growth habit against two drought susceptible ones. This will be for Type II's and IV's.

An experiment is already in progress assessing water-use efficiency of twenty genotypes of beans.

The GIARA (Germany-Israel Agricultural Research Account) Project intends to purchase equipment that will be used in the Drought Mechanisms Study (mentioned above) during May - October.

Drought Nursery

Drought Nurseries have been successfully distributed in the region. Malawi, Zambia, Zimbabwe, Tanzania, Lesotho, Botswana and Swaziland have been sent the nursery. Attempts to establish it have been unsuccessful in Lesotho and Zimbabwe because of environmental problems. Zimbabwe has now been sent another nursery. Swaziland has also just been sent this nursery. Results from other countries over the past year are being compiled by Zambia, which coordinates this component of the subproject.

The status on the questionnaire for the Agronomic Practices under Drought Situations, constructed by Tanzania, is unknown. Mr Ndakidemi, who is coordinating this component, has left for further studies but we hope the National Programme will continue and administer the questionnaire soon.

Zambia is coordinating the 'Breeding for Drought Tolerance' component of the subproject. Lines that showed promise in the previous studies of the subproject have been sent to Zambia. We are now awaiting a proposal for this component from Mr Mbewe, who is its coordinator.

SADCC/CIAT DR A B C MKANDAWIRE PROJECT - STATEMENT OF EXPENDITURE
FROM APRIL 1989 TO DECEMBER, 1989

April, 1989	Payment voucher No. 197	
	Paid Daily paid Labourers	K 182-49
	Payment voucher No 148	
	Paid wages for research assistants	198.80
JUNE	Payment voucher No. 619	
	Paid wages for research assistants	118.40
	Payment voucher No.679	
	Paid Daily paid labourers	457.71
JULY	Payment voucher No..792	
	wages for student vocational employment Ali W K	21.00
	Payment voucher No. 826	
	wages for student vocational employment Ali W K	21.00
	Payment vocuher No. 873 wages for Daily paid labourers	631.18
AUGUST	Payment voucher No. 899	
	vacational employment Ali W K	25.00
	Payment voucher No. 933	
	vacational employment Ali W K	25.00
	Payment voucher No. 1041	
	Vacational employment W K Ali	25.00
	Payment voucher No. 1088 wages for Daily Paid labourers	635.33
	Payment voucher No. 2004	
	vacational employment W K Ali	25.00
SEPTEMBER	Payment voucher No. 2058	
	vacational employment W K Ali	25.00
	Payment voucher No. 2221 wages for Daily Paid labourers	688.69
OCTOBER	Payment voucher No. 2426	
	wages for Daily paid labourers	894.52
	Petty cash voucher No.694 Extral time worked paid T Sabwelera	17.53

2.

NOVEMBER 1989

Payment voucher No. 2638
paid wages for Daily Paid
labourers

Photocopying charges for 64
copies at 32t. Invoice No. 16190 518.32

DECEMBER

Payment voucher No. 2836 wages
for Daily paid labourers 432.63

Total K5,009.08

REGIONAL PROGRAMME ON BEANS IN SOUTHERN AFRICA.

SADCC Regional Sub-project Proposal.

BREEDING DRY BEANS (PHASEOLUS VULGARIS L.) FOR DROUGHT TOLERANCE.

(A COMPONENT OF THE ON-GOING SADCC/CIAT DROUGHT SUB-PROJECT).

MARTIN N. MBEWE,
MSEKERA REGIONAL RESEARCH STATION,
P.O. BOX 510089,
CHIPATA,
ZAMBIA.

BACKGROUND

The SADCC/CIAT drought sub-project was initiated in Harare, Zimbabwe, from May 9-11, 1988. The object of the sub-project is to improve bean yields under conditions of moisture stress. The sub-project has four components:

- 1 - Regional Bean Drought Nursery.
- 2 - Screening for Drought Tolerance in beans.
- 3 - Agronomic Studies on Strategies for Allaviating Drought.
- 4- Breeding for Drought Tolerance.

Initial work on the first three components has been completed and promising materials have been identified. These will form parental genetic sources for drought tolerance in the fourth component of the sub-project.

INTRODUCTION

Drought is one of the two most important physiological problems limiting bean (*Phaseolus vulgaris* L.) production (2). Perhaps it comes second only to soil fertility. Within the SADCC region, it has been identified as one of the major factors lowering agricultural productivity and eventually leading to hunger. Consequently peoples' efforts are diverted from concentrating on development to hunting for food. It is imperative, therefore, that control measures are sought to contain drought conditions. Drought tolerance is one such control measure.

Drought tolerance encompasses all mechanisms which permit greater yields under soil moisture deficits. These mechanisms include characteristics such as earliness and deep roots both of which would be considered escape or avoidance mechanisms (2).

Drought tolerance is heritable and enough variability has been observed to exist in crop plants for this character. This facilitates the incorporation of the character into desirable genotypes, recognising that it varies across environments and that it depends on factors causing it.

METHODOLOGIES

1. Sources of drought tolerance.

In the Drought Tolerance Mechanism Study component of the drought sub-project, Dr. A.B.C. Mkwandawire of Bunda College of Agriculture, Malawi, identified the following ten (10) bean varieties as promising under drought conditions and they have since been sent to Msekera Regional Research Station, Chipata, Zambia, for use as tolerant parents in the breeding component of

the sub-project: PV 508, NUWEVELD, A 286, C-20, PVA 1082, A 268, 2-10, PVBZ 1589, 8-7, DIACOL CALIMA. Information on the characteristics that determined drought tolerance in these varieties has been requested from Dr. Mkandawire and its arrival is being awaited.

2 - Recipients of drought tolerance.

Requests will be sent to coordinators of National Bean Programmes within the SADCC region to send in their commercial varieties or breeding lines into which they would like drought tolerance incorporated.

3 - Incorporation of drought tolerance into desirable genotypes.

In breeding for drought tolerance in commercial varieties and/or breeding lines, other production limiting factors such as diseases and insect pest resistance should simultaneously be incorporated. It is important, therefore, that the parental sources for drought tolerance should also carry genetic factors conferring resistance to economically important diseases and insect pests prevalent in a given production region. It is hoped that the data collected on the parental source materials during the mechanism study include all of the above characteristics.

The Partial Diallel Mating Design will be used. Each of the ten (10) parental sources found promising under drought conditions will be crossed to some, but not all, of the other desirable parents into which drought tolerance is to be incorporated. This assumes that all the tolerant parental sources have similar characteristics. This mating design will be essential since there will be an unlimited number of recipient parents. This will also involve fewer matings than if every source parent was mated with every other recipient parent.

An inbred-backcross line programme will be followed in transferring drought tolerance, along with other characters, into desirable genotypes. Two backcrosses with recurrent parent (drought tolerant) followed by two generations of inbreeding will be adequate before beginning single plant selection and progeny test (†). In the initial stages of the selection process, great importance will be attached to selecting for resistance to diseases and insect pests. Yield and yield component evaluations will follow in later stages.

PROPOSED PROGRAMME OF ACTIVITIES FOR FIRST YEAR

<u>MONTH(S)</u>	<u>MAJOR ACTIVITIES</u>
MARCH, 1990,	-CLEARING FIELD -PLOUGHING -RIDGING -SETTING IRRIGATION PIPES -PLANTING TOLERANT PARENTS AND ZAMBIAN DESIRABLE GENOTYPES
APRIL	-CROSSING UNDER IRRIGATION CONDITIONS
MAY - JUNE	-HARVESTING F1'S
JULY	-VISIT AND COLLECT GERMPLASM FROM DRIER SOUTHERN, WESTERN PROVINCES AND THE VALLEY AREAS OF ZAMBIA
AUGUST	-PLOUGHING -RIDGING -PLANTING F1'S AND TOLERANT PARENTS IN PLASTIC POTS -ANTICIPATED RECEIPT OF VARIETIES AND BREEDING LINES FROM OTHER SADCC NATIONAL PROGRAMMES AND PLANTING THEM
SEPTEMBER	-BACKCROSSING F1'S TO RESPECTIVE TOLERANT PARENTS -CROSSING TOLERANT PARENTS WITH LINES FROM OTHER NATIONAL PROGRAMMES
OCTOBER - NOVEMBER	-HARVESTING BACKCROSS PROGENY -HARVESTING F1'S
NOVEMBER - DECEMBER	-PLOUGHING -RIDGING -PLANTING FIRST GENERATION BACKCROSSES AND TOLERANT PARENTS UNDER RAINFED CONDITIONS -PLANTING F1'S
JANUARY, 1991	-BACKCROSSING THE FIRST GENERATION BACKCROSSES TO RESPECTIVE TOLERANT PARENTS -BACKCROSSING F1'S TO RESPECTIVE PARENTS

FEB ← MARCH-----HARVESTING SECOND
 BACKCROSS PROGENY
 -HARVESTING FIRST BACKCROSS
 PROGENY

PROPOSED FIRST YEAR BUDGET

<u>ITEMS</u>	<u>COSTS IN U.S.\$</u>
6" PLASTIC POTS	1000.00
POT LABELS (PLASTIC)	50.00
CROSSING FORCEPS	100.00
CROSSING TAGS	50.00
CROSSING BENCHES	1000.00
REAGENTS - ALCOHOL/SPIRIT FOR STERILIZING FORCEPS	50.00
CHEMICALS - INSECTICIDES - FUNGICIDES - BACTERIOCIDES	50.00
SPRAYER	150.00
LABOUR	1700.00
FUEL	300.00
SUPPORT SERVICES/ COMMUNICATIONS	300.00
TRAVEL - LOCAL (10 DAYS TO DRIER SOUTHERN AND WESTERN PROV. AND THE VALLEYS OF ZAMBIA) AT 50\$/NIGHT + TRANSPORT COSTS BY ROAD	600.00
INTERNATIONAL (MALAWI AND TANZANIA FOR CONSULTATIONS)	650.00
<hr/>	
TOTAL	6000.00

REFERENCES

- 1 - BLISS, F.A. (1984). Breeding for enhanced dinitrogen fixation potential of common bean. pp.303 - 310. In (P. Ludden and J. Burris, eds.) Nitrogen Fixation and CO₂ Metabolism. Proc. 14th Steanboch Symposium. Elsevier Publishing Co., New York.
- 2 - Singh, S. and White, J. (1987). Breeding Common Beans for adaptation to drought conditions. Proceedings of the International Bean Drought Workshop, 19 - 20 October, 1987, Cali, Colombia. Working Document No. 41.

