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Report on a visit to Uganda  
to develop an integrated  
strategy in support of the  
post-harvest sector for non-grain  
starch staple (NGSS) crops.

18 - 24 March 1993

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Distribution

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## ABBREVIATIONS

|       |                                                    |
|-------|----------------------------------------------------|
| APO   | Associate Professional Officer (of the ODA)        |
| BHC   | British High Commission                            |
| CIAT  | Centro Internacional de Agricultura Tropica        |
| CIP   | Centro Internacional de la Papa                    |
| COSCA | Collaborative Study of Cassava in Africa           |
| DS    | Diagnostic Survey                                  |
| FAO   | Food and Agriculture Organisation                  |
| FSSP  | Farming Systems Support Programme                  |
| GoU   | Government of Uganda                               |
| GTZ   | Deutsch Gesellschaft für Technische Zusammenarbeit |
| IDRC  | International Development and Research Centre      |
| IITA  | International Institute for Tropical Agriculture   |
| NARO  | National Agricultural Research Organisation        |
| NBP   | National Banana Programme                          |
| NGSS  | Non-Grain Starch Staples                           |
| NRED  | Natural Resources and Environmental Department     |
| NRI   | Natural Resources Institute                        |
| ODA   | Overseas Development Administration                |
| RNR   | Renewable Natural Resources                        |
| UNDP  | United Nations Development Programme               |
| TPI   | Tropical Products Institute                        |
| WAU   | Wageningen Agricultural University                 |

## SUMMARY

i) A visit was made by Dr N. Poulter and Mr G. Bockett to Uganda to discuss a proposal to support the post-harvest sector for non-grain starch staples (NGSS) crops.

ii) The team met and discussed this proposal with Professor Mukiibi, Secretary of Research and Director General of the National Agricultural Research Organisation (NARO). He was receptive and encouraged the team to arrange a meeting with the key personnel involved with NGSS in Uganda.

iii) The team met with the National programme leaders for the banana (Dr E. Karamura), cassava (Dr E. Ebong on behalf of Mr W. Otim-Nape) and sweet potato (Dr R. Mwanga) programmes. They also met with Professor Rubaihayo, Head of the Department of Crop Sciences at Makerere University, responsible for the post-harvest input for each of the programmes.

iv) A meeting was held with the Programme Leaders and Professor Rubaihayo to discuss the proposal to support the post-harvest sector for non-grain starch staples (NGSS) crops put forward by NRI. The outcome of this meeting was supportive of NRI's initiative. In addition it was recommended that there should be commitment from NRI in the form of a long-term (2 yr) appointee to coordinate NRI's activities in the post-harvest NGSS sector.

v) The team met with Mr S. Nandy and Ms C. Owori of the FAO/UNDP supported post-harvest unit at Kawanda research station and discussed the potential for collaboration on the post-harvest sector of NGSS.

vi) The team met with Mr J. Parkinson of the Farming Systems Support Programme (FSSP) and discussed NRI's approach to support of the post-harvest sector of NGSS and its potential for integration into the NARO's strategy for the development of the agricultural sector in Uganda.

vii) The team met with and briefed Mr J. Murray Second Secretary Aid of the BHC on the nature of their visit.

## BACKGROUND

1. The ODA gives high priority in their strategy for research on natural renewable resources (RNR Strategy) to the non-grain starch staples (NGSS). These crops (cassava, banana and sweet potato) assume great importance in Uganda and the region in their role as basic starchy foods for consumption at the point of production (on-farm) and by expanding urban populations.

2. These commodities are also given the highest priority in the strategy of the newly established National Agricultural Research Organisation (NARO) in Uganda due to their significant contribution to food security and income generation in the country.

3. NRI through its developmental Programmes gives strong commitment and support to the NGSS in sub-Saharan Africa through the management and implementation of a number of projects in the region. These include projects involved with the transfer of needs assessment methodologies and post-harvest technology for NGSS in East and West Africa; the adaptive transfer of low-cost cassava storage techniques in Ghana; the evaluation of traditional cassava processing techniques through the Collaborative Study of Cassava in Africa (COSCA); the evaluation of the cyanogenic character of cassava and the potential consequences of cyanide exposure in cassava consuming populations in Tanzania, the medium scale industrial production and utilisation of cassava and other root crops into chips, flours and starches for food and feed; and support to the Ugandan National Banana Programme in their farming systems appraisal and Diagnostic Survey

4. In view of the close compatibility of ODA and GoU strategies with these crops, the post-harvest programme of NRI developed a draft document for discussion with the Director General of NARO, the Heads of the appropriate research stations, the Heads of commodity programmes and other institutions, including the University of Makerere. This document outlined a possible approach to NRI's support to existing activities with these crops and in particular to those concerned with post-harvest research and development (see - Annex 1).

