



Handbook of Sweetpotato Integrated Crop Management

Research Outputs and Programs for East Africa
(1995-2006)



Regina Kapinga, Oscar Ortiz, Joseph Ndunguru,
Emmanuel Omiat and Silver Tumwegamire

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Foreword

As part of the implementation of CIP's vision, which seeks to reduce poverty and achieve food security on a sustained basis in developing countries through scientific research and related activities on sweetpotato, CIP in collaboration with other stakeholders, has spear-headed integrated crop management (ICM) research in East Africa for the past 15 years (1994-2005).

Research was undertaken to address some key sweetpotato production constraints in Africa in the areas of integrated pest management (IPM), integrated disease management (IDM), post-harvest management (PM) and ICM. This handbook presents outputs and major achievements of the research in these thematic areas as presented for each East African countries (Kenya, Tanzania and Uganda).

Research work conducted on a regional basis is presented in the last section of this handbook. Most of the research work in East Africa was conducted in areas where sweetpotato serve as important component of the household food security.

It is believed that these findings will help researchers and policymakers to take different and correct decisions on issues pertaining to improvement of sweetpotato productivity. In addition, different international and national research programs can use these findings to avoid duplication of research work on sweetpotato in East Africa and hence optimize resource utilization.

We would like to give a special acknowledgement to our colleagues outside CIP who contributed to this research work and those involved in information collection. Different stakeholders and funding agencies were involved in the implementation of the research work.

Major issues raised

Research Gaps-IDM

- Information on control methods of SPVD in East Africa is not documented in accessible form
- The effect of SP viruses on the root quality is lacking
- Current status of SPVD in major growing areas of sweet potato in Kenya not documented

IPM

- Very minimal work has been done on the biological control of major sweet potato pests- weevil, this might be an affordable method in rural area
- Moles are becoming a major pest- control methods need to be explored- eg use of repellent like Tithonia shrubs
- Studies on inter-cropping legume eg climbing beans with sweet potato need to be done
- Screening clones for rooting characteristics for control weevil damage
- Studies on quantification of losses caused by pest damage
- New field vs old fields proximity- how does it affect pest spread and damage
- More studies on post-harvest handling of roots in controlling storage pest- farmers are currently harvesting whole field and storing roots temporary before transportation to major markets- storage technologies, curing methods to prolong the shelf life of roots need to be explored and sound recommendations given
- Simple technologies for on-farm storage of fresh roots to minimize pest damage

Summary

Sweetpotato productivity is limited by both abiotic and biotic constraints, leading to poor yields at farm level. They include low soil fertility and draught, shortage of improved varieties, shortage of planting materials, pests and diseases particularly viruses, post harvest problems such as storages, and market availability and demand as well as low socio status in some communities. For a period between 1994 and 2004 CIP together with other partners spearheaded a research on sweetpotato in East Africa to address some of the above constraints. This research was conducted in the major sweetpotato producing areas Kenya, Tanzania and Uganda. The major focus was on integrated pest management (IPM), integrated disease management (IDM), post-harvest management and integrated crop management (ICM). Major research findings and outputs have been published in different scientific journal and scientific reports by the participating researchers in the national agricultural research programmes as well as international research organization. Different methods for controlling sweetpotato weevils have been identified and prevalence of sweetpotato virus disease (SPVD) in the region has been mapped together with virus identification and characterisation. Factors affecting post-harvest characteristics of sweetpotato as well as different sweetpotato processing methods have been evaluated for different sweetpotato cultivars in East Africa. In addition, different sweetpotato crop management technologies were tested in order to develop a management system and practices that suit the specific conditions of the farm and results have been documented in this handbook. This handbook joins major results and outputs from sweetpotato research work conducted in East Africa to help in information dissemination to research scientists, funding agencies, policy markers and other stakeholders interested in improving sweetpotato production through support and strengthening of research in East Africa.

List of acronyms and abbreviations

ARC	Agricultural Research Center
ARCs	Austrian Research Centers
ARI	Agricultural Research Institute
ARTI	Agricultural Research and Training Institute
BBA	Federal Research Center for Agriculture and Forestry (<i>Biologische Bundesanstalt Fur Land-Und Forstwirtschaft</i>)
BIO-EARN	East African Regional Network for Biotechnology, Biosafety and Biotechnology Policy Development Programme
CIP	International Potato Center
DANIDA	Danish International Development Agency
DARS	Dakawa Agro-scientific Research Station
DFID	Department for International Development
EC	European Commission
EU	European Union
FFS	Farmer Field School
GoT	Government of Tanzania
GoU	Government of Uganda
IBP	<i>Institut für Biochemie und pflanzenvirologie</i> -Germany
ICM	Integrated Crop Management
IITA-ESARC	International Institute of Tropical Agriculture- Eastern and Southern Africa Regional Center
IPM	Integrated Pest Management
KARI	Kenya Agricultural Research Institute
KARI-Ug	Kawanda Agricultural Research Institute, Uganda
Ke	Kenya
LZARDI	Lake Zone Agricultural Research and Development Institute
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MARD	Ministry of Agriculture and Rural Development
MARDC	Mukono Agricultural Research and Development Center
MoA	Ministry of Agriculture
M.Sc	Master of Science
MUK	Makerere University, Kampala
Mphil	Master of Philosophy
MUARIK	Makerere University Agricultural Research Institute, Kabanyolo
NAARI	Namulonge Agricultural and Animal Production Research Institute
NARL	National Agricultural Research Laboratories
NARO	National Agricultural Research Organization
NCM-ELSA	Nitrocellulose Membrane- Enzyme Linked Immunosorbent Assay
NCSU	North Carolina State University
NRI	Natural Resources Institute
ODA	Overseas Development Administration

Handbook of Sweetpotato Integrated Crop Management

PhD	Doctor of Philosophy
PRAPACE	Regional Potato and Sweetpotato Improvement Programme for Eastern and Central Africa
SAARI	Serere Agricultural and Animal Production Research Institute
SARRNET	Southern Africa Root Crops Research Network
Sida/SAREC	Swedish International Development Agency/Swedish Agency for Research Cooperation
SLU	Swedish University of Agricultural Sciences (<i>SVERIGIES LANTBRUKSUNIVERSITET</i>)
SPCFV	Sweetpotato Chlorotic Fleck virus
SPCaV	Sweetpotato Caulimo-like Virus
SPCSV	Sweetpotato Chlorotic Stunt Virus
SPFMV	Sweetpotato Feathery Mottle Virus
SPMMV	Sweetpotato Mild Mottle Virus
SPVD	Sweetpotato Virus Disease
SRI	Sugarcane Research Institute
SUA	Sokoine University of Agriculture
TCSC	Tanzania Commission for Science and Technology
TFNC	Tanzania Food and Nutrition Center
TNRTCP	Tanzania National Root and Root Crops Programme
Tz	Tanzania
Ug	Uganda
UK	United Kingdom
UoN	University of Nairobi
UNDP	United Nations Development Programme

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Special thanks are also extended to colleagues who reviewed and made valuable comments on these chapters.

CHAPTER ONE: INTRODUCTION

East Africa depends heavily on agricultural production for food security, employment and export earnings. Population growth and fast urbanization has created additional demand for regular supplies of a variety of quality crops, and the need to diversify cereal-based production systems for sustainability has generated additional scope for root and root crops cultivation.

Sweetpotato, *Ipomoea batatas* (L.) Lam., the only important economic food plant of the family Convolvulaceae, originated in or near northwestern South America around 8,000-6000 B.C. (Austin, 1988). It ranks seventh among all food crops world-wide, with an annual production of 124 million tonnes (FAO, 1996) and of the root and root crops it ranks third in acreage (9.1 million ha) behind Irish potato and cassava.

In Africa, sweetpotato is the second most important root crop after cassava and production is concentrated in the East African countries around Lake Victoria. Sweetpotato is grown in several agro-ecological zones and usually plays significant roles in the farming and food systems. Sweetpotato is commonly grown by farmers in complex, mixed cropping systems where they normally plant several varieties with different characteristics (yield, maturity, palatability, time to maturity, root size and shape, root colour, storability in the ground, pest and disease tolerance, drought tolerance, and sweetness) in a single plot. Farmers may use the vines left in the fields to improve soil fertility, and the crop is used in crop rotation. Since it has a short growing period, it stores well in the soil and performs well in marginal lands. It is recognized as ideal an crop for food security. The yellow- and orange-fleshed sweetpotato varieties are also a good source of vitamin A that is frequently lacking in diets of most African farming communities (CIP 1999). Also, sweetpotato is widely used as animal feed (CIP 2000).

Sweetpotato productivity is limited by both abiotic and biotic constraints, leading to poor yields at farm level. They include low soil fertility and drought, shortage of improved varieties, shortage of planting materials, pests and diseases particularly viruses, post-harvest problems such as storage, and market availability and demand as well as low socioeconomic status in some communities.

While the factors affecting growth and productivity in agriculture in sub-Saharan Africa are many, there is general agreement that investing in a functioning agricultural R&D system is a necessary component of a successful development strategy. Three principal resources of increasing crop production in sub-Saharan Africa according to an FAO report (1986) have been identified: Expansion of arable land can contribute to increase in production by 27%, higher yields can contribute to increased production by 51%, and greater cropping intensity can contribute to increasing production by 23%. Increase in yields has therefore been identified as a key element and this can be achieved first and foremost by intensifying agricultural research. In Africa this principle spurred a rapid increase in the number of agricultural researchers. However, until the late 1980s, research investment by national and international agricultural institutes on sweetpotato in East Africa was far below that received by cassava, maize or potato because the role and significance of sweetpotato in the region was not fully appreciated (Scott and Ewell, 1994). Because of its significance, the crop is now one of the high priority commodities in the research and development agenda of National Agricultural Research Programmes of the East African countries. This handbook documents research outputs and achievements on sweetpotato for the past 15 years conducted in SSA particularly in East Africa to provide information on which to base the formulation of effective crop improvement strategies.

CHAPTER TWO: INTEGRATED PEST MANAGEMENT

Sweetpotato weevils are increasingly becoming an extremely serious threat to sweetpotato production in sub-Saharan Africa. Integrated pest management (IPM) is recommended to control most of sweetpotato pests. This system needs to be compatible with farmer's crop management practices, as well as with prevailing ecological and socioeconomic conditions, to ensure effective and sustainable solutions. Research in this area focused on evaluating pest control strategies that enhance farmers' ecological knowledge and decision-making and problem-solving skills. Different pests of sweetpotato were studied and their impact on sweetpotato yields assessed, as well as their control methods.



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2.1: Intercropping maize and sweetpotato and the effects on whitefly and aphid populations

Project Number ICA4-CT-2000- 30007

Objective: • To determine the effect of intercropping sweetpotato and maize on the whitefly and aphid population

Research Period: October 2002 to September 2003

Implementing Agencies: University of Nairobi

Donors: NRI, EU

Summary of Major Research Results

- Intercropping reduced aphid and whitefly vector population
- Variety Kemb 10, which has an erect growth habit, is better adapted for intercropping

Outputs

- Effect of intercropping sweetpotato and maize on the whitefly and aphid population
- Annual report, 2003 by Njeru, R.W. and Gibson, R.W.

Publication

Njeru, R.W and Gibson, R.W. 2003. Intercropping maize and sweetpotato and the effects on whitefly and aphid populations. *Third Annual Report: Identification and characterization of sweetpotato viruses in East and South Africa, and assessment of host plant resistance for sustainable production*. INCO-Dev: International Co-operation with Developing Countries (1998-2002).

Tanzania

2.2: Effect of time of planting sweetpotato on weevil damage in the Lake zone of Tanzania

Objectives	<ul style="list-style-type: none">• To investigate the best time of planting sweetpotato in order to escape heavy weevil damage• To investigate the varieties with low levels of damage at 4 planting dates (December, January, February and March)
Research Period:	1994/95, 1995/96, 1996/97 seasons
Implementing Agencies:	Ukiriguru Agricultural Research Development Institute
Donors:	SARRNET, Government of Tanzania

Summary of Major Research Results

- Late planting (i.e. February and March) results in higher damage levels of both *Cylas* and *Brocyrus* spp. whilst early planting (December and January) results in less weevil damages
- Variety SPN/O was more severely damaged than Budagala for all the planting times
- Late planting resulted in losses of about 50%
- Variety SPN/O had the highest mean root yield of 5.6 t/ha.

Outputs

- Effect of planting time on sweetpotato weevil damage assessed
- Recommendations on the best time for planting sweetpotato to control weevil damages in the Lake zone of Tanzania
- Publication by Jeremiah *et al.*, 1998. In: *Proceedings of the scientific workshop of the SARRNET*.

Publication

Jeremiah, S.C., Nyango, C., Rugutu, C and Amour, R. 1998. Effect of time of planting sweetpotato on weevil damage in the Lake Zone of Tanzania. In: Akoroda M.O and Teri, J.M (Eds.). Food Security and Crop diversification in SADC countries: the role of *cassava and sweetpotato*. *Proceedings of the scientific workshop of the Southern African Root Crops Research Network (SARRNET)* held at Pamodzi Hotel, Lusaka, Zambia, 17-19 August 1998.

2.3: Influence of time and method of harvesting on the incidence and severity of sweetpotato weevils

Objectives	<ul style="list-style-type: none">• To determine the critical period when the sweetpotato weevils are most serious.• Selecting among the 5 sweetpotato cultivars the least attacked by weevils• Selecting the earliest maturing sweetpotato cultivars• To determine the storage root yield performance among the 5 sweetpotato cultivars
Research Period:	1995 to 1996
Implementing Agencies:	Kibaha Agricultural Research and Development Institute, Sokoine University of Agriculture, Morogoro
Donors:	CIP, Government of Tanzania, SARRNET

Summary of Major Research Results

- Significant variety differences ($P < 0.01$) in sweetpotato weevil crown damage, % incidence, severity root damage and yield
- Sweetpotato weevil crown damage was lower for Sindano and Hali ya mtumwa while Turiani II and Sindano had lowest scores of sweetpotato weevil % incidence and root damage severity.
- Generally, sweetpotato crown damage was increasing as the time of harvesting. However, varieties Sindano, Kasimama and Hali ya mtumwa had high sweetpotato weevil crown damage at 135 days after planting (DAP) while Turiani II had the highest rate of damage at 150 DAP
- At Kibaha, sweetpotato weevil crown damage increased with time of harvesting for all the varieties except Sindano and Turiani II where it decreased at 135 DAP

Outputs

- Critical period of sweetpotato crown damage determined
- Storage root yield performance among the 5 sweetpotato cultivars determined
- Effects of sweetpotato weevil infestation on sweetpotato cultivars determined
- Effects of sweetpotato weevil crown damage on root yields determined
- Effects of sweetpotato cultivars and time of harvesting on sweetpotato weevil crown damage
- Final Technical report by Mbilinyi *et al.* 1996

Publication

Mbilinyi., Muhanna, M and Kiozya, H. 1996. Influence of time and method of harvesting on the incidence and severity of sweetpotato weevils. In: *Roots and Root Crops Research Programme. Progress report for 1996 and Work plans for 1997. Tanzania, Ministry of Agriculture and Co-operatives. Research and Training Department.* Pp 94-98.