University of Malawi
BUNDA COLLEGE OF AGRICULTURE

MSUKU

SADCC/CIAT STATEMENT OF EXPENDITURE MARCH, 89 TO JANUARY, 90

MARCH, 89	Payment voucher No. 2042 paid to Senior Staff Association for meals. Drinks served to CIAT visitors	K 58.08
	P. Voucher No. 2112 paid wages to research assistants	180.80
	P voucher No. 2150 paid wages to daily paid staff	188.65
	Purchase Journal No. 1640 Invoice No. 16189. Bata 12 pairs of Gumboots	457.53
	PJ. No. 1767 invoice No. 02207 61 Litres Petrol at K1.86	113.46
	PJ. No. 1777 invoice No. 33622 82.3 Litres Petrol at K1.86	153.08
APRIL, 89	P. Voucher No. 89 paid for 625 kgs. Fertilizer	393.75
	P. Voucher No. 197 paid wages to Daily paid staff	220.22
	Invoice No. 16847 73 Litres petrol at K1.86 1 x 5 litres oil at K29.64	K135.78 29.64
		165.42
	SUB TOTAL	K1,930.99
	Invoice No. 74773 87 Litres Petrol at K1.86	161.82
	Invoice No. 14332 Photocopying charges 12 copies at 32t	3.84
	Petty cash voucher No. 16 paid staff (Daily paid staff) to F Dickson	13.86

MAY, 89	Payment voucher No. 395 paid Daily paid Staff wages	K 509.96
	Invoice No. 14599 Duplication charges on 200 copies at .08t	16.00
JUNE, 89	Payment voucher No. 679 paid Daily paid Staff wages	526.68
JULY, 89	Payment voucher No. 843 paid wages to research assistants	92.80
	Payment voucher No. 859 paid L Kumfera 1988/89 Leave Grant	591.47
	SUB TOTAL	<u>K3,922.42</u>
AUGUST, 89	Payment voucher No. 1042 paid wages for Research Assistants	93.20
	Payment voucher No. 1088 paid wages for Daily Paid Staff	621.75
	Invoice No. 15138 treatment charges (Medical)	1.80
SEPTEMBER, 89	Payment voucher No. 2221 paid staff wages for Daily paid staff (Labourers)	630.15
	Payment voucher No. 2159 paid wages for Research Assistants	93.00
OCTOBER, 89	Payment voucher No. 2391 paid wages for Research Assistant	93.00
	Payment voucher No. 2426 paid wages for daily paid staff (labourers)	583.11
NOVEMBER, 89	Payment voucher No. 2462 paid Secretarial services to Mrs Chauluka	46.00
	Payment voucher No. 2593 paid wages to research Assistant	93.00
	SUB TOTAL	<u>6,177.43</u>

NOVEMBER, 89	Payment voucher No. 2638 Paid wages for daily paid Staff labourers	K 449.35
	PJ. Invoice no. 35657 2 fumigation sheets	422.00
	PJ. Invoice No. 8696 2 x 10 kg. Actellic Dust	320.00
DECEMBER, 89	Payment voucher No. 2757 paid wages for Research Assistant	93.00
	Payment voucher No.2842 Photographic films	46.65
	Petty cash voucher No. 906 secretarial services (Kalinda)	22.00
JANUARY, 90	Payment voucher No. 3004 paid wages for Research Assistant	93.00
	Total	<u>K7,623.43</u>

IDENTIFICATION OF APHID SPECIES AND
FIELD TECHNIQUES FOR APHID -
BCMV DISEASE

REPORT ON A TRAINING WORKSHOP HELD AT
BUNDA COLLEGE, MALAWI, JANUARY 1990

Leonard M. Kantiki, PhD
Training Workshop Organiser (Malawi)

CIAT/SADCC BEAN APHID-BCMV SUB PROJECT

ACKNOWLEDGEMENTS

The Bean Aphid-BCMV Sub Project team would like to thank Bunda College for hosting the workshop.

We also extend our thanks and appreciation to the resource person Dr Autrique and his technician Mr L Ntahimpera for their most valuable contributions at the workshop.

We would also like to thank the CIAT/SADCC Bean Programme for funding the workshop.

SUMMARY

1. A training workshop organised by the Bean Aphid-BCMV sub project was held at Bunda College, Malawi on 22-26 January 1990. Senior crop protection scientists working on Aphid-BCMV complex and their technicians from Malawi, Burundi, Tanzania and Zambia participated in the workshop.
2. The main objective of the workshop was to develop skills for identification and sampling techniques of aphids as vectors of BCMV. Through the expertise of the resource persons and experiences, in the field, of the other scientists from the disciplines of entomology and plant pathology developed and characterised 27 aphid species common in the region. Participants also learned sampling techniques and preservation methods of aphid.
3. Keys for aphid identification were adopted and distributed to participants for use in their respective stations.
4. This report further describes the topics discussed at the workshop.

1. INTRODUCTION

Aphids are critical to bean production in the tropics. They are vectors of Bean Common Mosaic Virus (BCMV) complex, a disease causing devastating yield losses in many bean producing areas. There are a few different species of aphids found on beans and it is not well known whether all the species transmit the BCMV.

The CIAT/SADCC Bean programme has the mandate to study aphid as one of the major pests of beans in this region. Through the bean aphid sub project, the ecology and management of aphids on beans are being investigated. It is envisaged that these studies will bring to our understanding of aphids as vectors of BCMV. The workshop therefore provided the required training backup to the scientists and technicians for the identification of aphid species and BCMV management in beans.

The workshop focused on the identification of aphid species and continued to emphasize characteristics of the different species.

2. TOPICS COVERED

Eight topics were covered in the workshop. These were organized in the form of lectures followed by discussions. Trapping techniques and collection practicals were also conducted. A tour of the farmers' field was organised in Dedza a distance of 100 kilometres from Bunda College. The participants were provided the opportunity to experience pest and disease problems farmers are facing on beans.

2.1 Insect Pests on beans in Africa

The first lecture was presented by Dr Ampofo (CIAT/SADCC Entomologist). The lecture addressed commonly encountered insect pest problems on beans in the region. It was established in the lecture and discussion that three major pests namely beanfly Ophiomyia spp, aphids and bruchids pose a serious problem in the region. In the discussion participants also shared their experiences with these bean pests in their areas.

2.2 Biology and Ecology

This lecture which was delivered by Dr Autrique covered basic as well as applied aspects of biology and ecology of aphids. Seasonal populations and population dynamics were also discussed. The participants appreciated the aphid population trend in Africa and particularly in our region. The lecture stimulated a lot of discussion among the participants.

2.3 Morphology of aphids

The aim of this lecture was to remind the participants morphological concepts of insects, in particular aphids. Emphasis was made on those body characters used in identification. Participants learnt a lot in this lecture and appreciated the vast differences in the morphology of aphids.

2.4 Aphid monitoring

This lecture covered different methods and techniques of trapping aphids to study their populations. The methods included direct counts

of aphids on plants and trap collections. The relative merits and limitations of the different methods and techniques were also discussed in this lecture.

Other topics discussed in the training workshop were BCMV strains commonly found on beans in this region; BCMV Etiology and Aphids as vectors of BCMV. In these lectures participants were taught different symptoms of BCMV and the strains causing them. The discussions that followed in these lectures also clarified the role of Igene in causing distinct (Black root) necrosis reaction in some bean genotypes. These are in addition to the possible variations in mosaic symptoms often considered in field identification of the BCMV strains. It was also mentioned to the participants that NL₃ strain appears to be the most common BCMV strain in Zambia. However, the Zambia team expressed concern for more research in this area. The discussions also highlighted the scope for BCMV resistance and integrated disease management. In conclusion problems and prospects for production of BCMV free bean seeds and the aims of exchanging seed material were resolved.

The final lecture at the workshop addressed aspects of BCMV spread in beans: aphid transmission, aquisition, dispersal and inoculation. Techniques on culturing virus-free aphid colonies, handling and procedures in determining the efficiency of aphid species in non persistent (Stylet-borne) transmission were discussed.

3. PRACTICALS

The practicals included identification of aphid species using taxonomic keys and collection of aphids in yellow water traps. Participants

acquainted themselves with characters of 27 species. This practical session was particularly useful to the participants in acquiring skills to be able to separate the commonly occurring aphid species in the region. The impact of this practical on the participants knowledge was demonstrated by the participants being able to identify and separate species of aphids collected from the water traps which were set on lawns of Bunda College. This was no doubt one of the successes of the training workshop.

4. FIELD TRIP

The participants were taken on field trip to Dedza, about 100km South West of Lilongwe. The group visited three farmers fields and the sub project experimental fields. On this field trip, participants were able to view aphid and BCMV problems in farmers' fields. They also tested in the farmers' fields a proforma and rating scales that were discussed at the workshop. Participants collected aphid samples from the farmers' fields for identification. This exercise gave participants confidence in applying their skills acquired at the workshop.

An ad-hoc committee was formed to review and up-date activities and procedures being used in the subproject. A separate report of the group's discussion is presented.

5. CONCLUSION

Participants expressed their appreciation for being invited to the workshop. They praised the manner in which the lectures and practicals were arranged. It was clear from their remarks that they had gained a

lot from the workshop. The organisers were very thankful to the CIAT/SADCC Regional Bean Programme for funding the workshop. The participants finally expressed their gratitude to the resource persons, and local organisers and the Government of Malawi for their various contributions towards the workshop.

6. FINANCIAL REPORT

The workshop had a funding of US\$5,000 being US\$1,000 from Zambia and Malawi sub-projects to cover Dr Autrique's travel expenses (Air ticket and enroute expenses). US\$3,000 was part of the cheque given to Dr A B C Mkandawire in Swaziland being US\$2,000 for the Aphid-BC-IV sub-project and US\$1,000 for Dr Autriques travel expenses. This means CIAT/SADCC, Arusha had to send Bunda College US\$4,000 for the workshop instead only US\$2,000 was sent by wire. The remaining US\$2,000 was never sent. We had therefore used the US\$2,000 from the Aphid-BC-IV sub project funds. This arrangement left the sub project without any money.