5. The document served to outline three important areas of support including; i) needs assessment of post-production systems, ii) demand-led strategic research in response to specific problems identified, and iii) technology adaptation, field testing and dissemination.

### National Agricultural Research Organisation

6. The NRI draft document that had been prepared (Annex 1) was discussed with Professor J.K. Mukiibi (Director General NARO and Secretary for Research) and was welcomed. It was agreed that the team would hold independent and joint discussions with senior Research Station staff and with the members of the Faculty of Forestry and Agriculture of Makerere

University. To facilitate such meetings Professor Mukiibi prepared a letter of introduction to the Directors of Namulonge and Kawanda Research Stations and to the Dean of Forestry and Agriculture in the University.

7. It was also agreed that subsequent to these discussions the team would report back to Professor Mukiibi with a revised outline discussion document, minutes of joint meetings held and with a more detailed and costed strategy for support. If agreed by NARO this strategy for support by the post-harvest programme of NRI could be incorporated within the existing Memorandum of Understanding drawn up between the GoU and NRI, and begin at the earliest mutually acceptable time.

8. An important issue with regard to the funding of NRI's support to NGSS in Uganda was raised by the team. Bilateral UK assistance to Uganda does not at present focus on the natural resources sector. The input by NRI under discussion is funded from the Natural Resources and Environmental Department (NRED) programmes of the ODA and is thus bound by the framework and conditions of the RNR strategy. This strategy aims to improve and strengthen the management, appraisal, implementation and monitoring of research. It thus does not support per se, the establishment of facilities, training or other general inputs which are not specific to project outputs and objectives. NRED funded activities should therefore build upon the existing resource base whilst providing the necessary operational funds in support of these field based operations.

9. A copy of the RNR strategy was provided to Professor Mukiibi. In addition a copy of the ODA Memorandum of Understanding for the Regional Africa TC Project for the "Transfer of needs assessment methodologies and post-harvest technologies for non-grain starch staple (NGSS) food crops in sub-Saharan Africa" was provided to Professor Mukiibi in advance of project installation in the East Africa Region proposed for later this year.

#### Namulonge Research Station

10. During the team's visits, Mrs T. Sengooba (Director) had just started on a period of two months study leave. The team therefore met with the acting Director, Dr C. Ebong. He had earlier visited NRI to undertake analysis of cyanogenic potential of Ugandan cassava varieties and had worked with the post-harvest team in the Root and Tuber Crops Programme.

11. Dr Ebong was provided with the letter of introduction from Professor Mukiibi, together with the outline draft discussion document prepared as the basis for discussion by NRI and a copy of the annotated list of NRI's global project activities with root and tuber and plantain and banana crops.

12. The NRI initiative was well received and arrangements were made to have a round table meeting of all interested parties later during the team's visit.

13. Copies of the outline discussion document prepared by NRI were also passed to Dr R. Mwanga, Leader of the Sweet Potato Programme and to Mr A. Bua who was acting on behalf of Mr W. Otim-Nape as the Cassava Programme Leader in his absence in the UK undertaking his Ph.D. studies at NRI and Reading University.

14. In discussions with Dr Mwanga the status of the second tranche of the CIP coordinated GTZ regional programme on sweet potato was raised. The status of this project, which has a proposed start date of May 1993 was unclear but it was understood that the Uganda country proposal had been submitted to CIP (Dr P. Ewell, Nairobi) for consideration. It is also understood that this component contains an element of support to the National Programme activities on post-harvest aspects of sweet potato to complement NRI's initiatives in this sector. The details of these activities were not available to the team. During meetings at Namulonge Research Station the team also took the opportunity to brief NRI staff seconded to the station of the nature of their visit and proposals. These included Mr J. Legg (ACMV Project), Mr W. Page (Maize Streak Project) and Mr D. Coyne (APO on the Cassava Nematode Project).

#### Kawanda Research Station

15. Discussions were held with Dr E. Karamura and Dr C. Gold concerning the nature of NRI's support to the Banana Programme. A letter of introduction from Ms F. J. Proctor (Programme Manager NRI) was given to Dr E. Karamura which included confirmation that Dr J. Aked would attend the Steering Committee meeting of the National Banana programme (scheduled for 1 April 1993). Dr Karamura was also provided with a copy of the NRI discussion document prepared for Prof. Mukilibi. Discussions were held on the status of past and proposed NRI post-harvest support to the Banana Programme. These very useful discussions provided an insight into the challenges facing the Diagnostic survey (DS). The NRI team also provided comment on the nature and constraints of the NRI funding source (see para. 7). These discussions allowed for the establishment of a more fully integrated approach to be agreed. The perceived need by the Banana Programme for NRI to provide in-country specialist inputs to further develop and implement the post-harvest field surveys during the remainder of the time available for the DS (December 1993) was agreed upon. The subsequent collation and interpretation of data together with the development of well focused and defined demand-led project activities would then be implemented.