2.4: Effects of planting time on incidence of sweetpotato weevils at different planting dates

Project No.	Q/3/20/94
Objective	<ul style="list-style-type: none">To find out suitable time of planting sweetpotato in order to minimize sweetpotato weevil infestation level
Research Period:	1994/95, 1995/96 seasons
Implementing Agencies:	Lake Zone Agricultural and Development Research Institute-Ukiriguru
Donors:	CIP, Uganda, Government of Tanzania, SARRNET

Summary of Major Research Results

- *Cylas puncticollis* damage on roots significant varied between planting dates. Late planting (February and March) gave slightly higher weevil damage (1.5) compared to early planting (December and January (1.3 and 0.7 respectively). No significant differences among varieties observed
- Rough weevil scores were higher (3.0-3.3) in the first planting to 3rd planting while fourth planting had lower rough weevil scores.
- Variety SPN/O was more attacked than Sinia.

Outputs

- Rough weevil damage, crown damage and *Cylas* sp. damage on storage roots at different planting dates
- Yield of sweet potato varieties at different planting dates determined
- Suitable planting time for sweetpotato to sweetpotato weevil damage identified
- Final Technical report by Jeremiah *et al.*, 1996.

Publication

Jeremiah, S.C., Mohammed, R and Nyango, A. K. 1996. Effects of planting time on incidence of sweetpotato weevils at different planting dates. In: *Roots and Root Crops Research Programme. Progress report for 1996 and Work plans for 1997. Tanzania, Ministry of Agriculture and Co-operatives. Research and Training Department.* Pp 98-101.

2.5: Screening sweetpotato varieties for host plant resistance against African sweetpotato weevils

Project No.	Q/3/25/95
Objective	<ul style="list-style-type: none">To investigate and select varieties with good level of resistance against sweetpotato weevils
Research Period:	1995 to 1996
Implementing Agencies:	Ukiriguru Agricultural Research and Development Institute, Kibaha Agricultural Research and Development Institute
Donors:	IPM-Dar es salaam, Government of Tanzania

Summary of Major Research Results

- Severity levels of weevil damage was very low on both crown and storage roots.
- At Kibaha, no weevil damage signs were observed on vines of all varieties.
- At Ukiriguru, Larvae, Pupae and Adult counts in storage roots were higher in varieties pembelyangholongo, Sinia and SPN/O while lower levels were recorded on Budagala and Mwanamonde
- Highest larvae/pupae and adult counts were observed on storage roots of variety SPN/O at both locations (Kibaha and Ukiriguru) while Budagala was among varieties with lowest the counts
- Variety Mwanamonde had higher weevil counts at Kibaha and low counts at Ukiriguru
- Variety Sinia had higher counts at Ukiriguru and lower counts at Kibaha

Outputs

- Sweetpotato storage root and crown damage by *Cylas puncticollis* at harvest
- Sweetpotato weevil severity, larvae/pupae and adult count on storage roots in different sweetpotato varieties evaluated
- Final Technical report by Jeremiah *et al.*, 1996.

Publication

Jeremiah, S.C., Muhanna, M., Mohammed, R and Kiozya, H. 1996. Screening sweetpotato varieties for host plant resistance against African sweetpotato weevils. In: *Roots and Root Crops Research Programme. Progress report for 1996 and Work plans for 1997. Tanzania, Ministry of Agriculture and Co-operatives. Research and Training Department.* Pp 101-104.

2.6 Comparative effectiveness of different cultural methods in the control of sweetpotato weevils (*Cylas puncticollis*)

Project No.	Q/5/25/96
Objective	<ul style="list-style-type: none">To determine cultural control methods that can provide effective control of weevils as hilling up twice but less labour intensive
Research Period:	April 1996 to August, 1996
Implementing Agencies:	IPM-Dar es salaam, GoT, SRI-Kibaha

Summary of Major Research Results

- Practices that reduced storage root damage due to weevils below the experimental mean (3.84) were: hilling up twice, intercropping with legumes + hilling up once + application of FYM and hilling up once + application of manure
- Sweetpotato weevil damage to crowns was reduced below the overall mean damage by hilling up twice, and intercropping with legumes + hilling up once + application of FYM
- Lowest yield was recorded from no hilling up treatment whereas higher yield (above experimental mean) was obtained when hilling up is done twice or when it is done once and accompanied by intercropping and application of manure

Outputs

Comparison of the effect on the sweetpotato yield and weevil damage of the different cultural practices, notably;

- Traditional method (weeding once (4 weeks after planting (WAP), without hilling up.
- Hilling up once + Legumes (cowpea).
- Hilling up once + manure (3 tonnes /ha)
- Hilling up twice (4 WAP and 8 WAP)
- Hilling up once (4WAP) + Legume (cowpeas) + manure
- Final technical report by Muhanna, M and Kiozya, H. 1996.

Publication

Muhanna, M and Kiozya, H. 1996. Comparative effectiveness of different cultural methods in the control of sweetpotato weevils(*Cylas puncticollis*). In: *Roots and Root Crops Research Programme. Progress report for 1996 and Work plans for 1997. Tanzania, Ministry of Agriculture and Co-operatives. Research and Training Department.* Pp 104-106.

Uganda

2.7 Identification of the appropriate date of planting sweetpotato to minimize infestation by *Cylas spp.* (Coleoptera: Apionidae) in Uganda

Objective	<ul style="list-style-type: none"> To understand the influence of varied planting times on infestation by insect pests of sweetpotato varieties
Research Period:	1995
Implementing Agencies:	Namulonge Agricultural and Animal Production Research Institute
Donor:	CIP-Uganda

Summary of Major Research Results

- C. puncticollis* and *C. brunneus* caused damage to roots of all five varieties tested
- No varietal differences in yields related to time of planting
- For the first rains, crops planted between May-June suffered less weevil attack when compared with those planted in July. First rain crop is likely to suffer less weevil infestation than second rain crop

Outputs

- Assessment of the influence of planting time on infestation of sweetpotato by insect pests
- Appropriate date for planting sweetpotato to minimize infestation by *Cylas spp* identified
- Paper prepared for the *African Potato Association Conference*, Pretoria, South Africa, (13-17 Feb 1997) Odongo *et al.* (1995).

Publication

Odongo, B., Laboke, P.O., Smit, N.E.J.M., Downham, M.C.A and Hall, D.R. 1995. Identification of appropriate date for planting sweetpotato to minimize infestation by *Cylas spp.* (Coleoptera: Apionidae) in Uganda. In: *Project report on Integrated Management of Sweetpotato Pests, Namulonge Agricultural and Animal Production Research Institute* (NAARI), Kampala.

2.8 Aspects of the biology of the sweetpotato butterfly (*Acraea acerata*) and impact of its defoliating the leaves on sweetpotato yield

Objectives	<ul style="list-style-type: none"> To generate biological information on the sweetpotato butterfly, <i>Acraea acerata</i> Hew To estimate the impact of the butterfly through simulated artificial defoliation and the effect of this on the agronomic performance of sweetpotato (<i>Ipomoea batatas</i> (L) Lam) and the interaction between butterfly and the sweetpotato weevil, <i>Cylas spp</i> damage.
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Research Period: 1996
Implementing Agencies: Makerere University, Kampala
Donor: CIP, Uganda

Summary of Major Research Results

- Mean developmental period of the sweetpotato butterfly was 37 days at an average temperature of 22.0 °C. Five instars exist within the larval stage
- There were nearly twice as many female butterflies as the males during the dry season but an equal proportion of the two sexes occurred during the rains
- Between 3-5 generations of the butterfly may develop during the growth cycle of the sweetpotato crop, given the optimum maturity period of six months
- Single defoliation at 50 and 100% levels caused either a slight increase or decrease in storage root yield but repeated complete defoliation significantly ($P < 0.05$) reduced root yield
- The crop growth stage at which defoliation was carried out did not have a significant effect on root yield
- Different levels of a single defoliation carried at different growth stages of the crop did not affect shoot survival and their effects on yield were insignificant

Outputs

- Biology of the sweetpotato butterfly
- Effect of defoliation on agronomic variables of sweetpotato
- MSc. Thesis (1996) Lugoja, F, Makerere University

Publication

Lugoja, F. 1996. Aspects of the biology of the sweetpotato butterfly (*Acraea acerata*) and impact of its defoliating the leaves on sweetpotato yield. M.Sc. Thesis, Makerere University. 90pp

2.9 Technique of re-hilling sweetpotato mounds to reduce *Cylas spp.* weevil infestation and improve sweetpotato yield in Soroti district, Northeastern Uganda

Project No.	R7024 C
Objective	<ul style="list-style-type: none">• To test Integrated Crop Management (ICM) techniques to improve yield and reduce weevil damage
Research Period:	1999 to 2000
Implementing Agencies:	Namulonge Agricultural and Animal Production Research Institute, National Agricultural Research Organization
Donors:	DFID, CIP, IITA-ESARC

Summary of Major Research Results

- Yield of improved varieties, namely, NASPOT 1 and 1927, compared favourably with that of the control variety, Haraka
- Spot re-hilling done when soil cracks appear was sufficient for reducing weevil infestation, and resulted in high yield

Outputs

- Effect of re-hilling on sweetpotato yield and weevil infestation
- Comparison of yield performance of improved sweetpotato varieties with those of the local check
- Publication by Odongo *et al.*, 2003 in: *Uganda Journal of Agricultural Sciences* 8: 117-122

Publication

Odongo, B., Heather, K., Ewell, P., Stathers, T., Elske van de Fliert., Mudiope, J., Ogiro, V and Lugwana, E. 2003. Technique of re-hilling sweetpotato mounds to reduce *Cylas* spp. weevil infestation and improve sweetpotato yield in Soroti istrict, Northeastern Uganda. *Uganda Journal of Agricultural Sciences* 8: 117-122.

2.10 Development of pheromone traps for control and monitoring of sweetpotato weevils, *Cylas puncticollis* and *C. brunneus*, in Uganda

Project No.	R6124 & R6115H
Objectives:	<ul style="list-style-type: none">• To optimise pheromone traps for the African sweetpotato weevil species, <i>C. puncticollis</i> and <i>C. brunneus</i>• To compare the effectiveness and practicability of various designs (funnel, water and sticky) of pheromone traps.
Research Period:	February 1995 to February, 1996
Implementing Agencies:	Namulonge Agricultural and Animal Production Research Institute
Donors:	NRI, CIP, Uganda

Summary of Major Research Results

- A 5 litre plastic jerrycan trap was the most effective and practicle design
- A solution of OMO detergent in water was found to be the most effective trapping agent
- Fewer weevils were caught in red traps than in yellow, white, green or blue traps.
- Catches of *C. puncticollis* increased when the trap was raised above crop height, but catches of *C. brunneus* were unaffected
- When marked weevils were dropped onto the trap, 36% of *C. puncticollis* and 23% of *C. brunneus* were captured, and, of weevils placed in the trap, 88% and 92%, respectively, of the two species remained overnight

- Lures for the two species showed no significant loss in attractiveness after 8 weeks in the field, and chemical analysis showed 19% of the *C. puncticollis* pheromone and 72% of the *C. brunneus* pheromone remaining after this time
- Increasing the height of the 5 litre jerrycan trap so that the lure was 15cm or 30cm above the canopy of the sweetpotato crop, significantly increased trap catches of *C. puncticollis* but had no effect on catches of *C. brunneus*
- Lowering the trap position so that the lure was 15cm below the canopy reduced *C. puncticollis* catches, but did not affect those of *C. brunneus*.

Outputs

- Development and comparison of trap designs for control and monitoring of sweetpotato weevils
- Evaluation of the efficiency of trapping agents
- Comparison of trap colour on the catches of sweetpotato weevils
- Effect of trap height on weevil catches established.
- Weevil entry and retention in the traps
- Longevity of the lures in the field determined
- Publication by Smit *et al.*, 1997. In: *Entomologia Experimentalis et Applicata* 85: 95-104.

Publication

Smit, N.E.J.M., Downham, M.C.A., Odongo, B., Hall, D.R & Laboke, P.O. 1997. Development of pheromone traps for control and monitoring of sweetpotato weevils, *Cylas puncticollis* and *C. brunneus*, in Uganda. *Entomologia Experimentalis et Applicata* 85: 95-104.

2.11 Reduction of pre-harvest infestations of African sweetpotato weevils *Cylas brunneus* and *C. puncticollis* (Coleoptera: Apionidae) using a pheromone mating-disruption technique

Project No.	R6115H
Objective	<ul style="list-style-type: none"> • To control sweetpotato weevils, <i>Cylas puncticollis</i> and <i>C. brunneus</i>, by mating-disruption using the synthetic sex pheromone of <i>C. brunneus</i> formulated in PVC resin dispensers.
Research Period:	1998
Implementing Agencies:	Namulonge Agricultural and Animal Production Research Institute
Donors:	DFID, NRI, IITA-ESARC, CIP, Uganda

Summary of Major Research Results

- Almost no *C. brunneus* males were caught in pheromone traps in the treatment plot, whereas catches in the control plot ranged up to 30 weevils per trap over each two-night monitoring period

- Suppression of *C. puncticollis* catches was weaker
- Mating of *C. puncticollis* was significantly suppressed on one sample date, 18 weeks after planting, but not on two subsequent occasions, at 19 and 33 weeks
- Yields of roots in the two plots were similar, but root infestation was lower in the plot treated with pheromone on four out of five sample harvest dates, from 17 to 36 weeks after planting.

Outputs

- Assessment of mating suppression of *C. puncticollis*
- Assessments of yield and damage to *Cylas*-infested roots
- Monitoring male populations with pheromone traps and determining the incidence of female mating
- Publication by Downham *et al.*, 2001 in: *Crop Protection* 20 (2001) 163-166.

Publication

Downham, M.C..A., Smit, N.E.J.M., Laboke, P.O., Hall, D.R & Odongo, B. 2001. Reduction of pre-harvest infestations of African sweetpotato weevils *Cylas brunneus* and *C. puncticollis* (Coleoptera: Apionidae) using a pheromone mating- disruption technique. In: *Crop Protection* 20 (2001) 163-166. www.elsevier.com/locate/cropro

2.12 Mass-trapping of male *Cylas* spp. with sex pheromones: a potential IPM component in sweetpotato production in Uganda

Project No.	R6115H
Objectives	<ul style="list-style-type: none"> • To investigate the possibility of using mass-trapping of <i>C. puncticollis</i> and <i>C. brunneus</i> with pheromone traps to reduce weevil populations and subsequent root infestation • To investigate the extent of interference between adjacent pheromone traps.
Research Period:	October, 1995 to December, 1997
Implementing Agencies:	Namulonge Agricultural and Animal Production Research Institute, Serere Agricultural and Animal Production Research Institute
Donors:	DFID, CIP Uganda, IITA-ESARC

Summary of Major Research Results

- Populations of male weevils were reduced by up to 89%, compared to un-trapped control plots in the four on-station trials of season-long mass-trapping of both species of weevil in 0.5 ha sweetpotato plots with 100 jerry can traps ha⁻¹ (50 traps for each species placed alternatively)
- No differences in root infestation levels were recorded between mass-trapped and untreated control plots
- No differences in the proportions of female weevils that were mated were observed.