The total Training Workshop budget was US\$5,000 (including Dr Autrique's US\$1,000). This was in Malawian kwacha (MK) 13,024.12. The following is the detailed expenditure:

<u>ITEM</u>	<u>AMOUNT SPENT (MK)</u>
1. Accommodation, meals and use of college facilities	5,267.00
2. Out of pocket allowance and travel expenses (claims)	3,384.00
3. Transport for local running (SS-Rent-A-Car company)	5,132.09 5,132.09
4. Fuel	204.60
5. Opening reception	616.00
6. Stationary and photocopying	386.91
7. Transport to Dedza farmers fields	<u>500.00</u>
TOTAL EXPENDITURE	<u>15,490.60</u>
INITIAL FUNDING	MK13,026.12
TOTAL EXPENDITURE	<u>MK15,490.60</u>
OVER EXPENDITURE	<u>MK2,463.88</u>

Note: The Aphid-BCMV project owes the College MK2,463.88.

I have already been asked to pay.

REPORT ON THE APHID-BCMV SUB PROJECT

AD-HOC GROUP DISCUSSION

This report was prepared by Dr S Sithanatham and edited by Dr L Kantiki.

This group discussion was held during the Training workshop with the objective to review procedures and methodologies of the sub project. Dr Ampofo introduced the aspects that need great attention in the sub project. These aspects are reported here. Dr Autrique also emphasised that we need to consider in the sub project, ecology of the aphids and transmission mechanisms of BCMV. Dr Autrique's remark was in agreement with comments from Dr Mike Iriwin of United States.

The objectives of the original subproject were reviewed and amended as follows:

Objective 3 in the proposal was amended as "to ascertain the species of aphids that transmit BCMV".

Objective was amended as "the potential of the commonly occurring species of aphids in transmitting BCMV would have been assessed".

There was also amendments on the time of plan work section of the proposal.

Section 1b: "Estimation of losses caused by aphids;" to be dropped.

Section 3: a sub-section "Aphid species that transmit BCMV (screen house/field tests)" should be added.

Section 4: studies on cultural practices should be dropped.

It was generally agreed that the visual rating of BCMV be on 1-9 scale instead of 1-5 as indicated in the proposal. In order to standardize the aphid infestation rating the following scale was agreed:

VISUAL RATING SCALE FOR BEAN APHID - ON FARM SURVEYS

<u>SCALE</u>	<u>APHID POPULATION/PLANT</u>
1	0
2	1 - 50
3	50 - 100
4	100 - 200
5	200 - 400
6	400 - 600
7	600 - 800
8	800 - 1,000
9	Above 1,000

The rating scale for other pests, diseases and weeds to be detailed also into 1-9 scale, on the following basis:-

- 1 - No incidence/damage
- 3 - Light (up to 10% incidence/damage)
- 5 - Moderate (11 - 30% incidence/damage)
- 7 - Heavy (31 - 50% incidence/damage)
- 9 - Very heavy (above 50% - incidence/damage).

In case the description of the scale needs to be modified for any local purposes, it must be explained, along with the details of the modified descriptions while reporting the results.

During the surveys, the natural enemies collected should be reared/preserved for identification.

- 2b. Trap monitoring: While yellow pan traps are known to be effective (being attractive to many aphid species), there is need to verify if the numbers and species of aphids caught in these traps are comparable to those landing on bean plants in the vicinity. Possibly transparent sticky traps/tile traps could be tested for comparison, at least in one season.
- 3a. Extent of seed-borne BCMV: This is an important aspect, and can also be taken up in Tanzania/Malawi at least during the second/third year of the project, with the supervision by or training from a local biologist/pathologist.
- 3b. BCMV secondary spread by aphids: The methodology may be modified so to keep plots of T1 and T2 separated by about 500 metres or in separate fields, and the aphid landings in each plot to be also monitored, if possible.
- 3c. Aphid species as vectors of BCMV: The common species of aphids based on trap/plant collections, will be established on disease-free hostplants. After optimum 'acquisition' and 'inoculation' access feeding, the percentage success in - transmission by each aphid species will be determined.

OTHER ASPECTS RELATING TO SUB-PROJECT

Materials:

Among the materials that are urgently required for purchase in the sub-project are glass vials for storing/shipping aphids for identification.

Dr Autrique offered to obtain details of supply of vials and Dr Ampofo agreed to facilitate their purchase by ordering through CIAT.

For Zambian program, there is an urgent need to repair the net house at Chipata for the transmission studies and CIAT Regional Program's help could be sought for facilitating this, if needed.

Reporting:

It was clarified that half - yearly reporting of activities, progress and problems besides financial statements for each country to be made by the concerned national programme entomologist, to the sub-project co-ordinator, with a copy to the Bean Entomologist, CIAT/SADCC Bean Program, Arusha. The sub-project co-ordinator shall prepare a consolidated Annual Report (July-June) and arrange to submit it to the Steering Committee through the Zambian National Food Legume Coordinator.

Collaboration/Link up:

Collaboration with Dr A Autrique (ISABU, Burundi) has been very valuable and should be continued. Link up with other projects on BCMV in the region, especially the one on BCMV strains and on BCMV resistance (being co-ordinated by Dr Allan Femilana of Morogoro, Tanzania) would be very productive for this sub-project.

Appendix 12.

REGIONAL PROGRAMME ON BEANS IN SOUTHERN AFRICA

SADCC Regional Subproject Proposal

BEAN STORAGE : BRUCHID DISTRIBUTION BIOLOGY, ECOLOGY AND
CONTROL

Dr. Denash P Giga
Department of Crop Science
University of Zimbabwe
PO Box MP167, Mount Pleasant
Harare
Zimbabwe

September 1989

BACKGROUND

Beans are extensively grown in the Southern Africa Development Co-ordination Conference (SADCC) Region by both small and large scale farming sectors.

Large scale producers tend to sell their crops soon after harvest to central marketing institutions who are equipped with methyl bromide or phosphine to fumigate the crop as it enters storage. However, small farmers often want to try and store relatively small amounts of beans as a useful protein supplement to their mainly cereal or root crop diets from season to season. The crop then falls at risk to attack from the bean weevils Acanthoscelides obtectus and Zabrotes subfasciatus, which leads farmers to store smaller quantities than their families can nutritionally benefit from. This, added to the damage to the quantities stored, represents an area where research could potentially directly contribute to improvements of household food security amongst the rural poor.

While the bruchids Z. subfasciatus and A. obtectus are undoubtedly economic pests of bean production in SADCC, as they are world wide, little is known of the seriousness of this detractor from food security in SADCC. Like other economically important bruchids (Callosobruchus spp.) Z. subfasciatus and A. obtectus can reproduce both in the field crop while the seeds are still enclosed in the pods, and during storage. This study will set out to establish the ecology, species composition, distribution and species interactions (competition) as well as levels of infield and

storage infestations. The need for this information has already been established through an intensive literature review in relation to the SADCC Region. Despite the absence of quantitative assessments there are several indicators of significant economic losses by small farmers. It is also likely that field infestation levels will be significant as, frequently, what appear to be wholesome seeds at the point of threshing contain the developing larvae which quickly multiply in storage.

The ability of bruchids to undergo many generations on a single seed source, until the food is exhausted, is well known and consequent levels of damage are well documented in areas other than SADCC.

Despite the prevailing situation in SADCC that large losses and short storage periods cause a major constraint to the availability of legumes for consumption, methods of pest control and effective storage have been slow to emerge. Caswell (1968) showed that traditional methods of storage on untreated cowpeas and beans has little effect on losses (Taylor 1981). Shelling and fumigation are the technically effective solutions presently available but the storage structures in use, dangers to operators of using phosphine and the potential for development of resistance militate against this with small farmers. Field infestations also tend to be high, often because of the proximity of stores to crops, as has been shown with Callosobruchus maculatus in Nigeria.

Vegetable oils have been tested and found effective as

protectants of grain legumes, for instance, palm oil, coconut oil, cottonseed, groundnut, sesame, castor, rapeseed and mustard oils. This is widespread practice in Latin America, Nigeria and India where about 5 ml per kilogramme of stored seed, but is not, as far as can be ascertained, used in the SADCC Region. Laboratory and on farm trials are therefore needed to test, demonstrate and extend this technology if it is to advantage.

Because of the importance of cost effective bruchid control for small scale farmers, work at CIAT is concentrating on producing consumer acceptable varieties with bruchid resistance. Sources of resistance have been identified and samples of new germplasm, eg. arcelin protein beans, will shortly be available for collaborative testing.

LINKAGES AND COLLABORATION

Bruchid entomology and bean storage have the potential for high significance in improving food security in SADCC where small scale farmers face common problems which research information, technologies and recommendations can assist in removing.

This regional sub-project will be a collaborative undertaking linking the University of Zimbabwe, Sokoine University, Tanzania and national bean programmes of Somalia, Ethiopia, Burundi, Tanzania, Lesotho and Zimbabwe. Relationships with entomologists in the SADCC region through the SADCC/CIAT entomologist will be developed for the collection of bean bruchids for species composition and

distribution studies biological and ecological studies on geographic strains of the different species from the different countries.

An important aspect of this work will be the formation of a network of researchers collaborating on different aspects of bruchid research and control. A particular aspect here would be the development and implementation of some standardised methodology in addition to which the exchange of local germplasm would be a benefit.

The institutional linkages in this proposed cooperative programme are:

Dr. Denash P Giga	University of Zimbabwe Department of Crop Science
Ms Olivia Venge-Mukoko	Crop Breeding Institute Zimbabwe
Mr M Duncan	Olivine Industries Zimbabwe
Mrs Lilian Pomela	Agricultural Research Div. Lesotho
Dr. Susan Nchimbi	Sokoine University Morogoro, Tanzania
Mr Simon Slumpa	Selian Research Institute Arusha, Tanzania
Mr David Kabungu	Uyole Agricultural Centre Mbeya, Tanzania
Mr P Ndaiyragije	Dept. Defence des Vegetaux Bujumbura, Burundi
Mr Abdi Guled	Agricultural Research Centre Mogadishu, Somalia
Mr Frede Negassi	Institute Agricultural Research, Nazret, Ethiopia.