16. Mr S. Nandy, Leader of the FAO/UNDP supported post-harvest unit and Ms C. Owori the National Counterpart for this unit were met and briefed on NRI's proposal for NGSS. They expressed considerable interest on learning of this proposal particularly as Mr S. Nandy has recently submitted a proposal to the UNDP seeking further support for the post-harvest sector including NGSS. If agreed upon, this would complement the ongoing post-harvest work on NGSS presently being



undertaken by Makerere University and Kawanda Research station.

#### University of Makerere

17. Discussions were held with Professor Rubaihayo, Department of Crop Science. He received a copy of NRI's proposal for support to the NGSS sector, a copy of the letter written by Professor Mukiibi inviting him to attend a round table meeting on NGSS and a copy of Dr J. Aked's latest report on the NBP. The University has the post-harvest remit for banana, cassava and sweet potato and currently data from the banana DS is being entered onto a dBase IV programme to prepare it for presentation at the Steering Committee meeting. Professor Rubaihayo was supportive of NRI's initiative for the NGSS sector and welcomed the opportunity to discuss this issue at the round table meeting.

#### Farming Systems Support Programme

18. Mr J. Parkinson, Team Leader of the Farming Systems Support Programme (FSSP), Ministry of Agriculture, Entebbe was met and briefed on NRI's proposal for support to the NGSS post-harvest sector. In turn, he described the remit of the FSSP which in conjunction with the Agricultural Extension Unification programme supported by the World Bank aims to ensure the effective dissemination of appropriate messages to Ugandan farmers. The primary objective of the FSSP is to improve the yield and quality of coffee grown by smallholder farmers. A second objective is to improve yields of staple foods grown in association with coffee in order to enhance Uganda's overall self-sufficiency in food.

19. Mr Parkinson was particularly interested to hear of the range of disciplinary expertise and skills that NRI can offer. As an extension specialist he is especially keen to collaborate with organisations who can supply appropriate technology transfer messages to be disseminated to Ugandan farmers. He was informed that NRI either have or would be able to acquire suitable messages specific to the post-harvest sector of NGSS. These could, upon being validated and approved by NARO, be effectively incorporated into the FSSP extension service. The scope for collaboration between NRI and the FSSP is thus considerable.

#### Round table meeting

20. A meeting was held on Tuesday 23 March in the Department of Crop Science at the University of Makerere to discuss NRI's proposal for the next phase of support to the post-harvest NGSS sector in Uganda. The agreed minutes are given in Annex 2.

#### 21. General Meeting Consensus:

The following points were accepted by all present at the meeting as necessary:

- a) long-term in country support for NGSS in the form of an NRI staff member to coordinate NRI activities in the post-harvest sector,
- b) in-country support in the post-harvest socio-economic component of the remainder of phase II (until Dec 1993) of the Diagnostic Survey on banana in the form of an NRI staff member, and
- c) to identify and develop phased and specific commodity activities as sub-components of the NRI's overall support to NGSS in Uganda. NRI will identify these specific projects with the appropriate Programme Leaders at Kawanda and Namulonge as each programme progresses.

#### OTHER MATTERS

##### Cassava

22. Dr C Ebong will work together with Ms Z Bainbridge from NRI during her visit to Namulonge Research Station from 18 April. The t.o.r. for this visit which had been earlier agreed are to supplement earlier evaluations undertaken by Dr Ebong on the cyanogenic potential of cassava germplasm in Uganda. The laboratories at Namulonge have now received the appropriate equipment and materials to permit in-country analysis of samples. These have been provided under a collaborative project with Wageningen Agricultural University (WAU) managed by Dr S. Essers.

23. The laboratory methodology has been tested by Dr Ebong and two technicians have been trained in its use. Dr Ebong enquired after NRI's view on this new methodology following the visit by Ms Bainbridge to WAU in January. (Ms Bainbridge to respond)

24. The COSCA programme in Uganda, implemented by the cassava team from Namulonge Research station has been hampered in its completion of Phase III due to delays in the release of funds from IITA. During the team's visit however, these funds were received and Mr Bua was planning to complete the remaining nine villages during the course of the following weeks.

25. It was also confirmed that Professor F Nweke (COSCA Project leader IITA) had called a meeting of COSCA Country coordinators to collate data and input Phase III data, and analyse Phase II data for a period of three months from April 1993.