Outputs

- Effect of mass-trapping of male weevils on population and infestation levels.
- Trap interference: effects of treatment on trap-catches of both *C. brunneus* and *C. puncticollis*
- Publication by Smit *et al.*, 2001 in: *Crop Protection* 20 (2001) 643-651

Publication

Smit, N.E.J.M., Downham, M.C.A., Laboke, P.O., Hall, D.R & Odongo, B 2001. Mass- trapping male *Cylas* spp. with sex heromones: a potential IPM component in Sweetpotato production in Uganda. In: *Crop Protection* 20 (2001) 643- 651 www.elsevier.com/locate/cropro

2.13 Host plant finding by *Acraea acerata* Hew. (Lepidoptera: Nymphalidae), the sweetpotato butterfly: Implications for pest management

Objectives

- To understand how the sweetpotato butterfly finds its host plants and to use that knowledge to elaborate and test sweetpotato butterfly management strategy
- To study visual and olfactory cues involved in host plant finding by the sweetpotato butterfly and seeking ways of interfering these cues to protect sweetpotato from insect attacks

Research Period: 2001

Implementing Agencies: Namulonge Agricultural and Animal Production Research Institute

Donors: CIP Uganda, University of Edinburgh

Summary of Major Research Results

- Sweetpotato butterfly is attracted to sweetpotato plants in a wind tunnel, with the butterflies moving upwind, landing and laying eggs on the plants
- Both host plant olfactory cues, visual cues and their interaction had significant effects on the mean average distances moved by butterflies for the first ten minutes of the observation time
- Olfactory cues had very highly significant positive effects on the mean average distances moved by butterflies ($P < 0.01$) throughout the observation time, whereas visual cues and the interaction between olfactory and visual cues had highly significant negative effects ($P < 0.01$)
- In the second 10 minutes of the observation time, only the interaction between olfactory and visual cues had significant but negative effects on the distances moved by butterflies ($P < 0.05$)
- In the last 10 minutes, the trend of the effects of visual cues and consequently that of the interaction remained negative
- Intercropping sweetpotato with strong smelling plants such as onion, tomato, garlic, molass grass repels sweetpotato butterflies

Outputs

- Effects of olfactory and visual cues on the attraction of *Acraea acerata* to sweetpotato plants
- Attractiveness of host plant volatiles to *Acraea acerata*
- Initial screening of potential repellent/ disorienting plants for *Acraea acerata*
- Screening for odour masking and/ or repellent plants to *Acraea acerata* in a wind tunnel conducted
- Effects of intercropping sweetpotato with onion or Desmodium plants on *Acraea acerata*
- PhD Thesis (2001), Hitimana, N, The University of Edinburgh, Scotland, UK

Publication

Hitimana, N. 2001. Host plant finding by *Acraea acerata* Hew. (Lepidoptera:Nymphalidae), the sweetpotato butterfly: Implications for pest management. Ph.D Thesis, The University of Edinburgh, Scotland, UK

2.14 Environmental factors affecting catches of sweetpotato weevils, *Cylas brunneus* (Fabricius) and *C. puncticollis* (Boheman) in pheromone traps

Objectives

- To assess the locational effect and seasonal variations in, and the effect of ambient temperature, wind speed and direction, rainfall and the level of moonlight, on the recapture rate of male sweetpotato weevils, *C. brunneus* and *C. puncticollis*, in pheromone-baited traps
- To assess the effects of temperature (15-27 °C) and food availability on the activities of the sweetpotato weevil using a temperature-controlled cabinet.

Research Period: August 1997 to February 1998

Implementing Agencies: Makerere University, Kampala

Donor: CIP Uganda

Summary of Major Research Results

- The effects of temperature and wind direction on the recapture rates of male sweetpotato weevils were more important than those of rainfall and wind
- Under controlled conditions, *C. brunneus* males were most active at 23°C while *C. puncticollis* were most active at 27°C
- The weevils were more active in the absence of food than when exposed to a food source
- The numbers of male sweetpotato weevils of both species trapped were not influenced by the intensity of moonlight
- More *Cylas* males were recaptured during warmer days and nights than cooler ones

Outputs

- Effect of temperature on activity of male virgin sweetpotato weevils, *C. brunneus* and *C. puncticollis* established

- Effect of levels of moonlight on pheromone trap catches of the sweetpotato weevils, *C. brunneus* and *C. puncticollis* established
- Locational effect and seasonal variations on the recapture rate of male sweetpotato weevils, *C. brunneus* and *C. puncticollis* in pheromone baited traps determined
- Publication by Laboke *et al.*, in: *African Potato Association Conference Proceedings*, Vol. 5. pp217-227
- M.Sc Thesis (1998) Laboke P.O. Makerere University

Publication

Laboke, P.O., Ogenga-Latigo, M.W., Smit, N.E.J., Downham, M.C.A., Odongo, B., Hall, D.R & Farman, D.I 2000. Environmental factors affecting catches of sweetpotato weevils, *Cylas brunneus* (Fabricius) and *C. puncticollis* (Boheman) in pheromone traps. In: Adipala, E., Nampala, P & Osiru, M (eds.). *Proceedings of the 5th Triennial Conference of the African Potato Association*, Vol. 5. pp 217-227 29 May- 2 June 2000, Kampala, Uganda.

2.15 Studies on aspects of the biology and control of *Araecerus fasciculatus* (DEGEER) (COLEOPTERA: ANTHRIBIDAE) on dried sweetpotato chips

Objectives

- To conduct a baseline survey to identify dried sweetpotato chip processing and storage constraints
- To investigate the biology of *A. fasciculatus*, the most serious pest of dried sweetpotato chips in storage under different management methods
- To develop management methods and assess their impact on the pest status of the most important pest of dried sweetpotato chips
- To develop a visual scale of damage for assessment of losses by insects in damaged sweetpotato chips
- To test promising pest control methods against insect pests of stored dried sweetpotato chips on-farm.

Research Period: 1995-1998

Implementing Agencies: University of Zimbabwe

Donors: NARO, NRI

Summary of Major Research Results

- Salting, parboiling and solarisation are effective in reducing pest damage of dried sweetpotato chips. These methods reduce infestation by causing mortality of adults and developing stages, and extending the development life cycle.

Outputs

- Identification of methods to reduce pest damage of dried sweetpotato chips by *A. fasciculatus*
- Visual scale of damage for sweetpotato chips by *A. fasciculatus*
- PhD Thesis (1998) by Agona, J.A, University of Zimbabwe

Publication

Agona, J.A. 1998. Studies on aspects of the biology and control of *Araecerus Fasciculatus* (DEGEER) (COLEOPTERA: ANTHRIBIDAE) on dried sweetpotato chips. Ph.D Thesis, University of Zimbabwe

Regional

2.16 Damage to storage roots by insect pests

Project No.	R7520
Objectives	<ul style="list-style-type: none"> • To determine the extent to which sweetpotato cultivars presently available in East Africa differ in their susceptibility to field infestation by <i>Cylas</i> spp • To examine the factors that determines the susceptibility of sweetpotato cultivars to <i>Cylas</i> spp • To use the findings from above to establish strategies for selection of suitable cultivars for East Africa with reduced susceptibility
Research Period:	1997-1998
Implementing Agencies:	National Agricultural Research Organisation-Uganda, Tanzania National Root and Root Crops Programme
Donors:	NRI, CIP

Summary of Major Research Results

- Significant and reasonably consistent differences in susceptibility to *Cylas* spp exist among East African sweetpotato germplasm
- At both Kibaha and Ukiriguru (Tanzania), varieties Budagala and Mwanamonde were less susceptible than Sinia and SPN/O
- High foliage weight was associated with reduced levels of infestation
- A relationship between laboratory experiments and crown damage by *Cylas* spp in the field suggests that cultivar differences in attraction/ deterrence for *Cylas* spp. exist

Outputs

- Assessment of storage root damage by *Cylas* spp
- Assessment of storage root damage by other insect pests

Publication

Stathers, T.E., Rees, D., Kabi, S., Mbilinyi, L.B., Smit, N., Kiozya, H., Jeremiah, S.C., Nyango, A and Jeffries, D. 2003. Damage to the storage roots by insect pests. In: Rees, D., Van Oirschot, Q and Kapinga, R (Eds.). *Sweetpotato Post harvest Assessment: Experiences from East Africa*. Chatham, UK: Natural Resources Institute. Pp 93-102

2.17 Sweetpotato infestation by *Cylas* spp. in East Africa: I. Cultivar differences in field infestation and the role of plant factors

Project No. R 6769

- Objectives**
- To establish whether sufficient variation in susceptibility to field infestation by *Cylas* spp. exists within the East African sweetpotato germplasm to be usable within a breeding programme
 - To identify the plant factors that determines the levels of susceptibility to weevils

Research Period: 1997-1998

Implementing Agencies: National Agricultural Research Organisation-Uganda, Ministry of Agriculture, Tanzania, Sokoine University of Agriculture, Serere Agricultural and Animal Production Research Institute, Sugarcane Research Institute-Kibaha

Donors: CIP, DFID, NR

Summary of Major Research Results

- Levels of infestation were very variable. At Kibaha, the average percentage clean marketable yield varied from 95.1% in 1997 to 14.4% in 1998
- At both Kibaha and Ukiriguru, cultivars Budagala and Mwanamonde were less susceptible than Sinia and SPN/O
- The main field cultivar characteristics identified that could be related to susceptibility to *Cylas* spp. were: root number per plot; root weight per plot; foliage weight; soil crack score; number of roots exposed per plot; percentage plants with exposed roots; short weevil distance; root neck length; number of plants per plot; and percentage roots with *Blosyrus* sp. infestation
- The yield parameters, root number per plot and root weight per plot were positively associated with infestation levels at Ukiriguru (1997) and Serere (1998), and both parameters differed significantly between cultivars
- The severity of damage to sweetpotato roots by the rough weevil *Blosyrus* sp. became apparent at Ukiriguru. In 1998, > 80% of marketable sized roots exhibited some degree of *Blosyrus* sp. damage in 10 of the 16 cultivars
- *Blosyrus* sp. was not considered an important pest in Uganda, although its presence is increasing in Soroti district
- Contradictory results were obtained for the relationship between the percentage roots with *Blosyrus* sp. infestation and the percentage clean yield, which was positive at Kibaha (1998) and negative at Serere (1998).

Outputs

- Assessment of the methods used to determine *Cylas* spp. damage
- Assessment of cultivar differences in susceptibility to *Cylas* spp. infestation
- Assessment of consistency of cultivar behaviour between seasons and sites (i.e. genotype effect) to infestation by *Cylas* spp

- Determination of plant (field) characteristics with varietal differences and their effect on *Cylas* spp. infestation

Publication

Stathers, T.E., Rees, D., Kabi, S., Mbilinyi, L., Smit, N., Kiozya, H., Jeremiah, S., Nyango, A and Jeffries, D. 2003. Sweetpotato infestation by *Cylas* spp. in East Africa: I. Cultivar differences in field infestation and the role of plant factors. *International Journal of Pest Management* 49(2) 131-140.

2.18 Sweetpotato infestation by *Cylas* spp. in East Africa: II. Investigating the role of root characteristics

Project No.	R 6769
Objectives	<ul style="list-style-type: none"> • To investigate the response of the sweetpotato weevil <i>Cylas puncticollis</i> (Coleoptera: Brentidae) to roots of different sweetpotato cultivars • To compare laboratory findings with field data to determine if root composition significantly affects field infestation levels
Research Period:	1997-1999
Implementing Agencies:	National Agricultural and Animal Production Research Institute-Uganda, Sokoine University of Agriculture, Serere Agricultural and Animal Production Research Institute, Sugarcane Research Institute-Kibaha, Lake Zone Agricultural and Development Research Institute-Ukiringuru, Tanzania
Donors:	DFID, NRI, CIP

Summary of Major Research Results

- For all the experiments, cultivar effects for the total number of emerging adults were significant to at least 10% and in most cases were much more significant
- At Ukiringuru and Kibaha, the results showed reasonable consistency between years, and of the four cultivars used at both sites, fewer *C. puncticollis* adults emerged from roots of cultivars Sinia and Budagala than from SPN/O and Mwanamonde on all occasions
- A relation more often appeared between laboratory results and *Cylas* spp. infestation of the crowns at Kibaha (1998) and Serere (1998)
- A correlation between laboratory results and damage of the storage roots by rough weevil was observed for Ukiringuru (1998)

Outputs

- Antibiosis experiments
- Root choice experiments
- Determination of the relationship between results of laboratory experiments and field infestation

Publication

Stathers, T.E., Rees, D., Nyango, A., Kiozya, H., Mbilinyi, I., Jeremiah, S., Kabi, S and Smit, N. 2003. Sweetpotato infestation by *Cylas* spp. in East Africa: II. Investigating the role of root characteristics. *International Journal of Pest Management* 49(2) 141-146.

CHAPTER THREE: INTEGRATED DISEASE MANAGEMENT

Diseases, particularly those caused by viruses, reduce sweetpotato yields worldwide, especially in sub-Saharan Africa. Planting of disease-free material and developing resistant cultivars can help to control the disease. Identification of viruses and developing control methods are fundamental steps towards this end. The research reported here focused mainly on virus identification, development of methods of detection and evaluation of different methods for virus control that are suited for use in different ecological and farming systems. The impact of virus diseases on sweetpotato yields was also evaluated during this research period. Integration of different methods for control of sweetpotato diseases was the major focus.



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Kenya

3.1 Effects of viruses on growth and yield of local sweetpotato varieties in Kenya

Objectives	<ul style="list-style-type: none">• To determine the effect of SPFMV, SPMMV, SPCSV and SPFMV + SPCSV on root yield, harvest index, and vine yield of 3 local sweetpotato varieties (Kemb 10, Bungoma and Ex-shimba hills)• To understand how yield effects might occur, through studying the effects of viruses on plant canopy cover
Research Period:	2001 to 2002
Implementing Agencies:	University of Nairobi
Donor:	EC

Summary of Major Research Results

- Dual infection resulted in severe SPVD symptoms and reduction in root yield through harvest index (HI)
- SPFMV and SPMMV had no significant effect on PAR (Photosynthetically Active Radiation) intercepted by the plant canopy
- Infection by SPCSV and SPFMV + SPCSV had a reduced PAR interception by 18% and 75% respectively
- SPCSV and dual infection reduced fresh vine yield by 40% and 75% respectively
- Infection with single viruses caused an increase in Specific Leaf Weight (SLW) ranging from 5% to 40% while plants dually infected with SPFMV + SPCSV reduced SLW by 15%
- Only dual infection with SPFMV + SPCSV caused 66% reduction in LAI (Leaf Area Index)
- Plants dually infected with SPFMV + SPCSV caused a marketable root yield loss ranging from 82-98% in all the three varieties
- Infection with SPFMV, SPCSV and SPMMV on varieties Bungoma and Kemb 10 reduced yields through hindered translocation of photosynthates as inferred by increased SLW and reduced HI
- Variety Ex-shimba hills was tolerant to single virus infections but Bungoma and Kemb 10 were susceptible
- All three varieties were susceptible to infection with SPFMV + SPCSV

Outputs

- Effect of viruses on vegetative plant growth, root yield, total root weight and root number determined
- Effect of viruses on harvest index, unmarketable root weight and number determined
- Effect of viruses on total and marketable root weight/yield and number
- Cheramgoi, E.C., 2003. MSc. Thesis, University of Nairobi.