Linkages and collaboration with bean entomologists outside the SADCC region viz. Burundi, Ethiopia and Somalia have

been established as well. Mr. F. Negassi will undertake a Master of Science programme funded by the East Africa/CIAT sub-project in Ethiopia.

Other Entomologists in the SADCC region will also be contacted to make collections of bean bruchids for species identifications and distribution.

AIM

The aim of this project is to obtain a detailed knowledge of the small farmers bean storage systems, losses in storage, and bean bruchid biology and ecology with which to improve bean storage efficiency amongst small farmers, thereby enhancing their nutritional status and food security.

OBJECTIVES

1. To identify and evaluate the constraints to efficient bean storage faced by small scale farmers in SADCC.
2. To assess crop losses incurred by small farmers through use of traditional bean storage.
3. To assess levels of infestation, and species composition and species distribution.
4. To investigate interspecies interactions (competition), reproductive and competitive abilities of Zabrotes subfasciatus and Acanthoscelides obtectus under controlled environments.
5. To study in detail, the comparative biology of geographically distinct strains of A. obtectus and Z. subfasciatus from varying agroecological zones.
6. To screen Phaseolus germplasm from CIAT, national and

regional programmes and bruchid resistance nurseries.

7. To develop and evaluate simple and cost effective bean storage technologies for use by small scale farmers.

- (i) to determine the effect of post harvest drying before threshing (optimum threshing time),
- (ii) to investigate the efficacy of edible oils as grain legume protectants in laboratory and then on-farm trials,
- (iii) to evaluate the efficacy of alternative pest control strategies such as the admixture of ash, sorptive dusts and plant products such neem, as grain legume protectants.

ANTICIPATED RESULTS AND BENEFICIARIES

This project will present the first concerted bean bruchid research effort in the SADCC Region of which the main anticipated outputs would be:

formalised links between bruchid specialists in SADCC, accumulation of knowledge on the extent of losses in storage, the biology, ecology and distribution of the two prevalent species of bean bruchids prevalent in bean storage systems in the Region and their constraints. The project would provide data on the efficiency of a selection of control measures, and would facilitate the transfer of research results to extension practitioners while deliberately setting out to strengthen the SADCC researcher and research:extension linkages. Thus beneficiaries would include small scale farmers, extension practitioners and researchers in SADCC. It is envisaged that scientific publications would ensue, and that further

research avenues would be identified in the bean post production systems. A network of bean bruchid workers would be established in the Region. The important outcomes of the project are that a wide range of promising germplasm from regional and national programmes would have been tested for bruchid resistance and an evaluation of control measures upon which recommendations suitable for farmer adoption.

METHODOLOGY

Objective 1

To identify and evaluate the constraints to efficient bean storage faced by small scale farmers in SADCC. This diagnostic objective will be accomplished through rapid appraisal techniques in major bean growing areas in the respective countries of the collaborators. A questionnaire/checklist will be devised to ascertain small farmer bean storage methods, pesticide use, pest control measures, quantity of beans stored for consumption and for sale, length of storage, farmers' perceptions of storage problems, etc. A full survey is not proposed due to high costs and logistical constraints. The survey will focus on the main bean growing areas in the different agro-ecological zones of the collaborating countries. Objective 1 will be undertaken in Zimbabwe, Tanzania, Lesotho, Burundi, Ethiopia.

Objective 2

To assess crop losses incurred by small farmers through use

of traditional bean storage. Some of the farmers selected from Objective 1 would be used to undertake loss assessment studies. About 10-15 farmers from different ecological zones would be selected for the detailed loss assessments. Samples of beans in storage (approx 0.5kg) will be collected regularly throughout the normal storage period, or for at least 6 months, and will be assessed for damage, weight loss, insect pest spectrum, population numbers and changes in infestation with time. The 0.5kg sample will be subdivided into three 1000 grain sub-samples and percentage damage and weight loss estimated for each. In order to ensure continuity and evaluation over several months, the beans would be purchased from the farmer and stored in the farmers' storage systems. Objective 2 will be undertaken in Zimbabwe, Tanzania, Lesotho, Ethiopia and Somalia.

Objective 3

To assess levels of infestation and species composition in storage. Collections of beans will be made from farmers in the several different agroecological zones. Collections of beans will be made from farmers in different agroecological zones which will then be incubated in the laboratory to enable the species contained therein to be identified. In Zimbabwe, the Department of Agricultural Technical and Extension Services (Agritex) and the national bean breeder will assist in the collection in representative areas. Collaborators in their respective countries may adopt a similar approach. For a more complete picture on species distribution entomologists in other SADCC countries would be

approached to make collections of beans and insects therein and submit them to the Department of Crop Science, University of Zimbabwe, for identification. The success of this 'postal survey' would depend on the responses of the national programmes and entomologists in the region. Objective 3 will be undertaken by Zimbabwe, Tanzania, Lesotho, Somalia, Ethiopia in the first instance and possibly Malawi, Zambia and Kenya.

Objective 4

To investigate interspecies interactions (competition) reproductive and competitive abilities of Z. subfasciatus and A. obtectus. The competitive outcome and competitive abilities of the two bruchids would be determined using the replacement series approach. This design quantifies competitive interactions and enables the prediction of the competitive outcome to be made after a single generation. The effect of species interactions/competitive on biological parameters such as oviposition and development will be determined. Objective 4 will be undertaken in Zimbabwe.

Objective 5

To study in detail, the comparative biology of geographically distinct strains of A. obtectus and Z. subfasciatus from varying agroecological zones. The bruchids collected from different geographical areas and SADCC region will be bred under laboratory conditions. These cultures will provide insects for the biological studies at controlled temperatures of 20^o, 25^o and 30^oC.

Parameters to be measured will include adult longevity, rates of reproduction, oviposition periods, egg hatch, incubation period, development time and survival for strains under different temperature conditions. The studies in objectives 4 and 5 will enable a better understanding of bruchid ecology and distribution in SADCC. Objective 5 will be undertaken in Zimbabwe.

Objective 6

To screen Phaseolus germplasm from CIAT, national and regional programmes and bruchid resistance nurseries. CIAT developed methodologies will be used to screen germplasm from several sources in the SADCC Region for bruchid resistance, as will the resistant nurseries. Co-operators will undertake their own screening programmes, while bean germplasm from other national programmes will be evaluated at the University of Zimbabwe. The use of standardised methods will enable the direct comparison of results across the Region, and with CIAT. Variations between results can then be attributed to differences between geographic strains, for instance African as opposed to Latin America. Objective 6 will be undertaken in Zimbabwe, Tanzania, Somalia and Ethiopia.

Objective 7

To develop and evaluate simple and cost effective bean storage technologies for use by small scale farmers.

The studies above would lead into the evaluation of simple method/products for bruchid control. The objectives will be achieved through a series of controlled and semi-

controlled experiments in the laboratory and on farms.

Alternate strategies for pest control such as the use of edible oils and natural substances will be investigated for efficacy and economic suitability for use by small scale farmers. Those which qualify from the laboratory tests will then go forward to on-farm trials. The admixture of edible oils is widely practised in other parts of the world but seems to be largely unknown in the SADCC Region. Thus, if it works technically, considerable effort will follow in demonstration and extension, through the appropriate extension agencies in the collaborators countries. Objective 7 will be undertaken in Zimbabwe, Tanzania, Lesotho, Ethiopia and Somalia.

BUDGET

SADCC/CIAT CONTRIBUTION

(US \$9000 over 3 years)

To be administered by Selian Research Institute, Tanzania.

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Research Expenses			
Local travel	1800	1800	1800
Consumables/ Laboratory Supplies	1000	1000	1000
Support Services	200	200	200
	-----	-----	-----
	3000	3000	3000
	-----	-----	-----

Gross budget for three years US\$ 9000

Budget notes

1. Local travel provides for visits to small farms where surveys and on-farm trials will be conducted and samples collected regularly for analysis from field experiments set up in different agroecological zones.
2. Consumables and laboratory supplies include purchase of fertilizers, pesticides, seeds, chemicals, glass-ware, seeds, compensation to farmers etc.
3. Support services include secretarial assistance, communications, postage of samples, photocopying, library charges etc.

TIMETABLE: Schedule of Activities

OBJECTIVE	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
1	✓	-	-
2	✓	-	-
3	✓	-	-
4	-	✓	-
5	-	✓	-
6	-	✓	✓
7	-	-	✓

SADCC/CIAT CONTRIBUTION

(US \$16500 over 3 years)

To be administered by University of Zimbabwe

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Research Expenses			
Local travel	2800	2800	2800
Consumables/ Laboratory Supplies	1000	1000	1000
Research assistants/ enumerators	1500	1500	1500
Support Services	200	200	200
	<hr/>	<hr/>	<hr/>
	5500	5500	5500
	<hr/>	<hr/>	<hr/>

Gross budget for three years US\$ 16500

Budget notes

1. Local travel provides for visits to Communal Areas where surveys and on-farm trials will be conducted and samples collected regularly for analysis from field experiments set up in different agroecological zones.
2. Consumables and laboratory supplies include purchase of fertilizers, seeds, pesticides, chemicals, glass-ware, compensation to farmers etc.

Part time technical/research assistants would be engaged to assist with surveys, laboratory and on-farm trials and analysis of samples.

3. Support services include secretarial assistance, communications, photocopying, etc.

General

The Gross Budget for Zimbabwe, Tanzania and Lesotho is US\$10000 per annum (total \$30000 over three years). Somalia, Ethiopia have received support from the East Africa/CIAT programme. Due to the importance of this project and extensive travel involved, supplementary funds from other sources would be sought.

SADCC/CIAT CONTRIBUTION

(US \$4500 over 3 years)

To be administered by Agricultural Research Division,
Lesotho

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Research Expenses			
Local travel	1000	1000	1000
Consumables/ Laboratory Supplies	400	400	400
Support Services	100	100	100
	<u>1500</u>	<u>1500</u>	<u>1500</u>

Gross budget for three years US\$ 4500

Budget notes

1. Local travel provides for visits to small scale farms where surveys and on-farm trials will be conducted and samples collected regularly for analysis from field experiments set up in different agroecological zones.
2. Consumables and laboratory supplies include purchase of pesticides, seeds, chemicals, glassware, seeds, compensation to farmers etc.
3. Support services include secretarial assistance, photocopying, postage of samples to Zimbabwe, library charges etc.