##### Banana

26. Copies of Dr J Aked's visit report (November 1992) concerned with support to the post-harvest and socio-economic components of the Diagnostic Survey on banana were passed to Professor Rubaihayo, Dr E Karamura and Dr C Gold.

## BRITISH HIGH COMMISSION

27. Mr J. Murray was briefed on the nature of the team's visit and informed as to how it links in with the work being carried out by NRI at Namulonge, Kawanda and Makerere University. He welcomed, in particular the 6 monthly schedule of NRI visits sent to him as this greatly facilitated planning within the BHC. He asked that this should be regularly updated. In turn, he informed the team of the ODA's current bilateral TC funded programmes in Uganda.

## FOLLOW-UP ACTIONS

28. The NRI will:

- (i) seek approval for and circulate minutes of the round-table meeting as soon as possible and pass these to Prof Mukiibi,
- (ii) prepare TOR for the long-term NRI input into Post-harvest NGSS activities. These, together with the curriculum vitae of a suitable candidate will then be submitted to NARO for approval.
- (iii) confirm the post-harvest and socio-economic inputs into the remainder of the DS of the banana programme, including a suitable person as soon as possible and pass the appropriate papers to Dr Karamura for comment,
- (iv) with national Programme leaders, post-harvest staff and other donors, assist in the arrangement of a meeting in late June to assess the current status of post-harvest NGSS issues in Uganda,
- (v) provide Mr Parkinson (FSSP) with details of small-scale potato stores from CIP literature,
- (vi) represented by Ms Z. Bainbridge liaise with Dr C. Ebong to brief Mr Parkinson on the current status of cassava toxicity following the forthcoming study on the cyanogenic potential of cassava germplasm in Uganda, and
- (vii) copy this report to Mr J. Mukoza-Kifuse, UNDP for information.

## CONTACTS MADE

### Ministry of Agriculture, Animal Industries and Fisheries

|                      |                                     |
|----------------------|-------------------------------------|
| Professor J. Mukiibi | Director General of NARO, Entebbe   |
| Mr J. Parkinson      | Team leader, FSSP, Entebbe          |
| Dr C. Ebong          | Cassava programme Namulonge RS      |
| Dr R. Mwangi         | Sweet potato programme Namulonge RS |
| Mr W. Page           | Maize-streak project, Namulonge RS  |
| Mr J. Legg           | ACMV project, Namulonge RS          |
| Mr D. Coyne          | APO Nematology project Namulonge RS |
| Dr E. Karamura       | Banana programme Kawanda RS         |
| Dr C. Gold           | Banana programme Kawanda RS         |
| Mr S. Nandy          | FAO Post-harvest unit Kawanda RS    |
| Ms C. Owori          | FAO Post-harvest unit Kawanda RS    |
| Mr A. Bua            | Socio-economist, Kawanda RS         |
| Mr J. Campbell       | FAO Post-harvest unit Kawanda RS    |
| Mr J. Cantwell       | FAO Post-harvest unit Kawanda RS    |

### University of Makerere

Professor P. Rubaihayo      Head Department of Crop Science

### United Nations Development Programme, Head Office

Mr J. Mukoza-Kifuse      Programme Officer

### British High Commission

Mr J. Murray      Second Secretary Aid

## ACKNOWLEDGEMENTS

The team would like to thank Mr J. Murray for briefing them on the ODA's activities in Uganda and to Professor J. Mukiibi and all his staff who facilitated the team during their visit.

## ANNEX 1:

DRAFT WORKING DOCUMENT TO BE DISCUSSED WITH PROFESSOR MUKIIBI,  
SECRETARY FOR RESEARCH, KAMPALA, UGANDA.

### Title:

A proposal for the Natural Resources Institute to provide post-harvest technology inputs in support of the transfer of technology and research initiatives which focus on the increasing recognition of non-grain starch staples (NGSS) in Uganda.

### GENERAL OBJECTIVE

1. This proposal has been written to highlight where the NRI could provide post-harvest technology inputs in support of the National Agricultural Research Organisation of Uganda in its programmes to establish: (a) research and development programmes directed towards the efficient utilisation of NGSS in Uganda; (b) the transfer of and adaptation of appropriate post-harvest technologies into farming systems; and (c) the development of training and extension programmes.

### SPECIFIC OBJECTIVES

2. The purpose of this proposal would be to:
- (a) determine from analysis of data already collected, key topics and policies for research and development,
  - (b) establish means by which this data may be held, analysed and updated regularly,
  - (c) help to ensure that technologies developed are 'translated' into relevant extension messages and that these are then transmitted to the target audience, and
  - (d) assist in the continuing dissemination of research findings and technology transfer issues concerning NGSS.