Publication

Cheramgoi, E.C. 2003. Effects of viruses on growth and yield of local sweetpotato varieties in Kenya. M.Sc Thesis, University of Nairobi, Kenya. Pp 80.

3.2 Reaction of *Ipomoea batatas* (L.) Lam. lines to *Alternaria* leaf and stem blight and effects of soil pH on disease severity

Objectives	<ul style="list-style-type: none"> • To determine the causative agent associated with leaf and stem blight of <i>Ipomoea batatas</i> (L) Lam. in sample materials from different sweetpotato growing areas in Kenya • To identify conditions influencing <i>in vitro</i> growth and sporulation of the identified pathogen • To study the effect of different soil pH ranges on disease development of the causative agent on some selected lines of <i>Ipomoea batatas</i> (L) Lam. under greenhouse conditions • To evaluate the reaction of 20 <i>Ipomoea batatas</i> cultivars/ accession to the pathogen under field conditions
Research Period:	May, 1998 to November, 1998
Implementing Agencies:	University of Nairobi
Donors:	CIP

Summary of Major Research Results

- Isolated *Alternaria bataticola* grew rapidly and sporulated abundantly on host-based media, sweetpotato vine decoction media (SPVDM) and sweetpotato leaves decoction media (SPLDM) as opposed to PDA (Potato Dextrose Agar) and MEA (Malt Extract Agar)
- Significant radial mycelial growth occurred under alkaline pH ranges {pH 7 (71.67mm), pH 8 (71.81mm) and pH 9 (71.90mm)}
- Abundant conidia production occurred at acidic pH levels with optimal level at pH 5.6 (20.33 x 10⁵ conidia/ml) on SPVDM
- Prolonged incubation period caused decline in sporulation at all pH levels tested.
- Continuous light for 12 hours alternating with 12 hours continuous darkness sustained the highest sporulation
- Better mycelial growth was enhanced by 24 hrs of continuous light, while 24 hrs of complete darkness sustained the lowest mycelial growth and supported less sporulation
- *bataticola* grew optimally at temperatures between 26°C and 28°C though it grew more rapidly at between 28°C and 30°C.
- Fungal sporulation declined at higher temperatures
- All isolates of *A. bataticola* and *A. alternata* under greenhouse conditions were pathogenic and differences in virulence depended on isolate source and conidial concentration
- Kabete isolate was more virulent than Kakamega, Kabondo and Alupe isolates, whose virulence did not differ significantly ($P < 0.05$) from each other
- No significant difference ($P < 0.05$) among the levels of soil pH tested on disease severity.
- Mean disease severity for soil pH 4.4, 4.6 and 6.7 was the same (3.42) and for soil pH 7.6 was 3.25

- In the field, cultivar Viola and Yanshu were more susceptible to the pathogen than all other entries tested
- Cultivar Jayalo had lowest disease levels in both seasons

Outputs

- Effect of type of media and incubation period on growth and sporulation of *A. bataticola*
- Effect of media, temperature and incubation period on growth and sporulation of *A. bataticola*
- Effect of media pH and incubation period on growth and sporulation of *A. bataticola*
- Effect of media, light regime and incubation period on growth and sporulation of *A. bataticola*
- Proof of pathogenicity of *Alternaria* species isolates on *Ipomoea batatas*
- Assessment of virulence of *Alternaria* species on *Ipomoea batatas*
- Reaction of sweetpotato accessions to *Alternaria* leafspot and stem blight.
- An'ginyah, J.T. 1999. MSc. Thesis, University of Nairobi

Publication

An'ginyah, J.T. 1999. Reaction of *Ipomoea batatas* (L) Lam. lines to *Alternaria* leaf and stem blight and effects of soil pH on disease severity. M.Sc. Thesis, University of Nairobi, Kenya. Pp 81.

3.3 Studies on the physiological effects of viruses on sweetpotato yield in Kenya

Objective	<ul style="list-style-type: none">• To determine the effects of the three most common viruses on physiological processes and yield of Kenyan sweetpotato varieties
Research Period:	2001 / 2002
Implementing Agencies:	University of Nairobi
Donors:	EC, NRI

Summary of Major Research Results

- Infection with single viruses caused no or mild symptoms and had no effect on chlorophyll content of leaves of any variety
- Dual infection with SPFMV and SPCSV resulted in severe symptoms characteristic of sweetpotato virus disease complex (SPVD) and significantly reduced chlorophyll content
- Only SPCSV and SPCSV + SPFMV reduced photosynthetically Active Radiation (PAR) interception
- Generally, infection with single viruses increased the specific leaf weight (SLW) but a decrease in SLW occurred in plants dually infected with SPFMV and SPCSV
- SPVD significantly reduced the harvest index (78%) and root yield (98%) in the varieties Bungoma and Kemb 10
- SPVD reduced yield through reducing leaf chlorophyll content, PAR interception, LAI and HI

- Single virus infections reduced assimilate translocation from leaves to roots as is inferred from high SLW

Outputs

- Effects of viruses on physiological processes and yield of sweetpotato determined
- Relative chlorophyll content in three virus free and virus infected sweetpotato varieties at four months after planting
- Effects of virus infection on the percentage PAR intercepted at 105 days after planting, SLW and leaf area index (LAI) determined
- Effects of virus infection on the HI and marketable root yield of the three sweetpotato varieties tested established
- Relationship between LAI and % PAR interception in sweetpotato infected with viruses established
- Publication by Njeru *et al.*, 2004. In: *Annals of Applied Biology*. 145 pp.74-76

Publication

Njeru, R.W., Mburu, M.W.K., Cheramgoi, E., Gibson, R.W., Kiburi, Z.M., Obudho, E and Yobera, D. 2004. Studies on the physiological effects of viruses on sweetpotato yield in Kenya. *Annals of Applied Biology*, Vol. 145, No. 1. pp. 71-76 (6).

3.4 Identification and distribution of viruses infecting sweetpotato in Kenya

Objectives	<ul style="list-style-type: none">• To identify and determine the relative importance of viruses infecting sweetpotato in all the major sweetpotato growing regions of Kenya• To determine the occurrence and distribution of multiple virus combinations in Kenya
Research Period:	January, 2001 to October, 2001
Implementing Agencies:	University of Nairobi
Donors:	EC, NRI, BBA Germany

Summary of Major Research Results

- Only SPFMV, SPMMV, and SPCFV were detected
- Ninety-two percent and 25% of the symptomatic and asymptomatic plants respectively tested positive for atleast one of these viruses
- SPFMV was the most common and the most widespread, detected in 74% of the symptomatic plants and in 50% of the fields surveyed
- SPMMV and SPCFV were detected in only 11% and 13% of the symptomatic and asymptomatic plant samples respectively
- Eight different combinations of these 4 viruses were found in individual plants.
- The combination SPFMV and SPCSV was the most common, observed in 22% of symptomatic plants
- Virus combinations were rare in the asymptomatic plants tested

- Incidence of virus infection was highest (18%) in Kisii district of Nyanza province and lowest (1%) in Kilifi and Malindi districts of Coast province

Outputs

- Incidence (%) of virus diseases in surveyed sweetpotato crops as assessed visually and serologically
- Distribution and relative importance of individual sweetpotato viruses in Kenya.
- Assessment of single and mixed sweetpotato virus infections in Kenya
- Publication by Ateka *et al.*, 2004. In: *Annals of Applied Biology* 144: 371-379

Publication

Ateka, E.M., Njeru, R.W., Kibaru, A.G., Kimenju, J.W., Barg, E., Gibson, R.W and Vetter, H.J. 2004. Identification and distribution of viruses infecting sweetpotato in Kenya. In: *Annals of Applied Biology* (2004), 144: 371-379.

3.5 Identification and distribution of viruses infecting sweetpotato in Kenya

Objectives

- To identify and establish the relative importance of viruses infecting sweetpotato in all the major sweetpotato growing regions of Kenya
- To determine the occurrence and distribution of multiple virus combinations

Research Topic: January 2001- October 2001

Implementing Agencies: University of Nairobi

Donors: European Commission, NRI, Federal Biological Research Center for Agriculture and Forestry (BBA), Germany

Summary of Major Research Results

- Only SPFMV, SPMMV, SPCSV and SPCFV were detected
- Ninety-two percent and 25% of the symptomatic and asymptomatic plants respectively tested positive for at least one of these viruses
- Virus-infected plants were collected from 89% of the fields. SPFMV was the most common and the most widespread, detected in 74% of the symptomatic plants and 86% of the fields surveyed. SPCSV was also very common, being detected in 38% of the symptomatic plants and 50% of the fields surveyed
- SPMMV and SPCFV were detected in only 11% and 3% of the symptomatic plant samples respectively
- Eight different combinations of these four viruses were found in individual plants. The combination SPFMV and SPCSV was the most common, observed in 22% of symptomatic plants
- Virus combinations were rare in the asymptomatic plants tested. Incidence of virus infection was highest (18%) in Kisii district of Nyanza province and lowest (1%) in Kilifi and Malindi districts of Coast province

Outputs

- Determination of the proportion (1%) of single and multiple infections of different viruses in symptomatic and asymptomatic sweetpotato plants collected from 16 districts of Kenya
- Visual and serological assessment of the incidence (%) of virus diseases in Kenya
- Number and types of virus infections of the symptomatic and asymptomatic plants collected in five provinces of Kenya

Publication

Ateka, E.M., Njeru, R.W., Kibaru, A.G., Kimenju, J.W., Barg, E., Gibson, R.W and Vetten, H.J. 2004. Identification and distribution of viruses infecting sweetpotato in Kenya. *Ann. Appl. Biol* (2004), 144: 371-379.

3.6 Participatory approaches to the management of sweetpotato virus disease in Coastal Kenya

Objectives

- To develop and test the use of a farmer field school (FFS) approach to enhance accurate knowledge by farmers on the cause, spread and management of sweetpotato virus disease in Coastal Kenya
- To improve the farmers' ability to accurately diagnose SPVD
- To demonstrate the role of genotypes, cultural practices and phytosanitation in the management of SPVD

Research Period: 2002

Implementing Agencies: Kenya Agricultural Research Institute-Mtwapa, University of Nairobi

Donors: EC, NRI

Summary of Major Research Results

- Progressive disease spread was noted only in fields where rouging was not carried out
- Healthy and diseased plants caged together in the absence of vectors retained their health status; but on introducing vectors, the healthy plants developed SPVD symptoms
- The highest disease incidence was observed in variety Ex-shimba hills and the lowest was observed in Bungoma
- The lowest mean whitefly population counts was recorded 50 days after planting while the highest was observed 42 days later
- No significant difference in whitefly population between shade and open environments

Outputs

- The role of vectors in spreading SPVD determined
- Causes and incidences of sweetpotato virus disease and whitefly populations in Coastal Kenya

- Yield performance of varieties 222/77, Bungoma, Kemb 10, and Ex-shimba hills in Coastal Kenya
- Njeru *et al.*, 2004. In press: *African Crop Science Journal*

Publication

Njeru, R.W., Obudho, E., Munga, T.L., and Gibson, R.W. In press. 2004.

Participatory approaches to the management of sweetpotato virus disease in coastal Kenya. *African Crop Science Journal*.

3.7 Etiology, effect of soil pH and sweetpotato varietal reaction to *Alternaria* leaf petiole and stem blight in Kenya

Objectives	<ul style="list-style-type: none">• To establish the causal agent of <i>Alternaria</i> leaf petiole and stem blight in Kenya• To study the effect of soil pH on the disease development• To assess the reaction of selected Kenyan sweetpotato accessions to the disease
Research Period:	May 1999 to November, 1999
Implementing Agencies:	University of Nairobi
Donor:	MARD

Summary of Major Research Results

- Isolates from Kabete, Kakamega, Busia (Alupe), and Kabondo were identified as *Alternaria bataticola* while the Kisii isolate was identified as *Alternaria alternata*
- The Kabete, Busia, Kabondo and Kakamega isolates were similar in colony appearance and conidia size
- The Kisii isolate differed from others in conidia shape and size and was identified as *Alternaria alternata*
- All isolates were pathogenic and differences in virulence depended on isolate source and conidial concentration
- Kabete isolate was more virulent than Kakamega, Kabondo and Alupe isolates, whose virulence did not influence disease severity ($P < 0.05$)
- Cultivars Viola (440046) and Yanshu 1 (440024) were more susceptible than other entries in the field
- Lowest disease levels were observed on cultivar Jayalo

Outputs

- Pathogen identification
- Effect of soil pH on disease development determined
- Susceptibility of Kenyan accessions to *Alternaria bataticola* determined
- Publication by An'ginya *et al.*, 2001. In: *African Crop Science Journal*, 9. No. 1

Publication

An'ginyah, J.T., Narla, R.D., Carey, E.E and Njeru, R. 2001. Etiology, effect of soil pH and sweetpotato varietal reaction to *Alternaria* leaf petiole and stem blight in Kenya. In: *African Crop Science Journal*, Vol. 9. No. 1, pp. 287-292.

3.8 Identification of resistance in sweetpotato clones to *Rhizopus* soft rot in Kenya

Objectives	<ul style="list-style-type: none">• To evaluate and identify sweetpotato clones for resistance to <i>Rhizopus</i> soft rot• To determine the relative resistance / susceptibility of the available germplasm in Kenya
Research Period:	1996
Implementing Agency:	Kenya Agricultural Research Institute
Donors:	PRAPACE, CIP, ODA

Summary of Major Research Results

- Soft rot development during the National Performance Trials (NPT) was very low 3 days after inoculation, with only 5 out of the 13 clones developing soft rot. Storage temperature was 16.9 - 24.2 °C, and mean relative humidity of 59.4%
- Oguroiwe and Kemb 10 were the only clones that were significantly different from the other clones in percent soft rot development by 3 days
- By 7 days, most of clones developed soft rot, but the percentage in all the clones was less than 50%; Oguroiwe, KEMB 10 and SPK 004 had soft rot development of over 40%
- Eighteen Advanced Yield Trials (AYT) clones were compared in the storage house with temperature range 15.2-19.5 °C and relative humidity of 72.5%. Clones varied in their reaction to *Rhizopus* soft rot development ranging from zero to over 70% by 3 and 7 days after inoculation
- Clones 420026, 420025, 420024 and 440131 had the highest percentage soft rot development, while 440093, Kemb 37, 420027 and 420008 did not develop soft rot

Outputs

- Evaluation and identification of sweetpotato clones for resistance to *Rhizopus* soft rot.
- Determination of the relative resistance / susceptibility of the available germplasm in Kenya.