Appendix 13.

Approximate budget position ¹ of SADCC/CIAT
Regional Bean Programme at 07.03.90

<u>ITEM</u>	<u>BUDGET</u>	<u>EXPEND</u>	<u>BALANCE</u>
NP EQUIPMENT	258,200	69,197	189,003
TRAINING	1,297,560	494,091	803,469
SUB-PROJECTS	361,000	102,483	258,157

¹ Ref. Harrington Hazel telex of 07 March 1990.

Revised Draft
11.1.90

ANNEX I
REGIONAL COLLABORATIVE RESEARCH SUB-PROJECT AGREEMENT
BETWEEN THE
CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL (CIAT)
AND

WITH RESPECT TO A REGIONAL SUB-PROJECT FOR
RESEARCH ON COMMON BEANS (*Phaseolus vulgaris*) TO BE
CONDUCTED BY _____ IN COLLABORATION WITH THE
SADCC/CIAT REGIONAL BEAN PROGRAMME

Agreement No. _____

WHEREAS the parties in this agreement, the Centro Internacional de Agricultural Tropical, hereinafter referred to as CIAT and

have common objectives in conducting research to improve the productivity and production of common bean (*Phaseolus vulgaris*), and

WHEREAS _____ wishes to take on leadership of a specific regional collaborative research sub-project on common bean in collaboration with CIAT.

WHEREAS the Steering Committee of the SADCC/CIAT Regional Bean Programme has determined _____ to be of regional significance and has recommended that _____ undertake (s) research to address this problem for the good of the SADCC Region.

Now therefore in consideration of the mutual agreements hereinafter set forth, the parties hereto mutually agree as follows :

ARTICLE I

The regional collaborative research sub-project covered by this Agreement is entitled

" _____ " and is described in Appendix I to this Agreement.

ARTICLE II

The principal investigator(s) charged with carrying out this research within _____ will be _____ who will cooperate with _____ of the CIAT staff in the SADCC/CIAT Regional Programme.

ARTICLE III

The responsibilities of _____ and of the principal investigator(s) for this project will be as follows :

- (i) To conduct the research according to the work plan accompanying the project description as attached in Appendix I to this Agreement.
- (ii) To provide a summary technical report annually to the regional representative of CIAT in order that the results of this regionally important research may be shared with other bean researchers of the SADCC region and to prepare a final report covering the research project according to the schedule indicated in the work plan in Appendix I.
- (iii) To prepare a scientific report when required by the Steering Committee to do so, on the results of the research for presentation at regional or international scientific meetings which will be held on a regular basis under the auspices of the Regional Programme for the countries of the SADCC Region.
- (iv) To certify that the funds received will be expended for the sole purpose of conducting the research described in Appendix I and that generally accepted accounting principles and internal control procedures will be followed in disbursing these funds.
- (v) To provide a financial report annually to the Steering Committee of the Regional Programme on expenditures incurred in this research with an audited financial report in accordance with the expenditure categories provided for in the budget projections in Appendix 2 to this Agreement. It is understood that CIAT reserves the right of performing an audit of funds spent before making any additional disbursement.

ARTICLE IV

The responsibility of CIAT with respect to this regional collaborative research sub-project are as follows :

- (i) To provide access to specialists, to scientific information, to appropriate techniques and to materials (including germplasm) to _____ in the conduct of the research involved in this regional sub-project.
- (ii) To provide financial resources for this regional sub-project to _____ in accordance with the budget projections which have been accepted by the Steering Committee and contained in Appendix 2 to this Agreement. CIAT will transfer the funds to _____ to the following bank account at the _____, account number _____.
- (iii) To assist the review of progress in the research and to recommend to the Steering Committee the continuation of the research in subsequent years if satisfactory results are being obtained and deemed of value to the SADCC Regional as a whole.

APPENDIX I

Suggest the following specific items be covered in each sub-project work plan :

- 1) Statement of Work : Description
- 2) Period of Performance. It is expected that the research described in this Agreement will commence approximately _____ and terminate approximately _____, unless terminated, modified or amended under the Articles of this Agreement.
- 3) Variance in Workplan. Any decision to suspend, terminate, modify or expand any of the planned work under this Agreement shall require consultation and concurrence between the parties.

APPENDIX II

- 4) Budget :
 - A) Life of project estimation
 - B) Annual budget by year
(if multi-year)

Research Grants Agreement

Grant Agreement No. Date

(1) Grant:US \$

(2) Grantee

(3) Project Title

(4) Administering Institute/Department

(5) Budget as approved and conditions for the Grant other than general conditions

With reference to the items under (1) to (5) SACCAR, and the grantee(1) and the Administering Institute (4) have agreed to their joint interest in supporting the Project (3) registered as SACCAR Research Grant No.

SACCAR will engage itself for a period of two years commencing on _____ 19 _____ by a grant of US \$ _____ subject to conditions under (5) and general conditions otherwise stated on this page and over leaf.

for SACCAR _____ date _____

I accept the grant (1) and agree to abide by the conditions

Grantee _____ date _____

We undertake to administer the grant (1) according to the conditions for Administering

Institution _____ date _____

General Conditions of Grant

Responsibilities of Grants

The Grantee agrees that the Grant provided shall be used solely for the purpose of the Project. The Grant is not transferable to another person without the written consent of SACCAR. The programme cannot be changed without the written consent of SACCAR.

Responsibilities of SACCAR

When SACCAR has received a duly signed copy of the grant agreement, the grant is at the disposal of the Grantee.

SACCAR retains the right to withdraw any unused part of the grant if it has not been used by the Grantee within the period of the agreement or if the agreement is cancelled or otherwise changed or some other circumstances prevents the fulfillment of the agreement.

Responsibilities of Administering Institute

The Institute (Department, Division) undertakes to administer the Grant for uses solely within the project and to provide the facilities necessary for the research.

Equipment purchased by the project and requiring installation will be installed by the Institute. Equipment, instruments purchased by the project shall remain the property of SACCAR until the completion of the project at which time their disposal will be arranged. Under most circumstances such purchases would become the property of the Institute.

Payment of Grant and Reports

Upon receipt of the signed copy of this agreement SACCAR will release to the Grantee approximately 75 per cent of the grant. The remaining 25 per cent will be released at the beginning of year 2 of the period and following the receipt of a progress report and statement of expenditures.

At the conclusion of the project a final report and statement of expenditures will be submitted to SACCAR.

Research Results

The Grantee is urged to publish all the results of the project in the designated journal for the agricultural sciences of the SADCC namely The Zimbabwe Journal of Agricultural Research. The Grantee shall keep SACCAR informed of the possible application of results of the project and shall deposit one copy of all publications with SACCAR.

SACCAR may use in its publication all material submitted by the Grantee or the Administering Institute after duly noting the source of such information.

Liability for Damage, Injury or Death

SACCAR shall not be liable for the death or injury of a person or damage to property arising out of conduct of the project. The Grantee and Administering Institute should jointly and severally agree to hold SACCAR immune from damages arising out of conduct of the project.

SMALL RESEARCH GRANTS

PAYMENT SCHEDULE - US \$

Research Grant No. _____ Name _____

Effective date for commencement of grant _____

First payment _____ date processed _____

Equipment _____

Operational _____

Total _____

date of receipt of progress report _____

Second payment _____ date processed _____

Equipment _____

Operational _____

Total _____

Comments

on financial control

on administrative matters

on other matters



APP-144-89
December 18th, 1989

Mrs. THANDIWE NLEYA
Agronomy Institute
Department of Research &
Specialist Services
P.O. Box 8100
Causeway, Harare
Zimbabwe

Through Mr. R. Fenner
Director

Dear Mrs. Nleya:

We are pleased to inform you that the Training and Communications Support Program of the Centro Internacional de Agricultura Tropical, CIAT is able to offer you an appointment as Visiting Researcher in the area of Biological Nitrogen Fixation for a period of 2 1/2 months, from September 17th through November 30th, 1990, under the supervision of Dr. Judith Kipe-Nolt.

Under the conditions of your appointment, CIAT will provide you with the following after receiving confirmation of your acceptance:

1. A round trip international economy airticket from Harare to Cali, via Nairobi, where it will be necessary for you to stopover for about 4 days to complete Colombian visa requirements, which include a medical examination. The PTA for your airticket will be placed by Falcon Travel, International House, Mama Ngina Street, Nairobi (Mrs. Julie Scott) Tlx: 22414.
2. Collection at Nairobi airport and delivery to a hotel. You will be entitled to receive the equivalent of US\$80/night plus US\$20 for airport tax on departure, payable on behalf of SADCC/CIAT through Falcon Travel. From this, you will be responsible for paying your own accommodation and meals in Nairobi. We shall soon request the Ministry of Foreign Relations in Bogota to situate a service visa for you at the Colombian Embassy in Nairobi, for the collection of which you will receive assistance from Falcon Travel.

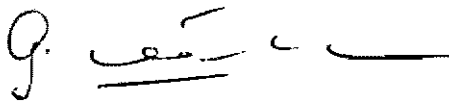
3. Collection at Cali airport and delivery to CIAT headquarters.
4. Room and board at CIAT.
5. A stipend payable in Colombia pesos at the rate of US\$10/day for the first 15 days, thereafter at US\$5/day. A portion of the stipend is payable instead in US\$ to assist during your return travel. No further entitlement exists for return travel, except in cases of unavoidable international stopovers as certified by Aviatur. (CIAT's travel agent in Colombia)
6. Group life insurance, hospitalization and medical expenses according to CIAT's policy.
7. Reference materials for the sum of US\$20/month.

We enclose a booklet entitled "Information for Visiting Researchers" which contains further details on CIAT, but you should note that some of the information contained therein is now out-of-date.

During the course of your visit to CIAT, we shall expect you to become fully familiar with the current work on Biological Nitrogen. CIAT also requires you to write a terminal report on your activities during your visit, and this should be submitted to the SADCC/CIAT Steering Committee, through Mrs. Olivia Makoko.