### INTRODUCTION

3. The production of traditional grain crops e.g. maize is becoming increasingly problematical due to prolonged periods of drought in sub-Saharan Africa. Non-grain starch staples (NGSS) such as cassava, banana, sweet potato and yams are particularly resistant to drought. They are therefore more reliable for food security. For this reason researchers are raising awareness for this group of crops and emphasising the need for a increased research effort.

4. The National Agricultural Research Organisation (NARO), is in the process of being established with financial support

2.7% to 8.3%. Such demographic changes will increase the urban demands in Uganda's cities for non-grain starch staple food crops in the future.

|             | Urban as a percentage<br>of total population | Urbanisation rate<br>(per annum) |
|-------------|----------------------------------------------|----------------------------------|
| East Africa |                                              |                                  |
| Uganda      | 7 %                                          | na                               |
| Rwanda      | 5 %                                          | 6.7 %                            |
| Burundi     | 2 %                                          | 2.7 %                            |
| Tanzania    | 14 %                                         | 8.3 %                            |

Source: World Bank, 1989 World Development Report

11. Expansion in urban demand has the potential to improve income earning opportunities for rural producers. This will then influence their position in the wider context of income generation and food security as they become more involved in a market economy. There is a need to investigate pre- and post-harvest systems for starch staple foods to determine in which areas need/demand for technical interventions exist and to assess the practicalities and impact of disseminating appropriate technologies and information.

#### THE NRI'S COMPARATIVE ADVANTAGE AND ALIGNMENT WITH RESEARCH ON NGSS.

12. The NRI is organised into a number of different divisions which are further divided into programmes as follows;

##### (a) Food Science and Crop Utilisation Division

- Programmes;
- (i) Cereals and Pulses
  - (ii) Horticulture & Tree Crops
  - (iii) Forest Products
  - (iv) Fisheries
  - (v) Oilseeds, Edible Nuts & Fibres

##### (b) Integrated Pest Management Division

- Programmes;
- (i) Annual & Perennial Crops
  - (ii) Windborne Pests
  - (iii) IPM Component Technologies
  - (iv) Biological identification and variability.

##### (c) Resource Assessment and Farming Systems Division

- Programmes;
- (i) Resource Assessment
  - (ii) Agronomy and Cropping systems
  - (iii) Livestock Production and Nutrition
  - (iv) Livestock Protection

## Banana

16. Banana is the most important staple in Uganda. About 66% of the country's urban dwellers depend on bananas as their staple food and it is estimated that more than 75% of farmers in the country grow bananas. Uganda produces about 7.9 million tons of the crop annually which is about 11% of annual world production (FAO yearbook - production, Vol 44, 1990).

17. In Uganda, banana and banana products are intertwined with the whole subsistence farming system and culture. Banana/plantain is a crop attractive to subsistence farmers for a number of reasons. Firstly the crop is able to fruit all year round with peak harvest during dry spells. This affords food security so that famine in banana/plantain growing areas is usually rare. The crop is readily intercropped, especially with legumes thereby providing protein to balance the carbohydrate diet. Furthermore, at full establishment, the crop's canopy protects the soil from direct insolation, rainfall impact and maintains high humidity which reduces evapotranspiration.

18. In spite of its importance, banana productivity in Uganda appears to be declining. In 1970, Uganda used only 0.9 million hectares to produce 7.6 million tons of matoke, currently, nearly 1.4 million hectares is required to produce that quantity. A number of factors has been attributed to this decline, including pests, diseases and decreasing soil fertility (Karamura, E.B. Banana/plantain production constraints as a basis for selecting research priorities. *INIBAP, Regional Network for Eastern Africa: Proceedings of the Regional Advisory Committee Meeting, Kampala, Uganda 23-25 September 1991.*)

19. In 1991, the National Banana Programme was implemented to co-ordinate research activities on banana based cropping systems. The first phase was a participatory rapid rural appraisal, which was used to focus the second phase- the Diagnostic Survey, which is ongoing in 1993. The principle objective of the Diagnostic Survey (DS) is "to define constraint status for the East African highland bananas and to carry out qualitative and quantitative analysis of the constraints as a basis for focussing research attention on farm/off farm."

20. Post-harvest was recognised as an important area of the D.S. Four areas of investigation were high-lighted:

- (a) assessment of levels of post-harvest loss during harvesting, transportation and storage of bananas,
- (b) food and beverage processing and quality assessment studies,
- (c) by-product processing and utilisation, and
- (d) effects of cultivars on quantity and quality of

products.

#### Cassava

21. Cassava is ranked as the second major staple in Uganda and is becoming increasingly important for food security due to its low labour demand and high yielding ability in marginal areas (Otim-Nape & Opio-Odongo, 1990). In 1991 it constituted approximately 20 % of the total annual food crop production. In order to ensure food security the production target for cassava is to increase from 3.1 in 1991 to over 4.0 million metric tonnes by 1994/95 (Bazirake, 1992).