Publication

Kihurani, A.W. 1997. Identification of resistance in sweetpotato clones to *Rhizopus* soft rot in Kenya. In: *Proceedings of the 4th Triennial Congress of the African Potato Association* held in Pretoria, South Africa. 23-28 February, 1997. Pp 113-117.

3.9 Biological and molecular characterization of potyviruses infecting sweetpotato

Objectives	<ul style="list-style-type: none">• To determine the identity, distribution and incidence of viruses infecting sweetpotato in the major growing areas of Kenya• To characterize SPV2 at the morphological, molecular and biological level and to study the interaction between SPV 2 and SPCSV• To study the variability amongst geographically diverse isolates of SPV 2.• To characterize SPVG isolates at the molecular level• To determine the variability of SPFMV isolates and to develop diagnostic tools for the detection of SPFMV• To analyse the molecular diversity of the first protein (P1), helper component proteinase (HC-Pro) and third protein (P3) genes regions of African isolates of SPFMV
Research Period:	2001-2004
Implementing Agencies:	University of Nairobi
Donors:	NRI, UK, Federal Research Center for Agriculture and Forestry, Germany.

Summary of Major Research Results

- SPFMV, SPCSV, SPMMV and SPCFV were detected in the major sweetpotato growing areas in Kenya
- Ninety-two percent and 25% of the symptomatic and asymptomatic plants, respectively, tested positive for at least one of these viruses
- SPFMV was the most common and the most widespread, being detected in 74% of the symptomatic plants and in 86% of fields surveyed
- Virus incidence was highest (18%) in Kissii district of Nyanza province and lowest (1%) in Kilifi district of Coast province
- Isolates of strain group O were also shown to occur in East Africa. A high-affinity monoclonal antibody (Mab 1C4) reacting with all SPFMV isolates tested was obtained following immunization with purified SPFMV virions of a Kenyan isolate (KY 115/1S)
- The determination of the 5'-proximal part of the SPFMV genome indicated that the P3 gene could be the most variable part
- Alignment of the P1 sequences of the five African isolates of SPFMV, with that of the previously known SPFMV P1 sequence from Japan revealed that the latter has a deletion of 75 nucleotides (25 amino acids) and is thus considerably shorter than the P1 of the African isolates. This could indicate a critical source of variation in SPFMV

Outputs

- Identification and distribution of viruses infecting sweetpotato in Kenya
- Characterization of sweetpotato virus 2 a hitherto uncharacterized potyvirus
- Analysis of sequence diversity of the P1 and P3 genomic regions SPFMV and SPV2 isolates

- Biological and molecular variability amongst geographically dispersed isolates of sweetpotato virus Y
- Biological serological and molecular variability of geographically distinct isolates of *Sweetpotato feathery mottle potyvirus*
- Identification of sweetpotato virus G strains based on their 3' terminal genome sequences

Publication

Ateka, E.M. 2004. Biological and molecular characterization of potyviruses infecting sweetpotato. Ph.D Thesis, University of Nairobi. 186pp.

Tanzania

3.9 Virus diseases of sweetpotato and cassava in the Lake Zone of Tanzania

Objective	<ul style="list-style-type: none">• To assess the incidence of sweetpotato virus disease and cassava mosaic disease in sweetpotato and cassava crops respectively
Research Period:	May, 1998 to June, 1998
Implementing Agencies:	Ukiriguru Agricultural Research and Development Institute
Donors:	CIP, IITA, NRI, DFID, DANIDA

Summary of Major Research Results

- SPVD-affected plants and more rarely SPCSD-affected plants were most common (19%) in Kagera region and least common (4%) in Shinyanga region
- Crops with high disease incidences (>40%) in Mwanza, Mara and Shinyanga regions were mainly in fields sheltered by ridges, buildings etc
- In Kagera region, the effect of shelter on the incidence of SPVD in individual fields was less evident, but there were dramatic differences in incidence between the different locations sampled.
- SPVD-affected plants were rare in "coastal" Bukoba (along the Lake shore both from Bukoba and around ARI-Maruku).
- SPVD reached high incidences (50%) plus additional 6% of plants affected with SPCSD inland" from Bukoba at locations north and west of Kyaka,
- Around Biharamula, SPVD incidence averages 15%, still higher than for Mwanza, Mara and Shinyanga region
- Whiteflies were abundant on sweetpotato in all regions
- In Kagera region, whitefly numbers in a field and SPVD + SPCSD incidence were highly ($P < 0.01$) positively correlated, unlike in Mwanza, Mara and Shinyanga regions
- Although whiteflies were generally more abundant in Mwanza, Mara and Shinyanga regions, crops here had low SPVD incidence than those in Kagera.

Outputs

- Incidence of SPVD in the Lake Zone of Tanzania assessed
- Assessment of the prevalence of whiteflies in the Lake Zone of Tanzania
- Relationship between whitefly numbers and SPVD + SPCSD incidence in regions within the Lake Zone of Tanzania established
- Publication by Jeremiah *et al.*, 1998. In: *Root Crops in the 21st Century. Proceedings of the 7th Triennial symposium of the ISTRC-AB.*

Publication

Jeremiah, S.C., Gibson, R.W., Msabaha, R.P. 1998. Virus diseases of sweetpotato and cassava in the Lake Zone of Tanzania. In: Akoroda, M.O & Ngeve, J.M (eds.). *Root Crops in the 21st Century. Proceedings of the 7th Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch (ISTRC-AB).* 11-17 October 1998. Pp 615-619.

3.10 The role of root sugar content on the susceptibility of sweetpotato cultivars to soft rot

Objective	<ul style="list-style-type: none"> • To determine whether root sugar content is important in sweetpotato cultivar resistance to <i>R. oryzae</i>
Research Period:	1999-2000
Implementing Agencies:	Sokoine University of Agriculture, Kibaha Sugarcane Research Institute
Donors:	DFID, NRI, CIP

Summary of Major Research Results

- The concentration of fructose, glucose and total sugar within sweetpotato roots influences the susceptibility of sweetpotato to *R. oryzae*
- High concentrations of these sugars in roots significantly suppress the disease
- The concentration of fructose, glucose and total sugar are also negatively correlated with the sweetpotato root dry matter content
- Correlations between rot weight and sugar content at both cultivar ($P < 0.05$) and root level were negative and significant for glucose, fructose, glucose + fructose and total sugar content

Outputs

- Determinations of sweetpotato susceptibility levels to *R. oryzae* as influenced by the root sugar content, both on cultivar and root basis

Publication

Muhanna, M and Rees, D. 2004. The role of root sugar content on the susceptibility of sweetpotato cultivars to soft rot. In: Tenywa, J.S., Bekunda, M.A and Nampala, M.P (Eds.). *African Crop Science Journal*, Vol. 12 No. 3 Pp 305-309.

3.11 Report on the preliminary work on the detection techniques of virus in sweetpotato planting material

Objective	<ul style="list-style-type: none">• To test the usefulness of NCM-ELISA technique and the grafting of method in obtaining virus-free sweetpotato planting material
Research Period:	1995
Implementing Agencies:	Ukiriguru Agricultural Research and Development Institute
Donors:	CIP, Uganda

Summary of Major Research Results

- NCM-ELISA test showed that all the four virus strains: SPFMV, SPMMV, Sweetpotato Caulimovirus-like Feathery Virus (SPCaFV) and Sweetpotato Latent Virus (SPLV) (1,3) are present at Ukiriguru
- Only sample 9 (Budagala) which showed mild mottling proved to be clean of all the four viruses
- Most of the varieties, which showed virus symptoms reacted positively to one or another virus strain
- Variety TIS 8050 was the only variety regarded clean as it was apparently healthy-symptomless and reacted negatively to the four viruses
- Only clone 21 of the ten selected and grafted with *I. setosa* did not develop mosaic symptoms in the first couple of weeks, though developed symptoms with time. Other clones showed increased severity in symptoms with time

Outputs

- Analysis of clones for their reaction to the four sweet potato virus strains
- Analysis of symptom appearance in grafted clones with *Ipomoea setosa*
- Comparison of the NCM-ELISA test results and those of the grafting method
- Technical report, Raya *et al.*, 1995

Publication

Raya, M.D., Rugutu, C., and Mohamed, R. 1995. Report on the preliminary work on the detection techniques of virus in sweetpotato planting material. *Cassava and Sweetpotato Plant Protection 1994/95, ARI-Ukiriguru. Presented at the annual Root and Root Crop Research Coordinating Committee Meeting*. 16-17 October 1995, Mwanza, Tanzania

3.12 Control of sweetpotato virus disease through farmer field schools approach in Kagera region, Tanzania

Objectives	<ul style="list-style-type: none">• To assess the effectiveness of farmer field schools (FFS) in controlling SPVD in farmers' fields• To identify constraints to FFS approach and possible solutions
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Research Period: 2004
Implementing Agencies: Maruku Agricultural Research and Development Institute
Donors: CIP, NRI, IITA.

Summary of Major Research Results

- FFS based approach was effective in all groups as it exploited the idea of farmer knowledge of their own problems and resources available in the surrounding environment
- Resistant varieties and phytosanitation reduced SPVD incidence to negligible levels
- About 55% of the farmers adopted selection and rouging against SPVD in their own fields

Outputs

- The effectiveness of FFS in controlling SPVD established
- Factors affecting FFS identified
- Final technical report by Rwegasira *et al.*, 2004, ARI-Maruku

Publication

Rwegasira, G.M., Marandu, E.F., Gibson, R.W and Kapinga, R.E. 2004. Control of sweetpotato virus disease through farmer field schools approach in Kagera region, Tanzania. *Final Technical Report*, ARI-Maruku.

3.13 Working with farmers to control sweetpotato virus disease in the Lake Zone of Tanzania

Objectives

- To train and demonstrate to farmers the use of phytosanitation as SPVD management technique
- To test the performance of SPVD-resistant sweetpotato varieties and key attributes required by farmers and other stakeholders
- To develop packages appropriate for SPVD control under farmers' conditions
- To train various trainers on SPVD and related management techniques

Research Period: 2003 to 2004
Implementing Agencies: Maruku Agricultural Research and Development Institute, Bukoba District Agricultural and Livestock Development Office,
Donors: CIP, Uganda, PARTAGE

Summary of Major Research Results

- Phytosanitation was effective in reducing SPVD spread
- Local sweetpotato varieties and Simama were very susceptible to SPVD.

- Variety Mavuno and Simama had the highest severity despite the moderate incidence recorded.
- Naspot series varieties generally proved resistant to SPVD compared to the Tanzanian based selections
- Highest SPVD infections were recorded at Kikuwe and Nyungwe in Kanyigo area; while Bugabo is a disease-free area.

Outputs

- SPVD management techniques assessed
- Sweetpotato variety response in terms of yield, diseases and pests evaluated
- Effect of phytosanitation on SPVD established
- Final technical report by Rwegasira and Marandu, 2004.

Publication

Rwegasira, G.M and Marandu, E.F. 2004. Working with farmers to control sweetpotato virus disease in the Lake Zone of Tanzania. *Final Technical Report*, ARI-Maruku.

3.14 Screening sweetpotato cultivars for susceptibility to *Rhizopus oryzae*

Objective	<ul style="list-style-type: none">• To investigate whether a range of susceptibility levels <i>R. oryzae</i> exist among sweetpotato cultivars grown in Tanzania
Research Period:	November 1998- December 1999.
Implementing Agencies:	Sugarcane Research Institute-Kibaha, Sokoine University of Agriculture, Cranfield University, Silsoe College
Donors:	NRI

Summary of Major Research Results

- Significant difference ($P < 0.05$) among cultivars in susceptibility to *R. oryzae* was noted in almost all the screening experiments. In some cultivars, the susceptibility levels are stable, while in some they are highly influenced by prevailing storage and crop growth conditions
- The least susceptible cultivars were Budagala and Sinia, while the most susceptible cultivar was SPN/O
- Inconsistent susceptibility levels over seasons were observed for cultivars Iboja and Ukerewe; though in most experiments, Iboja behaved as a susceptible cultivar

Outputs

- Determination of sweetpotato cultivar susceptibility levels to *Rhizopus oryzae*
- Mean soft rot (*R. oryzae*) infection levels 3 days after inoculation of roots of sweetpotato cultivars in terms of root weight (g), lesion diameter (cm) and root score
- Root characteristics and soft rot infection levels 3 days after inoculation of roots of the sweetpotato cultivars by *R. oryzae*

Publication

Muhanna, M., Rees, D and Aked, J. 2003. Screening sweetpotato cultivars for susceptibility to *Rhizopus oryzae*. In: Akoroda, M (ed.). *Root Crops: The Small Processor and Development of Local Food Industries for Market Economy. Proceedings of the Eighth Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch* (ISTRAC-AB). 12-16 November 2001, IITA, Oyo Road, Ibadan, Nigeria. Pp 537-541.

3.15 Evaluation of recently released sweetpotato varieties in the Lake Zone of Tanzania for yield potential and Sweetpotato Virus Disease

Observation	<ul style="list-style-type: none"> To identify superior sweetpotato varieties in Lake Zone of Tanzania
Research Period:	September, 1999 to October, 2001
Implementing Agencies:	Ukiriguru Agricultural Research and Development Institute, Maruku Agricultural Research and Development Institute,
Donors:	DFID

Summary of Major Research Results

- Higher number of plants with SPVD per plot was in varieties Sinia A, Sinia B and local check Kigambilenyoko
- Lower incidences of SPVD were noted in varieties Mwanamonde, Polista and SP 93/2
- Varieties SPN/O and SP 93/2 had low sweetpotato weevils infestation.
- Variety Kigambilenyoko was susceptible to SPVD
- Alternaria disease was only evident in NASPOT 1
- On average, 5 and 2 plants were noted to be affected by SPVD at Kyaka and Kanyangereko respectively
- Presence of shade in the field does not affect disease spread in the new established sweetpotato field.
- SPVD was observed to both Bukoba and Muleba districts, in sweetpotato grown both alone and in the banana field or banana/coffee niter crop
- Shade had no significant influence on the distribution of whiteflies in the fields

Outputs

- Survey on the occurrence of SPVD in the banana shade in Bukoba and Muleba district
- SPVD incidence in the open and inter crop sweetpotato field determined
- NASPOT varieties in Bukoba district evaluated
- Final Technical report by Ndyetabura and Jeremiah, 2002. *Research report*. ARI-Maruku; ARI-Ukiriguru

Publication

Ndyetabura, I. L and Jeremiah, S. C. 2002. Evaluation of recently released sweetpotato varieties in the Lake Zone of Tanzania for yield potential and Sweetpotato Virus Disease resistance. *Root and Root Sub-Programme, Research reports: Maruku Agricultural Research Institute*.