Together with Dr. Douglas Pachico, Leader of the Bean Program and Dr. Judith Kipe-Nolt, we wish you success during your stay at CIAT.

Yours sincerely,



GERARDO E. HÄBICH
Leader
Training and Communications
Support Program



DAVID J. ALLEN
Regional Coordinator
SADCC/CIAT Regional
Bean Program

c.c.: Dr. D. Pachico, Dr. J. Kipe-Nolt
Mr. C. Gamba Consul Embassy of Colombia, Mrs. Julie Scott,
Falcon Travel, Nairobi,

F.F.: CIAT

Ref cost centre: ECS41

Ref cost centre: ECS41



APP-145-89
December 18th, 1989

Miss ZODWA MAMBA
Malkerns Research Station
P.O. Box 4
Malkerns, Swaziland

Through Mr. Chris Nkwanyana
Chief Research Officer

Dear Miss Mamba:

We are pleased to inform you that the Training and Communications Support Program of the Centro Internacional de Agricultura Tropical, CIAT is able to offer you an appointment as Visiting Researcher in the area of Plant Pathology for a period of 2 1/2 months, from September 17th through November 30th, 1990, under the supervision of Dr. Julia Kornegay.

Under the conditions of your appointment, CIAT will provide you with the following after receiving confirmation of your acceptance:

1. A round trip international economy airticket from Manzini to Cali, via Nairobi, where it will be necessary for you to stopover for about 4 days to complete Colombian visa requirements, which include a medical examination. The PTA for your airticket will be placed by Falcon Travel, International House, Mama Ngina Street, Nairobi (Mrs. Julie Scott) Tlx: 22414.
2. Collection at Nairobi airport and delivery to a hotel. You will be entitled to receive the equivalent of US\$80/night plus US\$20 for airport tax on departure, payable on behalf of SADCC/CIAT through Falcon Travel. From this, you will be responsible for paying your own accommodation and meals in Nairobi. We shall soon request the Ministry of Foreign Relations in Bogota to situate a service visa for you at the Colombian Embassy in Nairobi, for the collection of which you will receive assistance from Falcon Travel.
3. Collection at Cali airport and delivery to CIAT headquarters.
4. Room and board at CIAT.

5. A stipend payable in Colombia pesos at the rate of US\$10/day for the first 15 days, thereafter at US\$5/day. A portion of the stipend is payable instead in US\$ to assist during your return travel. No further entitlement exists for return travel, except in cases of unavoidable international stopovers as certified by Aviatur. (CIAT's travel agent in Colombia)
6. Group life insurance, hospitalization and medical expenses according to CIAT's policy.
7. Reference materials for the sum of US\$20/month.


We enclose a booklet entitled "Information for Visiting Researchers" which contains further details on CIAT, but you should note that some of the information contained therein is now out-of-date. Also enclosed is a CIAT form of application for training which we ask you to complete and return direct to Alfredo Caldas at CIAT.

During the course of your training at CIAT, you will be expected to become fully familiar with the general operation of the Bean Program, with particular reference to bean breeding support to Africa and the range of international trials available. CIAT also requires you to write a terminal report on your activities while receiving training at CIAT; this should be submitted to the SADCC/CIAT Steering Committee.

Together with Dr. Douglas Pachico, Leader of the Bean Program and Dr. Julia Kornegay, we wish you success during your stay at CIAT.

Yours sincerely,

GERARDO E. HÄBICH
Leader
Training and Communications
Support Program



DAVID J. ALLEN
Regional Coordinator
SADCC/CIAT Regional
Bean Program

c.c.: Dr. D. Pachico, Dr. J. Kornegay, Dr. H. Hazel
Falcon Travel, Mr. Carlos Gamba, Consul Embassy of Colombia
Nóminas esp., B. Velásquez, L. Guengue, J. López

ref. cost centre ECS41

REPORT ON THE "APHID SPECIES IDENTIFICATION COURSE"
HELD IN BUNDA COLLEGE, MALAWI, JANUARY 22-25, 1989

The purpose of the course was to train the principal investigators and technicians in the sub-project entitled: "The role of Aphids in BCMV transmission and spread" on aphid species determination and the relevant techniques to be used in the experiments under the sub-project.

The course participants were from Zambia, Malawi and Tanzania (see list of participants). Dr. Alain Autrique, Mr. Leonidas Ntahimpera (from ISABU, Burundi) and Dr. JKO Ampofo participated as resource persons (Mr. Ntahimpera's participation was funded by the CIAT Great Lakes Program).

There were two-and-half days (Monday, Tuesday and Thursday AM) of instruction and discussion on:

i. Field pests of beans in Africa

- distribution, biology and nature of damage caused by the common pests i.e.
- beanfly
- foliage pests
- flower and pollen feeders
- pod borers
- pod sucking bugs
- storage pests

Lead discussant J.K.O. Ampofo

ii. Aphid biology and ecology, highlighting

- patterns of aphid population development
- common natural enemies of aphids

Lead discussant A. Autrique

iii. Aphid morphology and identification

- characters for species determination
(a laboratory exercise for 1.5 days)

Lead discussants A. Autrique/L. Ntahimpera.

iv. The role of aphids as vectors of plant viruses and transmission techniques. This focused on aphids in relation to:

- BCMV transmission and highlighted the main points for study under the sub-project i.e.
 - . vector species identification
 - . vector efficiency
 - . vector incidence
 - . the role of seed borne inoculum
 - . cultural and other strategies for aphid and BCMV control

Lead discussant P. Sogati/S. Sithanantham

v. BCMV - etiology, symptoms, spread and control. This focused on:

- necrotic strains with Dominant I-gene leading to Black root in some varieties
- non-necrotic mosaic inducing strains
- the role of virus free seed for experiments under the sub-project

Lead discussant J. Kannaiyan

vi. Field evaluation of BCMV incidence and severity of damage. (A laboratory demonstration and field practice)

Lead discussant J. Kannaiyan

vii. Aphid handling techniques for BCMV transmission (A laboratory discussion with some field demonstrations).

Lead discussants A. Autrique/S. Sithanantham

Wednesday was devoted to a field tour to monitor the incidence of aphids and BCMV in farmers' fields at Dodra district. Time was spent also discussing other pests and on-farm trials laid by Dr. L. Kantiki.

REFOCUSING OF SUB-PROJECT OBJECTIVES:

Discussions were held during the meeting to refocus the objectives of the sub-project. Dr. Ampofo stressed that the real impact that could come out of the sub-project would be a clarification of differential transmission of BCMV strains (necrotic vrs non-necrotic) by different aphid species. This was the view of the Bean Programme Working Group on Crop Protection and was supported by Dr. Alain Autrique and also by a letter from Mike Irwin, University of Illinois who has been corresponding with the sub-project investigators. It was agreed in principle

to adopt these objectives but Dr. Kannaiyan indicated that so far the only BCMV strain in the MW/ZA area is NL3 which causes necrosis in I-gene dominant varieties and mosaic symptoms in non I-gene dominant varieties. Both Kannaiyan and Autrique indicated they (ZA and BDI) had received no feed back from Dr. Vetten on BCMV strains collected from the two countries. However, the sub-project on BCMV strain characterization will be a very useful link in this study and every effort should be made to use it.

**PROCEEDINGS OF A GROUP DISCUSSION ON CIAT/SADCC
BEAN APHID-BCMV SUB PROJECT FOCUS AND PLANS**

**HELD ON 25 JANUARY, 1990 AT BUNDA COLLEGE OF AGRICULTURE,
LILONGWE, MALAWI**

PRESENT

A. Autrique	-	Burundi
S. Sithanantham	-	Zambia
P.H. Sohati	-	Zambia
J. Kannaiyan	-	Zambia
J.J. Mbale	-	Tanzania
J.K.O. Ampofo	-	CIAT

**ABSENT WITH
APOLOGY**

L.M. Kantiki	-	Away due to other commitments
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BACKGROUND

This group discussion was held during the Training Workshop on Bean Aphids-BCMV identification and experimentation, held under the auspices of the CIAT/SADCC Regional Bean Improvement Program during 22 - 25 January, 1990.

Dr. Ampofo highlighted that among the different aspects to be studied, the focus should be on determining which species of aphids that can and do transmit BCMV. Dr. Autrique also emphasized that ecology and transmission aspects need to be focused on, as was also indicated in the comments from Dr. Mike Irwin, Illinois, U.S.A.

REVISION IN THE SUB-PROJECT

It was agreed to revise the sub-project proposals as follows:

Objectives:

Item (iii) to be revised as :

- " to ascertain the species of aphids that transmit BCMV", and their efficiency in the transmissions of the common BCMV strains in the region.

Expected Impact:

Item (iii) to be revised as :

- The potential of different species of aphids in transmitting BCMV would have been assessed.

Plan of Work:

Section 1, b and c; estimation of losses caused by aphids - is now of low priority.

Under Section 3, an additional sub-section to be added as :

- (c) Studies on differential transmission of BCMV by aphid species (net house/field tests).

Section 4 (Cultural/practices) to be dropped.

Methodology:

- 1a. Surveys - All visual rating to be on 1-9 scale (Instead of 1-5 as proposed earlier) to enable precision and to be comparable with ratings elsewhere. The rating scale for aphid infestation, to be as detailed below :

The rating scale for aphids, BCMV, other pests, diseases and need to be also classified into a 1-9 scale, on the following basis :

- 1 - No aphid incidence or damage
- 3 - Light (up to 10% incidence/damage)
- 5 - Moderate (11 - 30% incidence/damage)
- 7 - Heavy (31 - 50% incidence/damage)
- 9 - Very heavy (above 50% incidence/damage)

In case the scale needs to be modified for any local purposes, the reason may be recorded along with the details of the modified descriptions while reporting the results.

During the surveys, the natural enemies collected should be reared and preserved for identification.