22. The Collaborative Study of Cassava of Africa (COSCA) is an inter-institutional programme funded by the International Institute of Tropical Agriculture in Ibadan, Nigeria. The aim is to provide baseline information on cassava from 6 countries in Africa, including Uganda. The Natural Resources Institute, in collaboration with the staff of Namulonge research station have provided analysis of the post-harvest aspects of processing cassava.

23. Currently the incidence and severity of African Cassava Mosaic Virus (ACMV) infection is contributing greatly to production constraints. The need to identify, multiply and distribute resistant cultivars to areas where the yields of cassava have been severely infected by the disease is clear. Varieties have been imported from International Institute for Tropical Agriculture (IITA) e.g TMS 30572 which exhibit greater tolerance to the disease and these are presently under evaluation within the National Root Crops Programme. The screening of this material to identify those varieties with the post-harvest attributes required by the local community is now an issue that needs to be addressed.

#### Sweet potato

24. Uganda is the largest sweet potato producing country in Africa. Sweet potato roots are most commonly stored in the ground over an extended harvest period, harvested piecemeal, boiled or roasted and eaten immediately. They are hardly ever stored in pits or storage structures.

25. Fresh roots are widely marketed both in small rural markets and to urban centres. Their short shelf life limits market opportunities for many farmers and increases the risks for transporters and merchants.

26. Simple processing at the household level e.g. slicing and sun-drying, is practiced on a small scale in a few areas, particularly where high infestations of sweet potato weevil (*Cylas* spp) would otherwise destroy the roots in the ground. Very few processed sweet potato products are marketed.

27. The nutritious leaves and tender tips of sweet potato vines are commonly eaten in other parts of Africa and could be promoted in Uganda for both human and animal consumption.



28. Policy makers and leaders of National Agricultural Research Systems in Uganda have expressed a strong interest in promoting research and development on post-harvest technologies for sweet potatoes. The Ugandan Government, CIP and NRI have agreed to collaborate on the development of an inter-disciplinary research programme, encompassing the following key elements:

- (a) socio-economic assessment of the current systems for the production, harvesting, transporting marketing and consumption of sweet potatoes, and of the potential markets for new products,
- (b) development of appropriate in country skills to support the physiological and biochemical testing of indigenous sweet potato cultivars and products,
- (c) development, adaptation and testing of indigenous and new storage and processing technologies to reduce losses and broaden the utilisation of the crop and exploit new markets.

#### PROPOSED PROGRAMME FOR RESEARCH AND TECHNOLOGY TRANSFER

29. For the proposed research and technology transfer approaches to be effective they must be demand led. The approach taken should therefore be an interactive process of information flow between farmers, marketeers, urban consumers, researchers and extension workers. As resources are limited, research and technology transfer should be focused on priorities identified by dialogue between the various groups in Uganda concerned with NGSS. To achieve this, the following sequence is adopted:

- (a) needs assessment followed by
- (b) strategic research followed by
- (c) technology transfer and dissemination

#### I. NEEDS ASSESSMENT

30. Needs assessment is the first stage in determining the requirements of farmers and consumers. It is usually carried out using information gathering exercises such as formal case studies, rapid rural appraisal and informal interviews. Needs assessment common to all NGSS commodities are as follows:

- (a) production and agronomic constraints which affect post-harvest,
- (b) identification of key post-harvest qualities

and characteristics,

- (c) evaluation of traditional processing methods including curing of roots,
- (d) evaluation of post-harvest marketing systems,
- (e) applicability of known storage systems to the Ugandan market system,
- (f) demand for alternative processed products such as animal feeds, flour etc,
- (g) production of commercial secondary products such as starch, ethanol.

## II. STRATEGIC RESEARCH

31. This research is demand-led in response to specific problems identified during the needs assessment phase. It is an evolving and dynamic phase which is constantly being supplemented. Areas which have already been identified and are common to NGSS are as follows:

- (a) methods for characterising post-harvest quality,
- (b) characterisation of traditional and new varieties for important post-harvest quality attributes, including;
  - (i) physiological storage life,
  - (ii) physiochemical and organoleptic qualities,
  - (iii) stability of quality in relation to phenotypic variation.
- (c) quantitative and qualitative post-harvest loss assessment,
- (d) quality of processed products and extension of storage life,
- (e) export potential.