Uganda

3.16 Nature of resistance and response of sweetpotato to sweetpotato virus disease

Objectives	<ul style="list-style-type: none">• To determine the inheritance of resistance to SPVD in sweetpotato and to estimate the nature of genetic variance• To demonstrate that use of a suitable sweetpotato genotype for maintenance and increase of SPVD inoculum and, appropriate cleft-graft inoculation modifications, coupled with efficient SPVD scoring techniques, can be used to facilitate rapid screening of large sweetpotato populations for SPVD resistance• To investigate the genetic basis of resistance to sweetpotato chlorotic stunt crinivirus (SPCSV) and sweetpotato feathery mottle potyvirus (SPFMV) in 15 sweetpotato diallel families (1352 genotypes) in Uganda.
Research Period:	1998 to 2000
Implementing Agencies:	National Agricultural Research Institute, Namulonge Agricultural and Animal Production Research Institute, North Carolina State University
Donors:	McKnight Foundation, CIP Uganda

Summary of Major Research Results

- Resistant parents exhibited high general combining ability indicating that additive gene effects were predominant in the inheritance of resistance to SPVD and recovery
- Recovery from SPVD contributes to SPVD resistance
- Cultivar Tanzania was a superior host for maintaining and increasing SPVD inoculum (scions) for mass grafting
- Graft inoculation with SPCSV and SPFMV resulted in severe SPVD symptoms in all the families in Uganda
- Two separate recessive genes inherited in a hexasomic or tetradisomic manner conditioned resistance to SPCSV and SPFMV.

Outputs

- Diallel analysis of sweetpotato for resistance to sweetpotato virus disease.
- Phenotypic differences of resistance to SPVD determined
- Molecular genetic analysis of resistance to SPCSV, SPFMV and SPVD determined
- Ph.D. Thesis (2001) Mwanga R.O.M, North Carolina State University, USA.

Publication

Mwanga, R.O.M. 2001. Nature of Resistance and Response of Sweetpotato to Sweetpotato Virus Disease. Ph.D Thesis. North Carolina State University. 145 pp

3.17: Sweetpotato resistance to sweetpotato virus disease (SPVD) in Uganda

Objectives	<ul style="list-style-type: none">• To establish resistance to vectors of SPVD• To test for disease recovery and virus elimination in SPVD pathosystem• To gain evidence of the virus inoculation pressure and susceptibility of the popularly grown sweetpotato cultivars in Uganda• To evaluate resistance of some improved Ugandan sweetpotato cultivars to SPVD
Research Period:	May 1996 to November 1997
Implementing Agencies:	Makerere University, Kampala
Donors:	CIP, DFID, Rockefeller Foundation

Summary of Major Research Results

- Throughout the two seasons, aphids were rarely observed in the field, while whitefly counts were not significantly different on the three cultivars tested in either season
- Whitefly populations varied considerably within the weeks in both seasons but the trends of increase and decrease were similar on all the genotypes tested (i.e. NIS-93-63, New Kawogo and Tanzania)
- Overall incidence of SPVD increased slowly with time on most cultivars, and the mean incidence in Busia being 0.08%, Namulonge- 2.09% and Kanoni- 13.38%; the highest mean being recorded in April for the three locations
- Vector population generally increased in all the locations from December to March, but this fluctuates in the subsequent without any definite pattern in all locations

Outputs

- Resistance in some improved Ugandan sweetpotato cultivars to SPVD identified
- Establishment of sweetpotato resistance to vectors of SPVD
- Publication by Aritua *et al.*, 1999 in: *African Crop Science Conference Proceedings, Vol. 4*. pp 547-554
- M.Sc. Thesis (1998), Aritua, V. Makerere University

Publication

Aritua, V. 1998. Studies on sweetpotato resistance to sweetpotato virus disease (SPVD) in Uganda. M.Sc. Thesis, Makerere University

3.18 Resistance to Sweetpotato Chlorotic Stunt Virus and Sweetpotato feathery mottle virus is mediated by two separate recessive Genes in Sweetpotato

Objective	<ul style="list-style-type: none">• To investigate the genetic basis of resistance to <i>sweetpotato chlorotic stunt</i> crinivirus (SPCSV) and <i>sweetpotato feathery mottle</i> potyvirus (SPFMV) in 15 sweetpotato diallel families (1352 genotypes) in Uganda
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Research Period: 1996 to 1997
Implementing Agencies: Namulonge Agricultural and Animal Production Research Institute, National Agricultural Research Organization, North Carolina State University
Donors: CIP, ARC, Austria; McKnight Foundation

Summary of Major Research Results

- Graft inoculation with SPCSV and SPFMV resulted in severe SPVD symptoms in all the families in Uganda
- Two promising diallel families ('Tanzania' x 'Bikilamaliya' and 'Tanzania' x 'Wagabolige') showed severe SPVD in most of the progenies when graft inoculated with SPVD and SPFMV at CIP
- Resistance to SPCSV and SPFMV was conditioned by two separate recessive genes inherited in a hexasomic or tetradisomic manner
- AFLP and RAPD markers linked to SPCSV and SPFMV resistance explained 70% and 72% of the variation in resistance, respectively

Outputs

- Inheritance of resistance to SPVD in promising diallel progenies
- Inheritance of resistance to SPCSV, SPFMV and SPVD predicted by expected theoretical ratios
- Molecular genetic analysis of resistance to SPCSV, SPFMV and SPVD
- Publication by Mwanga *et al.*, 2002 in: *Journal of American Horticultural Science* 127 (5): 798-806

Publication

Mwanga, R.O.M., Kriegner, A., Cervantes-Flores, J.C., Zhang, D.P., Moyer, J.W., Yencho, G.C. 2002. Resistance to Sweetpotato Chlorotic Stunt Virus and Sweetpotato Feathery Mottle Virus Is Mediated by Two Separate Recessive Genes in Sweetpotato. *Journal of American Hort. Sci.* 127 (5): 798-806.

3.19 Reaction of sweetpotato clones to virus disease and their yield performance in Uganda

Objective

- To evaluate reaction to sweetpotato virus disease (SPVD) and yield of 15 clones in three geographical regions (Namulonge, Kachwekano, Bulegeri, Mbarara and Serere) in Uganda.

Research Period: March, 2000 to January, 2001
Implementing Agencies: Namulonge Agricultural and Animal Production Research Institute, National Agricultural Research Organization, Serere Agricultural and Animal Production Research Institute, Makerere University, Kampala
Donors: Rockefeller Foundation, DFID, CIP, NRI

Summary of Major Research Results

- Mbarara and Namulonge had high incidence of SPVD (area under disease progress curve, AUDPC = 0.77, 0.47, respectively), while Serere had the lowest incidence (AUDPC = 0.13)
- Clones Zapallo, Kembo 37, Mugande and Araka red were the most infected by SPVD (AUDPC=1.17, 1.04, 0.96, 0.77, respectively)
- Clones 93-523, 93-1927, 93-493 and 93-319 each had a consistently lower AUDPC across all locations (AUDPC = 0.086, 0.112, 0.114, 0.118, respectively)
- Clone 93-52 was high yielding across all locations (17.7 tha⁻¹) followed by 93-1927, Kemb 37, Mugande and Tanzania (16.9, 16.1, 15.6, 13.9 tha⁻¹, respectively)
- The lowest yielding clones were 93-316, 93-663, 93-523 and 23/60
- Clones 93-29, 93-1096 and 23/60 were adaptable to all sites.

Outputs

- Incidence of SPVD in different environments/ locations of Uganda
- Yield performance and stability analysis of sweetpotato clones in different locations of Uganda
- Publication by Byamukama *et al.*, 2002 in: *African Crop Science Journal*, Vol. 10. No. 4. pp. 317-324.

Publication

Byamukama, E., Adipala, E., Gibson, R and Aritua, V. 2002. Reaction of sweetpotato clones to virus disease and their yield performance in Uganda. *African Crop Science Journal*, Vol. 10. No. 4, pp. 317-324.

3.20 Within- crop spread of sweetpotato virus disease and the population dynamics of its whitefly and aphid vectors

Project No.	R7492
Objective	<ul style="list-style-type: none"> • To monitor whiteflies (<i>Bemisia tabaci</i>), and aphids (<i>Myzus persicae</i> and <i>Aphis gossypii</i>) and the spread of SPVD within and outside the sweetpotato crop containing a central plot of SPVD-infected plants.
Research Period:	2000 to 2001
Implementing Agencies:	Makerere University, Kampala
Donors:	Rockefeller Foundation, DFID, NRI

Summary of Major Research Results

- More whiteflies were trapped within than outside the crop
- Most whiteflies were trapped close to the canopy
- Aphids were rarely found on sweetpotato plants, although they were commonly found on the traps
- The number of aphids trapped inside the crop did not differ significantly from those trapped outside the crop

- A higher proportion of plants developed SPVD symptoms in the inner square than plants located farther away from the infected plot
- Number of infected plants correlated with trap catches of whiteflies only for the first season.

Outputs

- Assessment of mean numbers of whiteflies trapped in and outside the crop
- Relationship between trap height and pole position both within and outside the crop established
- Assessment of whitefly nymphs and aphids found on plants in different squares around the infected plot
- SPVD spread and population build-up of whiteflies
- Publication by Byamukama *et al.*, 2004 in: *Crop Protection* 23 (2004) 109-116

Publication

Byamukama, E., Gibson, R.W., Aritua, V & Adipala, E. 2004. Within-crop spread of sweetpotato virus disease and the population dynamics of its whitefly and aphid vectors. *Crop Protection* 23 (2004) 109-116. www.sciencedirect.com; www.elsevier.com/locate/cropro

3.21 Sequence variability within the 3'-proximal part of the *sweetpotato mild mottle virus* genome

Project No.	771599/ 771502
Objective	<ul style="list-style-type: none"> • To study the sequence variability of SPMMV by cloning and sequencing a 1.8-kb fragment representing the 3'-end of the SPMMV genome
Research Period:	2002
Implementing Agencies:	Makerere University, Kampala, Sokoine University of Agriculture, University of Helsinki, Finland
Donors:	CIP, Sida/SAREC, BIO-EARN Sweden

Summary of Major Research Results

- Sequence comparisons indicated 85.9% - 99.9% nucleotide sequence identity and 92.8 - 100% amino acid sequence similarity for the coat protein (CP) encoding region
- The nucleotide sequence identity within the 3'-untranslated region (3' UTR) was 84.7-100%, and the region was variable in length (303-308 nucleotides) due to some deletions within the 5'-proximal part of the 3' UTR
- Significant clustering of the CP amino acid sequences, indicating existence of distinguishable sequence variants or strains

Outputs

- Sequence variability of SPMMV determined

- Sequence alignment and phylogenetic analyses of complete coat protein nucleotide and amino acid sequences
- Publication by Mukasa *et al.*, 2003 in: *Archives of Virology* (2003) 148: 487-496

Publication

Mukasa, S.B., Rubaihayo, P.R and Valkonen, J.P.T. 2003. Sequence variability within the 3'-proximal part of the *sweetpotato mild mottle virus* genome. *Archives of virology* (2003) 148: 487-496.

3.22: Genetic variability and interactions of three sweetpotato infecting viruses

Project No.	771502; 771599; 771402
Objectives	<ul style="list-style-type: none">• To provide a quantitative assessment of the incidence of sweetpotato viruses and virus-diseased plants, and associations of co-occurrence between different viruses in the major agro ecological zones of Uganda• To determine the genetic variability and population structure of SPMMV and SPFMV and SPCSV in Uganda• To determine the sweetpotato virus-virus and virus-host interactions and their implications on sweetpotato productivity.
Research Period:	2001 to 2004
Implementing Agencies:	Makerere University, Kampala, Swedish University of Agricultural Sciences
Donors:	BIO-EARN, CIP

Summary of Major Research Results

- High genetic variability in SPMMV and SPFMV whereas SPCSV isolates from East Africa seem less variable
- Co-infections of SPCSV with SPFMV and/or SPMMV were associated with persistent and more severe symptoms than infections with each of the viruses alone, and were responsible for over 90% of the field diseased plants
- SPMMV and SPFMV RNA accumulation greatly increased by over 32 and 64 fold, respectively, in mixed infection with SPCSV
- Accumulation of SPCSV in mixed infection with SPMMV or SPFMV was reduced by 2-4 fold, indicating an antagonistic interaction
- Neutral (non-detectable) interactions were observed between SPFMV and SPMMV.

Outputs

- Incidence of sweetpotato-infecting viruses in Uganda established
- Genetic variability of the major sweetpotato infecting viruses determined
- Virus-virus interactions and cultivar reaction to virus infection established

- Symptoms caused by single-virus infection and co-infection of viruses assessed
- Virus accumulation associated with synergistic interactions determined
- Ph.D Thesis by Mukasa, S.B. 2004. Swedish University of Agricultural Sciences, Uppsala.

Publication

Mukasa, S.B. 2004. Genetic Variability and Interactions of Three Sweetpotato Infecting Viruses. Ph.D Thesis, Swedish University of Agricultural Sciences, Uppsala. 496 pp

3.23 Yield loss and spread patterns of sweetpotato virus disease in areas around the Lake Victoria Crescent of Uganda

Objectives	<ul style="list-style-type: none">• To compare yield losses due to SPVD in cutting and vector-induced infections.• To determine effects of vector-spread infections over time on yield• To determine spread patterns of SPVD at 2 locations within the Lake Victoria Crescent of Uganda• To give recommendations on SPVD management measures in the study areas and similar environs elsewhere
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Research Period: October, 2002 to September, 2003

Implementing Agencies: Namulonge Agricultural and Animal Production Research Institute, Makerere University, Kampala, Ministry of Agriculture and Rural Development Mukono Agricultural Research and Development Center

Donors: PRAPACE, CIP, Rockefeller Foundation, EU

Summary of Major Research Results

- First SPVD symptoms in the screen house appeared on the plants (1.6%) from 14 days after inoculation (DAI), but by 30 days most plants (91.9%) had developed the symptoms
- The peak time for SPVD infection in the screen house was between 24 and 29 DAI
- SPVD symptoms in the field started developing on plants one month after planting
- Highest number of marketable storage roots per plant (11.3%) was obtained from healthy vines; the least (1.3) was obtained from vines diseased at 30 days after planting
- SPVD incidences were low during the wet months and high in the dry months.
- *Sweetpotato chlorotic stunt crinivirus* (SPCSV) and *sweetpotato feathery mottle potyvirus* (SPFMV) were the two most frequently detected viruses
- Infection by cutting resulted in more reduced yields (4.1 t/ha), whereas vector-induced infection resulted in less reduced yield (13.5 t/ha), when compared to 22.7 t/ha obtained from healthy plants
- Early vector-induced infections were associated with lower yields compared to late vector-induced infections

- The SPVD infection pattern and indices indicated two distinct spread peaks occurring in the dry periods of December-January and June-July
- A positive relationship ($R^2 = 0.68$) existed between SPVD incidence and whitefly counts

Outputs

- Effects of sweetpotato virus disease temporal spread on yield of sweetpotato.
- Relationship between disease incidence and whitefly population established
- The rate of infection and the infectivity indices of SPVD determined
- M.Sc Thesis, Nambogga, M. 2004, Makerere University.

Publication

Nambogga, M. 2004. Yield loss and spread patterns of sweetpotato virus disease in areas around the Lake Victoria Crescent of Uganda. M.Sc. Thesis, Makerere University.