- 2b. Trap monitoring: While yellow pan traps are known to be effective attractants to many aphid species, there is need to verify if the numbers and species of aphids caught in these traps are comparable to those which land on bean plants in the vicinity. Possibly transparent sticky traps/tile traps could be tested for comparison, at least in one season.
- 3a. Extent of seed-borne BCMV: This is an important aspect, and can also be taken up in Tanzania/Malawi at least during the second/third year of the project, with assistance from a pathologist. The extent of seedborne BCMV and of subsequent spread should be assessed.
- 3b. BCMV secondary spread by aphids: The methodology may be modified to keep plots of T1 and T2 separated by about 500 metres or in separate fields, and the aphid landings in each plot to be monitored also if possible.
- 3c. Aphid species as vectors of BCMV: The common species of aphids, based on trap/plant collections, will be established on disease-free host plants. After optimum 'acquisition' and 'inoculation' through access feeding, the percentage success in transmission by each aphid species will be determined.

OTHER ASPECTS RELATING TO SUB-PROJECT

Materials:

Among the materials that are urgently required for purchase in the sub-project are glass vials for starting/shipping aphids for identification.

Dr. Autrique offered to obtain details of supply and Dr. Ampofo agreed to facilitate their purchase by ordering through CIAT, debiting to the sub-project budget.

For Zambia program, there is an urgent need to repair the net house at Chipata to be able to undertake the transmission work.

Reporting:

It was clarified that reporting of activities, progress and problems besides financial statements for each country to be made by the concerned national program entomologist, to the sub-project coordinator, with a copy to the Bean Entomologist, SADCC/CIAT Bean Program, Arusha. The sub-project coordinator shall prepare a consolidated Annual Report (July-June) and submit it to the Steering Committee through the Zambian National Food Legume Coordinator.

Collaboration/Link up:

Collaboration with Dr. Antrique (ISABU, Burundi) has been very valuable and should be continued. Link up with other projects on BCMV in the region, especially the one on BCMV strains and BCMV resistance being coordinated by Dr. Allan Lana of Morogoro, Tanzania, would be very productive for this sub-project.

VISUAL RATING SCALE FOR BEAN APHID - ON FAR SURVEYS

<u>SCALE</u>	<u>APHID POPULATION/PLANT</u>
1	0
2	1 - 50
3	50 - 100
4	100 - 200
5	200 - 400
6	400 - 600
7	600 - 800
8	800 - 1,000
9	Above - 1,000

LIST AND ADDRESSES OF PARTICIPANTS IN BEAN
 APHID - BCMV TRAINING WORKSHOP,
 BUNDA COLLEGE OF AGRICULTURE, LILONGWE
 22 - 25 JANUARY, 1980

<u>NAME AND ADDRESS</u>	<u>TELEPHONE</u>	<u>TELEX</u>
<u>ZAMBIA</u>		
1. DR S SITHANANTHAM LEGUME ENTOMOLOGIST MSEKERA REG. RES. STATION P O BOX 510089 CHIPATA <u>ZAMBIA</u>	OFFICE 21725/21153 RESID 21302	63060 EPADZA
2. DR J KANHAIYAN LEGUME PATHOLOGIST MSEKERA REG. RES. STATION P O BOX 510089 CHIPATA <u>ZAMBIA</u>	OFFICE 21725/21153 RESID. 21394	63060 EPAD ZA
3. MR P H SOHATI LEGUME ENTOMOLOGIST MSEKERA REG. RES. STATION P O BOX 510089 CHIPATA <u>ZAMBIA</u>	OFFICE 21725/21153	63060 EPAD ZA
4. MR P CHILEMBO AGRICULTURAL SUPERVISOR MSEKERA REG. RES. STATION P O BOX 510089 CHIPATA <u>ZAMBIA</u>	OFFICE 21725/21153	63060 EPAD ZA
5. MRS B CHIRWA SENIOR AGRICULTURAL ASSISTANT MSEKERA REG. RES. STATION P O BOX 510089 CHIPATA <u>ZAMBIA</u>	OFFICE 21725/21153	63060 EPAD ZA

MALAWI

6. DR L M KANFIKI
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AGRIC. ASSISTANT
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MINAGRI MI
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DEVELOPMENT OFFICER
DEDZA HILLS R D P
E P A B
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TANZANIA

10. MR J J M NEALE
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MBEYA
TANZANIA
- OFFICE
2116/17
- 51039
UYOLE TZ
11. MR D NDEGEULA
AGRICULTURAL FIELD OFFICER
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P O BOX 400
MBEYA
TANZANIA
- OFFICE
2116/17
- 51039
UYOLE TZ

BURUNDI

12. DR A AUTRIQUE ENTOMOLOGIST ISABV P O BOX 795 BUJUMBURA <u>BURUNDI</u>	OFFICE 23390 RES. 26877	5147 MINAGRI BDI
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13. MR L NTAHIMPERA ISABV P O BOX 795 BUJUMBURA <u>BURUNDI</u>	OFFICE 23390	5147 MINAGRI BDI
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CIAT TANZANIA

14. DR J K O AMPOFO BEAN ENTOMOLOGIST CIAT/SADDC DEAN PROGRAM SELIAN RESEARCH CENTRE P O BOX 2767 ARUSHA <u>TANZANIA</u>	OFFICE 2268	42106 CANWIT TZ 42119 LIONS TZ
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PROPOSAL FOR A TRAINING COURSE FOR RESEARCH ASSISTANTS
IN THE MALAWIAN AND ZAMBIAN NATIONAL BEAN PROGRAMMES

Prepared by:

Dr. A.D.C. Mkaadawiro

BACKGROUND

The National Bean Programme in Malawi conducts experiments at nine locations in the country, viz: Misuku Hills, Chilipa; Ng'onga, Rumph; Lunyangwa Research Station, Mzuzu; Champhira, Malimba; Bunda, Lilongwe; Dedza Hills, Dedza; Lifuwu Research Station, Salima; Matapwata, Thyolo; and Kasinthula Research Station, Chikwawa. All except Bunda and Lunyangwa sites are manned by qualified technicians. The Research Assistants used by the Programme are basically secondary school leavers with no training in crop production technology. However, these are the staff that work for the large bean programme of nine scientists. Unless told to do something they often do not know what to do because they are afraid of doing it wrongly. As a result they are not self-starters. And when they get to do the work the quality of the output is usually poor.

The Zambian National Programme has a number of well-trained technicians. However, they too have some research assistants that need training at the level of the Malawian staff.

These two National Programmes are, therefore, requesting the SADCC/CIAT Steering Committee to financially support a one week training course to be held at Bunda College of Agriculture, Lilongwe during August, 1990. Resource personnel will be the highly qualified technicians from both programmes who also attended CIAT training courses in the region before. The programme for the course is enclosed in Appendix I and the Budget in Appendix II. To minimize on expenses the Zambians will travel by road to Bunda and back. The Malawians will use buses from the research sites to Bunda and back to their respective places of work. We shall have 14 participants from Malawi and 4 from Zambia whereas we shall have two resource personnel from Zambia and two from Malawi.

TENTATIVE PROGRAMME

DAY 1 Forenoon: Theory

Introduction to the bean plant :

- . Seed morphology (shape, size and colour) and
- . Plant morphology (growth stages and habits)

Note: Need have potted plants brought into the classroom for ease of explanation.

Afternoon : Practical

- . Seed morphology and plant morphology (with emphasis on growth stages and habits.
- . Need pre-planted crops at varying times to demonstrate stages (Vo-R9 and all four growth habits.

DAY 2 Forenoon : Theory

Principles of field experimentation :

- . Experimental designs (RCB and Split plot)
- . Factorial experiments
- . Site selection
- . Field books
- . Listing, calculating and obtaining inputs for trials
- . Laying out of trials
- . Planting trials
- . Super imposing treatments in already planted trials (especially in on-farm trials)

Afternoon: Practicals

- . Laying out of trials
- . Planting trials
- . Data recording in field books

DAY 3 Forenoon : Theory

- . Fertilizers : types, calculation of rates and application methods (broadcasting, banding, dollop)
- . Bean diseases : identification and scoring
- . Bean insect pests : identification and scoring

Afternoon Practical

- . Fertilizers : calculation of rates and application
- . Disease : identification and scoring
- . Insect pests: identification and scoring

DAY 4 Forenoon : Theory

On-farm research

- . Concept and justification
- . Stages
- . Farmer and site selection
- . Calender of activities
- . Choice of designs, treatments and replicates
- . Logistics
- . Farmer participation and farmer evaluation of technology
- . Seed multiplication and distribution to farmers
- . Link between on-station and on-farm research
- . Farmer, research and the extension worker

Afternoon : Theory and practical

- . Harvesting and processing bean trials (Theory)
- . Seed handling (Theory)
- . Harvesting and processing bean trials (Practical)
- . Visit seed store at Bunda College.

DAY 5

- . Field visit to seed multiplication at Bunda and Salima (Lifuwn)
- . Course evaluation by participants

Appendix 20.

SECOND DRAFT PROPOSAL

9th SUA/CRSP BEAN RESEARCH WORKSHOP, INCORPORATING 2nd SADCC/CIAT
REGIONAL BEAN RESEARCH WORKSHOP

Sokoine University of Agriculture, Morogoro, Tanzania

17th - 22nd September, 1990

Objectives

To bring together national, regional and international scientists concerned with the improvement of food beans in the SADCC region of southern Africa to exchange technical information and ideas at the recent forum in Harare to the advantage of the opportunity to extend participation to countries beyond Tanzania through well-attended and the Second SADCC Regional Bean Research Workshop to be held; and to promote strategies and develop plans for bean improvement in southern Africa in view of present and changing the decision made at the Regional Workshop on the development of field beans in Southern Africa was held, in Harare, Harare, Zimbabwe.

Structure

The format of the Workshop would be modelled on the following, which draws upon the experience of the previous SADCC workshops as well as upon the structure adopted at the recent SADCC regional workshop, held in two stages in October, 1987. Possible speakers are indicated, and slots for "offered papers" (in contrast to invited presentations) are included in each session.