## III. ADAPTIVE TECHNOLOGY AND DISSEMINATION

32. This phase is designed to 'transmit' the findings of strategic research to the target audience in Uganda; whether they are farmers, processors, traders, consumers or policy makers in as concise and explicit a manner as possible. In addition, cooperation is encouraged by providing support and facilitating dissemination of appropriate research findings to other national programmes in the region. These could include Rwanda, Eastern Zaire, Burundi, Tanzania and Kenya. Technology or information ready for dissemination includes:

- (a) adapting traditional storage methods to reduce

post-harvest losses and improve quality of marketed products,

- (b) introduce improved but appropriate storage technologies,
- (c) methods for analysis of post-harvest quality,
- (d) improved processing techniques, including ex-country sources which may support the development of new or improved processed products,
- (e) recommendations to farmers for varieties with good agronomic traits that meet specific post-harvest requirements,
- (f) production of training materials in the form of pamphlets, videos, flow-charts, slide series.

#### CONCLUSIONS

33. The NRI by collaborating with the NARO would have the capacity to provide post-harvest technical assistance and expertise in support of the growing national awareness of NGSS.

34. This document outlines a proposal put forward by the FVRC section for collaboration on post-harvest research and development of NGSS in Uganda. It proposes that this is a possible mechanism to combine strategic research, adaptive research, technology transfer and dissemination within the programme of Uganda's National Agricultural Research Organisation. By combining the research effort in this manner it is hoped that an effective long-term approach to increased utilisation of NGSS in Uganda can be achieved.

ANNEX 2:

AGREED MINUTES

Tuesday 23 March 1993

Meeting to discuss and obtain comments on NRI's draft discussion proposal for NGSS research and development in Uganda - presented to Professor J. Mukiibi Director General NARO and Secretary for Research.

PRESENT:

Prof. P Rubaihayo, Makerere University  
Dr E Karamura, Leader, National Banana Programme Kawanda  
Dr C Ebong, Acting Head, Namulonge Research Station  
Mr A Bua, Acting Leader, National Cassava Programme, Namulonge  
Dr R Mwanga, Leader, National Sweet Potato Programme, Namulonge  
Dr N Poulter, Research Manager, NRI  
Mr G Bockett, Farming Systems specialist, NRI

APOLOGIES:

Apologies were received from Mr Silim Nandy, Head FAO/UNDP Post-harvest Unit, Kawanda Research Station.

DISCUSSION:

1. Dr Poulter: Outlined the NGSS proposal (Appended) and emphasised three points;

i) that the NRI post-harvest programme is committed to the development of integrated and sustained support to the national programme activities with NGSS,

ii) that the NRI gives strong emphasis to the importance of effective research-extension linkages and on the improvement of technology transfer to beneficiaries in the post-harvest system, and

iii) that from individual discussions with Leaders of Commodity Programmes it was evident that NRI, in order to fully complement the NGSS sector in Uganda, should consider the secondment of an officer on a long-term basis to coordinate and support NRI post-harvest support to this sector.

2. These statements were welcomed and supported by all members of the meeting.

3. Prof Rubaihayo: Suggested that insufficient emphasis was given to the importance of extending banana shelf-life and the production of derived products. Due to significant wastage of fresh banana products it is important to look at the potential for producing such products as flours, chips, wines etc.

4. Dr Karamura: Asked for examples of technology already developed and ready for dissemination by NRI.

5. Dr Poulter: Explained that the ODA/NRI give priority to food crops which focus in particular on resource poor farmers (often women) in sub-Saharan Africa. Post-harvest issues are becoming increasingly important as they have often been under emphasised in the past. In response to the question the following examples of technologies were given:

i) production and preparation of cassava chips and flours- developed by NRI/CIAT,

ii) chips, flours and starch extraction from sweet potato- both for animal and human consumption,

iii) improved process technologies for the extraction of starch so as to maximise yields and reduced water usage and consequent environmental pollution,

iv) improved sun-drying/artificial techniques to reduce microbial contamination and improve the quality of extracted starches and flours,

v) production of on-farm livestock feeding regimes in order to maximize the use of crop residues and increase economic productivity to satisfy urban demands for livestock products,

vi) germplasm evaluation techniques for the assessment of post-harvest qualities,

vii) low-cost cassava storage techniques to overcome post-harvest losses during transportation and marketing.

6. It was emphasised that NRI's strategy is to improve on-farm value and quality of NGSS products and to support small-scale industrial development.

7. Prof Rubaihayo: Wished to correct a point in the introduction of the NGSS proposal that bananas (and probably sweet potatoes) are not drought resistant.

8. Dr Karamura: More information is required in the form of the rural technology guides produced by the former TPI. An example would be the packaging of bananas.

9. Dr Poulter: Agreed and intended to ensure that these types of document which provide summaries of appropriate technologies would be developed under this programme for NGSS as one means of technical intervention and dissemination of information.