3.24 Yield loss induced by sweetpotato virus disease (SPVD) as influenced by the mode and time of infection

Objective	<ul style="list-style-type: none">• To determine the yield losses induced by sweetpotato virus disease (SPVD), in relation to the mode and time of infection.
Research Period:	2001
Implementing Agencies:	Namulonge Agricultural and Animal Production Research Institute
Donors:	NRI, Government of Uganda, EU

Summary of Major Research Results

- Significant differences ($P < 0.05$) in the number of plants diseased with time.
- Highest SPVD spread occurred 120 days after planting (DAP)
- High significant relationship ($r = 1, P < 0.05$) between the time of symptom expression and root root yield
- Yield of inoculated plants and plants diseased 30 and 60 DAP were not significantly different at $P = 0.05$
- The greatest yield reduction was obtained from plants infected as cuttings compared to those infected by vectors
- Plants infected early by vectors recorded higher yield reduction than those infected late by vectors
- Overall, SPVD caused yield reductions of up to 85.2%
- First symptom expression in the screen house was from 12 to 15 days after inoculation, while in the field it was 30 days after planting

Outputs

- Symptom expression of SPVD in the screen
- Symptom expression of SPVD on samples planted as healthy cuttings in the field

- Publication by Nambogga *et al*, 2001. In: *Proceedings of the African Crop Science Society Conference*, Vol. 5.

Publication

Nambogga, M. 2001. Yield loss induced by sweetpotato virus disease (SPVD) as influenced by the mode and time of infection. In: *Proceedings of the African Crop Science Conference*, Vol. 5, Part 1 of 2. Lagos, 22-26 October 2001.

3.25 Whiteflies and associated viruses on sweetpotato in Uganda: prevalence, distribution and importance

Objective	<ul style="list-style-type: none">• To establish the current distribution of whiteflies and associated viruses on sweetpotato in Uganda.
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Research Period:	November, 1997 to December, 1997
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Implementing Agencies:	<i>Institut für Biochemie und pflanzenvirologie</i> -Germany
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Donors:	CIP, NRI, DANIDA, IITA-ESARC
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Summary of Major Research Results

- Whiteflies were more abundant in south/west and central areas than in north and east
- SPVD incidence was greatest in southern areas around the shores of Lake Victoria, the highest being in Mpigi district (29%)
- 100 out of 154 fresh leaf samples tested using ELISA reacted positively to SPCSV monoclonal antibodies, 72 to SPFMV while SPMVM was detected in 9 samples, which were from the central and southern areas only
- The two serotypes of SPCSV, Ugandan and Kenyan, detected in 68 and 32 samples, respectively
- The Ugandan serotype occurred in all districts except for Tororo and Iganga, though more frequently in the South and West
- The Kenyan serotype occurred more frequently in northern and eastern Uganda.

Outputs

- Incidence of sweetpotato virus disease in Uganda determined
- Sweetpotato whitefly abundance in Uganda established
- Distribution of sweetpotato chlorotic stunt virus serotypes in Uganda established
- Publication by Aritua *et al* 1998. In: *Root Crops in the 21st Century. Proceedings of the 7th Triennial symposium of the ISTRC-AB.*

Publication

Aritua, V., Legg, J., Sseruwagi, P., Smit, N.E.J.M and Gibson, R.W. 1998. Whiteflies and associated viruses on sweetpotato in Uganda: prevalence, distribution and importance. In: Akoroda, M.O & Ngeve, J.M (eds.). *Root Crops in the 21st Century. Proceedings of the 7th Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch (ISTRC-AB)*, Cotonneou, Benin. 11-17 October 1998. Pp 580-586.

Regional

3.26 Status of sweetpotato virus disease in East Africa: A 1999 update on incidence

Objective	<ul style="list-style-type: none">To assess the geographical distribution and frequency of SPVD in major sweetpotato producing regions in East Africa
Research Period:	November 1997 to June, 1998
Implementing Agencies:	National Agricultural and Animal Production Research Institute-Uganda, Kenya Agricultural Research Institute, Root and Root Crops Research Programme-Tanzania
Donors:	DANIDA, DFID, IITA-ESARC, NRI

Summary of Major Research Results

- SPVD incidence was highest in Uganda, followed by Tanzania and least in Kenya
- In Uganda, SPVD incidence was high in southern, eastern and western regions where it exceeded 40% in some districts and approached 80% in a few individual farms
- SPVD incidence was also high in Kagera district of Tanzania where the mean was close to 20% and in western Kenya with a mean of 10%
- Lower values of SPVD incidence were recorded in northern and eastern Uganda, coastal and Nyanza province in Kenya and Coastal Tanzania
- ELISA analysis confirmed the existence of sweetpotato feathery mottle virus (SPFMV) and sweetpotato chlorotic stunt virus (SPCSV) in SPVD-affected plants
- SPFMV was frequent and largely restricted to the Lake Victoria region

Outputs

- SPVD incidence in Uganda
- SPVD incidence in Tanzania
- SPVD incidence in Kenya
- Detection of viruses in diseased samples
- Publication by Aritua *et al.*, 2000 in: *African Potato Association Conference Proceedings*, Vol. 5. pp 393- 398

Publication

Aritua, V., Mwangi, R.O.M., Legg, J.P., Ndunguru, J., Kamau, J.W., Vetten, H.J & Gibson, R.W. 2000. Status of sweetpotato virus disease in East Africa: A 1999 Update on incidence. In: Adipala, E., Nampala, P & Osiru, M (eds.). *Proceedings of the 5th Triennial Conference of the African Potato Association*, Vol. 5. pp 393-398. 29 May- 2 June 2000, Kampala, Uganda.

3.27 Identification and characterization of sweetpotato viruses in East and South Africa, and assessment of host plant resistance for sustainable production

Project No.	ICA4-CT-2000-30007
Objective	<ul style="list-style-type: none"> • To establish the incidence, identities and relative frequencies as a single or part of a complex infection, of the different viruses infecting sweetpotato in Uganda, Kenya and South Africa • To assess the resistance of different Ugandan / Kenyan / South African isolates of sweetpotato viruses when inoculated singly or as a mixture with SPCSV • To identify variation within common viruses, notably SPCSV and SPFMV, and to develop diagnostic methods for distinguishing their prevalent strains • To isolate and characterize any previously undescribed and novel viruses found in Uganda, Kenya or South Africa within WPI and to provide diagnostic methods and tools for the identification and detection of these viruses • To investigate how SPCSV synergises SPFMV, CMV and any other viruses identified to be synergised • To investigate if and how resistance to SPCSV can stabilize resistance against SPFMV, CMV and any other viruses synergised by SPCSV
Research Period:	October 2000 to September, 2003
Implementing Agencies:	University of Nairobi, Makerere University, Kampala, BBA, Germany
Donors:	CIP, PRAPACE, NRI, SLU Sweden, ARC-Roodeplaat, SA

Summary of Major Research Results

- The aphid-borne, SPFMV was the commonest virus infecting sweetpotato in all the three countries
- Four strains (RC/S, C, O and EA) were found in Uganda and Kenya whereas only the C strain was found in South Africa
- The next most common virus identified was SPCSV, found only as the East African strain, SPCSV_{EA}
- SPMMV was the next most common virus, found in all the three countries, followed by SPCFV in E. Africa only and sweetpotato caulimo virus (SPCaV), of which only a single infected plant was found in Uganda
- SPCSV was commonly found in combination with SPFMV, causing SPVD
- Infection with SPVD affected yield significantly only when it occurred within the first three months of growth
- Landraces occurring in areas where SPVD is common are also more SPVD-resistant than those occurring in areas where SPVD is rare

- Sweetpotato virus Y and *sweetpotato chlorotic fleck virus* (SPCFV) were characterized, SPCFV being assigned to the Carlavirus group

Outputs

- Identification of sweetpotato infecting viruses in Uganda, Kenya and South Africa
- Incidences of viruses in Uganda, Kenya and South Africa
- Susceptibility of sweetpotato to different viruses
- Identification, characterization and detection of sweetpotato viruses
- Farmer perceptions of sweetpotato virus diseases and development of control strategies
- Understanding the mechanism of synergism by SPCSV
- Final Technical Report by Gibson *et al.*, 2003

Publication

Gibson, R.W., Adipala, E., Njeru., R.W., Graham, T., Vetten, J and Jari, V. 2003. Identification and characterization of sweetpotato viruses in East and South Africa, and assessment of host plant resistance for sustainable production. Final Report INCO-DEV: International Cooperation with Developing Countries (1998-2002). <http://www.nri.org/spv/>

CHAPTER FOUR: POST-HARVEST MANAGEMENT

Research in this area aimed at studying technologies to improve the livelihoods of the rural poor through diversification and expansion of sweetpotato. The goal is to enhance food security through the nutritional qualities of sweetpotato. Researchers focused on evaluating opportunities and undertook collaborative research on sweetpotato markets, raw-material quality, process development, product quality and socio-acceptability of innovations. Research on sweetpotato added-value from primary processing (e.g. starch and flour), and the more efficient use of sweetpotato roots, vines and byproducts was conducted. Research also focused on enhancing the shelf-life of sweetpotato under different storage conditions.



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Kenya

4.1 Evaluation of sweetpotato storage roots for storability at room temperature in Kenya

Objective	<ul style="list-style-type: none">To evaluate the storability of sweetpotato roots at room temperature in a storage house
Research Period:	1995
Implementing Agencies:	Kenya Agricultural Research Institute
Donor:	CIP

Summary of Major Research Results

- Variety KSP 20 showed the lowest rate of root and weight loss among the NPT clones and 440024 among the AYT clones
- All clones had lost over 90% weight by 6th week, except KSP 20 and MTW 13 with a loss of 74.4 and 77.9%
- For all the 14 clones, the percentage number of discarded roots (>51% of roots rotten) was below 10% in the first three weeks; but by the 7th week, it was over 90% except for KSP 20 with 85.0% and MTW 13, 88.1%
- Significant differences occurred between clones in percentage number of roots discarded and in weight loss

Outputs

- Evaluation of the storability of NPT and AYT sweetpotato clones

Publication

Kihurani, A.W., Gichuki, S.T and Carey, E.E. 1995. Evaluation of sweetpotato storageroots for storability at room temperature in Kenya. In: Akoroda, M.O and Ekanayake (eds.). *Root Crops and Poverty Alleviation. Proceedings of the Sixth Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch*. 22-28 October, 1995, Lilongwe, Malawi. Pp 466-467

4.2 Prolonging the shelf-life of fresh sweetpotato through solar curing

Objective	<ul style="list-style-type: none">To evaluate the effectiveness of a simple and inexpensive curing method that utilizes solar energy and simple materials to attain curing conditions and help to prolong the shelf life of fresh sweetpotato in tropical developing countries
Research Period:	2002-2003
Implementing Agencies:	Kenya Agricultural Research Institute
Donors:	CIP, Rockefeller Foundation

Summary of Major Research Results

- Solar cured roots had a significantly higher percentage of marketable roots after 100 days of storage compared with uncured roots
- Solar curing effectively helps to preserve market quality of the stored roots by reducing post-harvest pathological deterioration and excessive shrinkage due to moisture loss
- The cured roots had good appearance and the surface of the artificially created wound developed a thin layer of cells resembling the intact root periderm
- The uncured roots were discoloured and shrunken. The tissue at the site of the artificially created wound was also shrunken and had lost market quality

Outputs

- Effect of solar curing and washing on marketability of sweetpotato cultivar “Kemb 20” after storage at ambient tropical conditions for 100 days

Publication

Kihurani, A.W. 2003. Prolonging the shelf life of fresh sweetpotato through solar curing. In: Akoroda, M.O (ed.). *Root Crops: The Small Processor and Development of Local Food Industries for Market Economy. Proceedings of the Eighth Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch (ISTRC-AB)*. 12-16 November 2001, IITA, Oyo Road, Ibadan, Nigeria. Pp 194-197.

4.3 Use of ambient conditions and saw dust in storage of sweetpotato (*Ipomoea batatas* L.) roots in Kenya

Objectives

- To identify the most rustic varieties to natural storage conditions

To improve shelf life of sweetpotato roots using advantageously natural tropical ambient environment and simple storage method, storage equipments in ambient conditions and in saw dust using 31 local sweet potato root varieties.

Research Period: 1994

Implementing Agencies: University of Nairobi

Donor: CIP

Summary of Major Research Results

- Visual examination of edible portions of stored roots showed that varieties KEMB 7, KEMB 9, KEMB 19, KEMB 20, KEMB 24, KEMB 37, KSP 20 and KSP 119 were acceptable and did not rot after five weeks of storage in ambient air conditions
- Storage in sawdust permitted the storage of roots up to 14 weeks (100 days) for most varieties
- Although stored-root edible portion and colour were acceptable or good, sprouting was noted for almost all varieties

- Shriveling for KSP-type sweetpotato roots was lower than the KEMB-type
- Sprouting occurred with almost all varieties after 100 days of storage in sawdust, except KEMB 10, which shriveled before 100 days in storage
- Roots with high moisture content initially store badly and are more susceptible to shriveling and microorganism attack

Outputs

- Assessment of different sweetpotato root varieties stored in sawdust for 100 days
- Sweetpotato root moisture content and weight loss assessment during storage in sawdust
- Aspects of the edible portion of different sweetpotato root varieties stored in ambient conditions for five weeks

Publication

Karuri, E.G and Hagenimana, V. 1995. Use of ambient conditions and saw dust in storage of sweetpotato (*Ipomoea batatas* L.) roots in Kenya. *Zimbabwe J. agric. Res.* 33 (1) (1995): 83-91.

4.5 Factors associated with Postharvest deterioration of sweetpotato (*Ipomoea batatas* L.) roots in Kenya

Objectives

- To conduct a baseline field survey in the main sweetpotato growing areas of Western, Nyanza and Central provinces of Kenya in order to collect information on sweetpotato production, postharvest handling, postharvest pathological problems encountered by farmers, and to collect naturally infected sweetpotato root samples
- To isolate and identify fungi associated with postharvest deterioration of sweetpotato from the naturally infected root samples collected from the main sweetpotato growing areas
- To study the effect of pre-harvest vine removal, time of harvesting, soil pH and cultivar on post harvest pathological deterioration of sweetpotato roots
- To study the effect of curing and washing on post harvest deterioration of sweetpotato roots during storage over a prolonged period
- To study the effect of storage temperature on infection of sweetpotato roots.

Research Period: 1998-2001

Implementing Agencies: Kenya Agricultural Research Institute, University of Nairobi

Donors: CIP, Rockefeller Foundation

Summary of Major Research Results

- Vine removal before harvesting, and especially at two weeks, and delayed harvesting at 28 weeks after planting significantly ($P < 0.05$) enhanced post harvest pathological deterioration of sweetpotato roots, while early harvesting reduced deterioration
- Cultivar differences in root susceptibility to post harvest pathological deterioration were significant at ($P < 0.05$) with cultivar KEMB 36 showing high disease resistance and cultivar KEMB 10 high disease susceptibility compared with the other cultivars
- The influence of soil pH and post harvest washing on post harvest deterioration of sweetpotato roots was not significant ($P < 0.005$)
- Solar curing significantly ($P < 0.05$) reduced percent loss of marketable roots during prolonged storage at room temperature and relative humidity
- Low temperature range of 12-16 °C significantly ($P < 0.05$) suppressed infection in all test pathogens while the temperature range 24-36 °C significantly enhanced post harvest pathological infection variedly
- Infection by Java black rot (*Botryodiplodia theobromae*) and *Rhizopus oryzae* was highest between 24 °C and 36 °C, while infection by *R. stolonifer* was highest between 24 °C and 28 °C

Outputs

- Fungi associated with post harvest deterioration of sweetpotato roots
- Preharvest factors associated with post harvest pathological deterioration of sweetpotato roots examined
- Studies on post harvest factors associated with post harvest deterioration of sweetpotato roots

Publication

Kihurani, A.W. 2004. Factors associated with Postharvest deterioration of sweetpotato (*Ipomoea batatas* L.) roots in Kenya. Ph.D Thesis, University of Nairobi. 125 pp.