Opening Session

Beans in the agricultural economy of eastern and southern Africa	W. Gertzel and D. Padgett
Beans in African farming systems	U.L. Ehlers and D.J. Allen
Bean research networks and cooperation in eastern and southern Africa	R.A. Firth, and D.J. Allen
Discussion	

Session 2 : On-farm research

Production constraints and their diagnosis	R.A. Firth,
Exploration trials	U.L. Ehlers

On-farm soil fertility trials	G.F. Bunting and A.G. Odeh
On-farm soil fertility trials	R. Giller, P.L. Edger, K. Britton
Village saboteurs in the farmer managed trials	P. Bänziger and L. Upchurch
Farmer participative research	L. Agre, Ungu, Kwintsey and M. Odeh
Research-extension linkages: objectives, missions and the results	R. Bänziger, M. Odeh, K. Britton, G. Odeh, A. Odeh and M. Odeh
Offered papers in OII	
OII Discussion Group	

Session 3 : Crop Protection

Pest, diseases and seed quality production constraints : method of assessment for use	P. Bänziger
Methods for evaluation of resistance to disease in beans	H.M. Silliman P. Bänziger
Methods for evaluation of insect pest resistance	J.H. Bänziger
Prospects for integrated pest management in beans	L. Abate
Prospects for integrated management of weeds in beans	R. Bänziger and P. Bänziger
Review of research on bean diseases at IITA	J.H. Bänziger
Recent advances in research on Eastern and Southern Africa on :	
Beanfly in Mozambique	B. Davies
Beanfly in Tanzania	S. Simpa and M. Odeh Amplio
Bruchids	D. Uga
Aphids	S. Srinanthan, L. Pantill
Viruses	H.M. Silliman, P. Bänziger Odeh

RCMV

Nematodes

Anthraxnose

Angular leaf spot

Rust

Halo blight

Common bacterial blight

Femi-Lana and others

A. Balle

J. Cullis et al.

E. Fluchyona

H.H. Hadzi

H. Huhajda, G.H.

Steadman and H. Huhajda

B. Gondwe, L.

Habuyanga and H. Huhajda

St. Huhajda

E. Upton, S. D. Upton

and H. Huhajda

5

Offered papers in crop protection

Concurrent group discussions on pathology, entomology and weed science for development recommendations

Session 4 : Breeding

The available genetic resources

D. Bostard

Germplasm collection, evaluation and storage in the Sahel region

E. Chiffoleau and
O. Boudaoud

Germplasm exchange in the West region and plant quarantine legislation

R. Abdoullah and
A.H.A. Bellizzi

Existing genetic diversity in beans in Africa

J. Bokozi,
A. Fransson and
L. Esterl

A new look at the molecular basis for colour gene inheritance and their potential roles in disease and pest resistance, and digestibility

L.L.M. Leake

Custom-built crosses for Africa

M. G. Huhajda
and G. Ferrero

Hybridization and handling segregating populations

J. Huhajda-Huhajda
and A. Huhajda

Review of CIMMYT bean trials in Africa

S. R. Upton, E.
Huhajda and G.
Ferrero

Strategies for the maintenance of genetic mixtures, including composite breeding

W. Ferrero and
L. G. Ferrero

Strategy and progress in regional trials	C.S. de Wit H.E. ...
Site selection and the management of genotype x environment interactions	J.R. ...
"Beangro" computerized growth modeling as a complement to cultivar evaluation and breeding programmes	G. Hoogenboom
Data management methods	R. ...
Yield system analysis of national and regional trial information	D. Wallace M. ...
Cultivar releases and impact on production	J.H. ... and W. ...
Offered papers in breeding	
Breeding Group Discussion, to develop recommendations	

Session 5 : Seed production, marketing and utilization

Small farm seed production	L. ... P. ...
The possible role of the private seed sector in the production, promotion, storage, transport and marketing of newly released bean varieties	J. ... J.H.C. Davis
Seed technology relevant to dried beans in Africa	E. ... or G. ...
Post-release considerations : genetic drift, outcrossing, mixtures, seed stock maintenance requirements	J. ...
Marketing of beans in Africa and the assessment of impact on markets of new cultivars	J. ...
Varietal acceptability patterns	S. ... F. ...
Cookability and softening for hot cooking beans	E.E. ...

Seed protein quality, digestibility and ways of integrating food quality factors into a breeding programme

R. Mueselhi

Offered papers

Discussion

Session 6 : Agronomy

Traditional systems of soil fertility maintenance, with special reference to beans

O.J. Edre and
J. Sward

Recent advances in biological nitrogen fixation

J. Fajana-Hall
L. Gilbertson
K. Graham

Recent progress in biological nitrogen fixation in Malawi

S. J. Hingora

A review of work on biological nitrogen fixation at IITA

M.P. Salcedo

Prospects for utilising soil phosphorus in the development of sustainable systems of cropping with beans

J. Semola,
O.L. Edje
L. Muvinda
O.L. Kweya

Methods for screening for phosphorus tolerance in acid soils

J. Enche and
J. Lorenzini

Potassium as a limiting factor in cropping systems with beans in Tanzania

J.B. Mathew, O.J. Edre, U. H. and U. G. H. H.

Recent research progress with drought tolerance

A.R.G. H. Anderson,
H. Mbotya, G. Ochebo and O. H. H.

Recent advances in intercropping with beans

O.L. Edre,
C. Mortenson, G. H. H. and J. Fajana

Prospects for developing agroforestry systems with beans

L. Landfala,
S. Hironaka
+ J. K. R. and G. L.
L. D.

Offered papers to agronomy

Agronomy Group discussion, to develop recommendations

Closing Session

The unaddressed needs of national programmes and the search for supplementary funding

W. B. G. G.

Concurrent discussion by discipline, to identify key needs and draft recommendations, with emphasis on cooperative work

Presentation of recommendations in final plenary session

Appendix 21.

STATUS OF ORDERS OF EQUIPMENT FOR NATIONAL PROGRAMMES

<u>Country</u> <u>Item</u>	<u>Date</u> <u>ordered</u>	<u>Cost</u> <u>USD</u>	<u>Suppliers/</u> <u>agents</u>	<u>Shipped</u>	<u>Status/</u> <u>action</u>
ANGOLA					
Sprayers (4)	29/8/88	\$619	ICC	20/9/88	Received
Projector (1)	18/6/88	\$1180	ICC	10/12/88	Received
Small bundle thresher (1)	9/7/88	\$3547	Almaco/ICC	30/11/88	Received
Planter (2)	9/7/88	\$5370	Almaco/ICC	30/11/88	Received
Precision balance (1)	28/11/88	\$733.50	Salter, UK	17/1/89	Awaiting confirmation
Portable type- writer 'Azerty' (1)	11/4/89	\$294.00	ICC	5/8/89	- do -
Motorcycles (2)		- in process -			
Altimetres (3)		- in process -			
Landrover spares		List of spares requested			
Culture media (PDA)		Information for quantity and type requested			

BOTSWANA

All items received.

LESOTHO

Projector	18/6/88	\$1180	Dev. Corp/ICC	19/7/89	Received
Small bundle thresher (1)	15/8/88	\$3182	Almaco/ICC	-	Received
Altimetre (1)	14/9/89	\$163	ICC, Mbo	5/10/89	Received
Binocular dissecting microscope (1)		- in process -			

Table 9. (Cont.) STATUS OF ORDERS OF EQUIPMENT FOR NATIONAL PROGRAMMES

<u>Country</u> <u>Item</u>	<u>Date</u> <u>ordered</u>	<u>Cost</u> <u>USD</u>	<u>Suppliers/</u> <u>agents</u>	<u>Shipped</u>	<u>Status/</u> <u>action</u>
MALAWI					
Motorcycles (3)	20/10/87	\$6150	Jackys Dubai	6/12/88	Received
Soil sterilizer	-	-	-	-	Awaiting quote fr ref. 414 22/7/88 message sent via OIE 29/8/88
Altimetre (1)	14/9/89	\$163	ICC Nairobi	5/10/89	Received
MOZAMBIQUE					
Motorcycles (2)	17/8/88	\$4460	Jackays Dubai	24/9/88	Received.
Precision Balances (2)	17/8/88	\$1440	Salter UK	18/10/88	Received
Tapes (4)	2/9/88	\$813	ICC Nairobi	20/9/88	Received.
Clothing (4)	2/9/88	\$582	ICC Nairobi	20/9/88	Received.
Gumboots (6)	2/9/88	\$304	ICC Nairobi	20/9/88	Received.
Sound slide projector	March	\$1180	ICC Nairobi	22/3/89	Received.
Projector lamps	29/3/89	\$69.70	ICC, Nairobi	30/5/89	Received
Altimetes (2)	In process				
TANZANIA					
Small bundle thresher (1)	9/7/88	\$3342	Almaco/ICC	31/10/88	Received
Precision balance (1)	17/8/88	\$742	Salter UK	23/10/88	Received.
Knapsack sprayers (2)		\$1339.90	ICC, Nho	17/5/89	Received

Altimetres (4)	14/9/89	\$654.88	ICC, Nbo	5/10/89	Received
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Table 9. (Cont.) STATUS OF ORDERS OF EQUIPMENT FOR NATIONAL PROGRAMMES

<u>Country</u> <u>Item</u>	<u>Date</u> <u>ordered</u>	<u>Cost</u> <u>USD</u>	<u>Suppliers/</u> <u>agents</u>	<u>Shipped</u>	<u>Status/</u> <u>action</u>
Moisture Metre	1/11/89	426.=	Protimetre	18/12/89	Received
Photocopier	23/1/90	3000.=	ICC, Nbo	23/2/90	Received
Typewriter		- in process -			
Motorcycles (2)	15/1/90	4485.=	Jarllys, Dubai	3/2/90	Received registration in process

ZAMBIA

Altimetre (1)	14/9/89	\$163	ICC, Nbo	5/10/89	Received
Seed storage jars (4000)	29/3/89	\$3923.11	ICC, Nbo	26/4/89	Received

ZIMBABWE

Altimetre (1)	14/9/89	\$163	ICC, Nbo	5/10/89	Received
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Swaziland

Specifications requested; -in process-

Precision Balance
Seed drier
Bulk thresher
Altimetres
Knapsack sprayers

N.P. Equipment Expenditure (To Jan, 1990)

Angola	\$ 11,743.50
Botswana	970.00
Lesotho	4,525.00
Malawi	7,283.00
Mozambique	8,848.70
Tanzania	13,989.78
Zambia	5,226.11
Zimbabwe	4,227.75
TOTAL	<u>56,813.84</u>