10. Dr Karamura: Asked what type of staff would NRI provide in support of their in-country commitment, as often a range of skills and expertise would be required? Some of the staff would need to be reasonably experienced and also able to provide training.

11. Dr Poulter: accepted this point and made the following points comments:

i) ODA funding to NRI specifically for technology generation and adaptation is not able to support non-project specific training activities,

ii) it is possible to support in-country research training in the form of Master and Ph.D degrees, however the subject matter has to be directly related to specific project objectives,

iii) the support to be provided by NRI could include:

a) a two year secondment of an NRI officer to Uganda to coordinate NRI post-harvest support to NGSS,

b) inputs from experienced specialists for specific tasks eg engineers, microbiologists, physiologists, biochemists etc

c) partial or full financial support for operational costs of specific project activities, and

d) supply of essential laboratory equipment which is for the specific and active use of the Project concerned with NGSS.

12. Dr Poulter noted that NRI is not able to fund infrastructural change and/or improvements. This is due to the nature of the source of funding from the ODA which indicates that this particular fund is for research, technology adaptation and transfer

13. Prof Rubaihayo: was pleased to hear of this approach but feels that a greater input on socio-economic issues is required. For instance the possibility of exporting sweet and lady's finger bananas to the Middle East as Sudan used to do. It is important to assess the means of earning foreign exchange.

14. Dr Poulter: Agreed that this is an important and relevant issue for the Government of Uganda, however in the context of the project under discussion the focus is towards ensuring food security and improving subsistence production in-country and in the East African region.

15. Dr Karamura: Asked how and when the needs assessment phase was going to be implemented, as the various NGSS programmes are at different stages of development.

16. Dr Poulter: Evaluation of the extent to which the various programmes are meeting these objectives may need to be undertaken to answer this question. Is the data from the various surveys going to provide us with the information that is required to identify problem areas requiring research and technical intervention? Integration of the data from each programme may also be required for us to obtain an overview of the farming system as a whole.

17. Dr Karamura: This should be carried out at the outset of the proposed project in order to determine the research and technology transfer agenda.

18. Mr Bua: Agreed that it is essential to identify the priority areas and to arrange a forum for this.

19. Dr Mwanga: Stated that there is very little information available on post-harvest in sweet potato.

20. Dr Karamura: Stated that findings from the Diagnostic Survey of Banana will be presented at a symposium to be held in Kampala in June 1993.

21. Prof Rubaihayo: Suggested that subsequent to this symposium in late June it would be an opportune time to assess the needs for the post-harvest sector for the different NGSS commodities. It would be a useful time to get all donors concerned with post-harvest issues together in order to identify strengths and weaknesses of existing data and to develop future plans.

22. Dr Ebong: raised the following concerns and enquired as to the support that the NRI project may give in these areas:

i) no provision is made for Ph.D. training and wondered whether it would not be possible to review the situation vis a vis ODA funding restrictions to NRI,

ii) there is a general lack of scientific journals in the country which creates an intellectual gap, and

iii) the project will require equipment for the labs.

23. Dr Poulter: reiterated that:

i) it is not possible to finance overseas training due to the constraints imposed on the budget,

ii) the purchase of journals cannot be supported, and

iii) the refurbishing of laboratories cannot be financed but specific equipment needs for the project could be considered.

24. Dr Ebong: asked whether there is a link between the Regional TC Africa project on NGSS (the Project Memorandum had earlier been presented to Prof Mukiiibi) and the proposal for NGSS under current discussion in Uganda. He was referring to the supply of counterpart staff and vehicles.

25. Dr Poulter: Yes there will be a linkage between these two projects. It should be noted that all ODA TC programmes require conditions such as salaries for counterpart staff etc to be met by the recipient country government.

General Meeting Consensus:

26. The following points were accepted by all present at the meeting as necessary:

i) long-term in country support for NGSS in the form of an NRI appointee to coordinate activities,

ii) in-country support for the remainder of the Diagnostic Survey on banana in the form of an NRI appointee, and

iii) to develop phased and specific commodity activities as sub-components of the NRI's overall support to NGSS in Uganda. NRI will develop these specific projects with the appropriate Programme Leaders at Kawanda and Namulonge.

Actions required

i) Seek approval for and circulate minutes as soon as possible and pass these to Prof Mukiibi,

ii) NRI will identify a specialist for the long-term NRI input into Post-harvest NGSS activities and send details to Prof Mukiibi as soon as possible to seek his comments,

iii) NRI will identify a specialist for the input into the remainder of the DS of the banana programme as soon as possible and pass the appropriate papers to Dr Karamura for preliminary comment, and

iv) Programme Leaders in conjunction with NRI post-harvest staff and other donors will arrange for a meeting in late June to assess the current status of post-harvest issues in NGSS.