Tanzania

4.6 Mechanization of the slicing process for the production of sweetpotato chips (*Michembe*) in Shinyanga district

Objective	<ul style="list-style-type: none">• To design, fabricate and test a mechanical sweetpotato slicer suitable for use at farm level
Research Period:	November 1999
Implementing Agencies:	Sokoine University of Agriculture
Donors:	NORAD

Summary of Major Research Results

- Peeling time ranged between 0.5 and 2.0 per root (mean around 1.18 minutes) depending on the size of the root. A person can peel about 11.5 Kg of fresh sweet potatoes per hour

- Slicing time was 1.23 and 1.46 minutes for manual and machine slicing respectively. Contrary to expectation, manual slicing proved to be more efficient than mechanical slicing
- Average thickness of slices obtained was about 5 and 4.8 mm for manual and machine slicing, respectively. Free setting of the machine-enabled production of slices that were not so different from those obtained from manual slicing
- Lack of uniformity of the thickness of slices was a problem, mainly experienced with manual slicing

Output

- Determination of the efficient method of slicing sweetpotato for the purpose of saving time, thus freeing more labour to other processing activities such as peeling

Publication

Silaya, V.C.K., Laswai, P.J and Mbiha, E.R. 1999. Mechanization of the slicing process for the production of sweetpotato chips (*Michembe*) in Shinyanga district. *Proceedings of the Fourth Annual Research Conference of the Faculty of Agriculture held at the Horticulture Multipurpose Hall, Sokoine University of Agriculture, Morogoro, Tanzania*. Pp. 287-291.

4.7 Improving sweet potato processing and storage through manipulation of slicing, drying and processing

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- | | |
|-----------|---|
| Objective | <ul style="list-style-type: none">• To investigate the traditional slicing process so as to see if the fabricated slicer could be adapted to for production of sweetpotato chips (<i>Michembe</i>) that were similar to those produced traditionally and study how their drying and pack aging were influenced during storage |
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Research Period:	2000
Implementing Agency:	Sokoine University of Agriculture
Donors:	NORAD

Summary of Major Research Results

- Slices produced by traditional slicing closely resembled those produced at the 4 mm and 8 mm knife cuttings
- Perforated surface was the most superior in terms of drying of the slices; ground floor was the most inferior. Variation in slice weight during drying between sizes was significant ($P < 0.05$) on ground and thatched roof treatments, whereas this was not for perforated surface samples. Time was the most important factor significantly ($P < 0.05$) affecting the drying rate on all 3 drying surfaces
- Increasing slice thickness increased throughput but on contrary drying rate decreased. This implies that to achieve effective drying in the shortest possible time, thin slicing is advocated
- Quality of stored product was influenced by thickness of slices, type of drying surface used, type of packaging material used and duration of storage

- Packaging materials that offer aeration seem essential in ensuring in pack drying and discouraging moisture build up during storage
- Airtight containers are only suitable for effectively dried product

Outputs

- Determination of Knife settings for production of slices similar to those produced traditionally
- Factors affecting in pack drying of sweetpotato determined
- Examination of the factors affecting quality of stored product

Publication

Silayo, V.C.K., Laswai, H.S., Makungu, P.S.J and Mbiha, E.R. 2000. Improving sweetpotato processing and storage through manipulation of slicing, drying and packaging. *Proceedings of the first University Wide Scientific Conference held at the Institute of Continuing Education, Sokoine University, Morogoro, Tanzania. Pp 341.*

4.8: Development of a pilot system for converting sweetpotato starch into glucose syrup

Objective	<ul style="list-style-type: none">• Development and testing of a laboratory scale setup for converting sweetpotato starch into glucose syrup
Research Period:	2003
Implementing Agency:	Sokoine University of Agriculture, Tuskegee University
Donors:	NORAD

Summary of Major Research Results

- Continuous Stirred Tank Reactor (CSTR) was found to be good for heating and hydrolysis, very good conversion into sugars, can be obtained with 1-h and 16-h hydrolysis with Diastase of Malt and Dextrozyme C respectively
- The vacuum filtration process alone produces a product with less pigmentation but the process is very slow
- Use of a centrifuge is a much faster process but with more pigmentation in the product and high sugar losses
- The use of 0.1% Kaslin or Lunar Mass Simulant removes more solids from the solution
- Purification with ion exchange resin in the column yields a product with very low ash content and as a filter bed; it removes a good amount of colouring materials.

Output

- Demonstration of the performance of a laboratory setup for converting sweetpotato starch into glucose

Publication

Silayo, V.C.K., Lu, J.Y and Heshmat, A.A. 2003. Development of a pilot system for converting sweetpotato starch into glucose syrup. *Habitatation*, Vol. 9. Pp 9-15.

4.9 Effect of sun drying on some quality characteristics of sweetpotato chips

Objective	<ul style="list-style-type: none">• To investigate the effect of sun drying on moisture content, microbial load and sensory characteristics of sweetpotato chips
Research Period:	November 2003
Implementing Agency:	Sokoine University of Agriculture
Donors:	NORAD

Summary of Major Research Results

- Drying on either perforated surface or the corrugated iron sheet gave same results thus choice of either of the surfaces should be based on cost
- The highest mold and bacterial loads were observed on chips dried on the ground floor, followed by the raised perforated surface. Corrugated iron sheet had the least load
- Whereas the ground floor gave the worst product, the perforated surface gave a better product in terms of appearance, colour and general acceptability
- *Michembe* of large size thickness were generally more inferior to the thin ones
- Time to approach moisture equilibrium was short at 4 mm and increased with increasing thickness of slices. This implies delayed drying for chips with large thickness, which may result in mold deterioration

Output

- Effectiveness of three different drying surfaces for various thickness levels of sweetpotato chips determined

Publication

Silayo, V.C.K., Laswai, H.S., Mkuchu, J and Mpagalile, J.J. 2003. Effect of sun drying on some quality characteristics of sweetpotato chips. *African Journal of Food, Agriculture, Nutrition and Development*. Volume 3. No. 2.

4.10 Post harvest evaluation of selected sweetpotato varieties for perishability and consumer acceptability in Tanzania

Objectives	<ul style="list-style-type: none">• To improve storability and quality of the fresh sweetpotato roots• To understand the influence of environmental factors, both pre and post harvest so that improved production and handling practices can be defined
Research Period:	1994 to 1996
Implementing Agencies:	Ukiriguru Agricultural Research and Development Institute, Tengeru Agricultural Research and Development Institute, Uyole Agricultural Research and Development Institute, Chollima Agricultural Research and Development Institute, Kibaha Agricultural Research and Development Institute.
Donors:	NRI, Government of Tanzania

Summary of Major Research Results

- Rotting of roots (internal and external) was a major form of root deterioration during storage
- Weight loss (primarily as a result of water loss) was another form of deterioration reaching > 40% over two weeks
- Highest weight loss was observed at Chollima followed by Kibaha and Ukirigruru, while it was low at Uyole and Tengeru
- Cultivars differed in their rates of rotting at all sites. At Kibaha and Ukiriguru, varieties Sinia and SPN/O showed low rates of rotting than varieties Mwanamonde and Iboja
- At Uyole, varieties SPN/O and Masyabala were fast rotting whereas Mpufya, Nyekundu and Babati were slow
- Dry matter content increased with time, with no significant differences observed between damaged and undamaged roots

Outputs

- Influence of pre and post-harvest environmental factors on fresh sweetpotato roots
- Changes in dry matter content of sweetpotato with time
- Changes in consumer acceptability of cooked roots of sweetpotato varieties with storage time
- Publication by Kapinga *et al.*, 1997. In: *African Potato Association Congress Proceeding, Vol. 4*

Publication

Kapinga, R., Rees, D., Rwiza, E., Mtunda, K., Kilima, M., Ndoni, T., Chottah, M., Chilosa, D and Mayona, C. 1997. Post harvest evaluation of selected sweetpotato varieties for perishability and consumer acceptability in Tanzania. In: *Proceedings of the 4th Triennial symposium of the African Potato Association*, Pretoria, South Africa.

4.11 Physiological and biochemical factors determining resistance of sweetpotato (*Ipomoea batatas* (L) to post-harvest pathogens in Tanzania

Objectives	<ul style="list-style-type: none">• To identify the most important sweetpotato post-harvest pathogen(s) in Morogoro, Tanzania• To establish the susceptibility levels inherent in some important East African cultivars to the identified pathogen(s)• To determine the biochemical and physiological causes of varying levels of susceptibility to the identified pathogen(s)
Research Period:	1999-2000
Implementing Agencies:	Sokoine University of Agriculture, Cranfield University, Silsoe College
Donors:	DFID

Summary of Major Research Results

- *Rhizopus oryzae*, which causes soft rot of sweetpotato roots during storage, is the most important post-harvest pathogen in Morogoro region
- *Botrytis* spp (grey mold) was found to be growing on very few fungal media plates and mostly in association with the soft rot fungus
- Differences in susceptibility to *R. oryzae* exist among the different cultivars of sweetpotato evaluated. Susceptibility levels were stable in some cultivars while in others, it was highly influenced by prevailing storage and crop growth conditions
- Tanzanian cultivars Budagala and Sinia exhibited relatively consistent levels of susceptibility (least susceptible) to *R. oryzae*
- Among the Kenyan cultivars, KSP 20 was consistently least susceptible to *R. oryzae* when screening was done under medium relative humidity conditions.
- Cultivar SPN/O maintained high levels of susceptibility to *R. oryzae*
- Cultivars Iboja and Ukerewe were inconsistent, but in most experiments, Iboja was susceptible
- Kenyan cultivar SPK 004 maintained higher levels of susceptibility to *R. oryzae*.
- Although cultivar dry matter content and root hardness were found not to have a significant effect on cultivar rot weight (susceptibility), there was an indication that hardness is negatively correlated to susceptibility and dry matter is positively correlated to susceptibility
- In some cases, root dry matter was found positively correlated to susceptibility of roots to *R. oryzae* (under low humidity conditions)
- Amount of Phenolic compounds in damaged and the root tissue infected by *R. oryzae* increased; but no significant correlation was found between susceptibility and root phenolic content
- Higher concentrations of some root sugars such as fructose, glucose and total sugar content within the sweetpotato roots are significantly correlated to high susceptibility of sweetpotato to *R. oryzae*
- These root sugars are also negatively correlated to dry matter content
- Resistance to *R. oryzae* is partly due to antifungal compounds induced in sweetpotato root tissue as a result of infection. Growth and germination of spores of *R. oryzae* on Sweetpotato Meal Agar (SMA) prepared from the root tissue close to the infection lesion was very poor, while growth and spore germination was very good on SMA at a point 10cm from the infection lesion
- More accumulation of phenolics in the root tissues that were injured prior to inoculation by the fungus than tissues injured after inoculation
- *R. oryzae* infection levels were relatively lower in roots that were injured prior to inoculation than in undamaged roots

Outputs

- Important post-harvest pathogen of sweetpotato in Morogoro, Tanzania identified
- Screening sweetpotato cultivars for susceptibility to *R. oryzae*
- Biochemical and physiological causes of resistance of sweetpotato to soft rot (*R. oryzae*).
- The role of root components and root properties in susceptibility to *R. oryzae* determined
- Muhanna M (2001). Mphil. Thesis, Cranfield University, Silsoe College

Publication

Muhanna, M. 2001. Physiological and biochemical factors determining resistance of Sweetpotato to post-harvest pathogens in Tanzania. Mphil. Thesis, Cranfield University, Silsoe College. 152pp

Uganda

4.12 Field testing of improved local ovens and sweetpotato slicers

- Objectives**
- To train artisans in improved oven construction
 - To demonstrate the efficiency and effectiveness of the sweetpotato slicers and local ovens
 - To obtain the response of the users on suitability of the sweetpotato processing technologies and products
 - To identify technology aspects that require modifications to suit user needs.
 - To train processors in sweetpotato processing technology

Research Period: November 1997 to December 1997

Implementing Agencies: Ministry of Agriculture, Animal Industry and Fisheries, Kawanda Agricultural Research Institute

Donors: PRAPACE, CIP, UNDP

Summary of Major Research Results

- The three designs of ovens (i.e. single layer brick oven, Double layer brick oven and Double layer drum oven) were all effective in baking products and suited to the needs of different categories of users
- Sweetpotato products baked in the developed ovens were generally acceptable.
- The two designs of sweetpotato slicers were more efficient than the traditional knife and they do not require skilled labour

Outputs

- Testing of improved local ovens
- Acceptability tests of sweetpotato products
- Testing of sweetpotato slicers
- Final technical report, 1997 by Owori, C.

Publication

Owori, C. 1997. Field testing of improved local ovens and sweetpotato slicers. *Final Technical Report, Post harvest Programme, Kawanda Agricultural Research Institute, Kampala, Uganda.*

4.13 Collection and standardization of Ugandan traditional sweetpotato recipes

Objectives	<ul style="list-style-type: none">• To develop knowledge and preparation skills on traditional sweetpotato dishes• To popularize the use of traditional sweetpotato dishes.
Research Period:	May, 1997 to February, 1999
Implementing Agencies:	of Agriculture, Animal Industry and Fisheries, Kawanda Agricultural Research Institute
Donor:	PRAPACE

Summary of Major Research Results

- 50% of farmers consume sweetpotato daily
- Recipes for breakfast foods included: sweetpotato flour porridge with tamarind, sweetpotato flour porridge with raw mangoes, sweetpotato flour porridge with sour milk
- Recipes for sweetpotato snack products included: Boiled fresh sweetpotatootatoes, Roasted fresh sweetpotatootatoes, Boiled dried sweetpotato chips, Flavoured (enriched) dried chips
- Different types of mashed sweetpotato included: Pure mashed fresh sweetpotato; Fresh sweetpotato mashed with cassava
- Fresh sweetpotato mashed with a legume (either beans, pigeon peas or cow peas); Mashed dried chips; Dried sweetpotato chips mashed with either simsim paste or sour milk; Dried chips mashed with fresh sweetpotato; Dried sweetpotato chips mashed with a legume (pigeon peas or beans) Sweetpotato flour based traditional bread included: sweetpotato flour bread; sweetpotato-cassava flour bread; sweetpotato-sorghum flour local bread; sweetpotato/cassava/ millet flour local bread

Outputs

- Collection of traditional sweetpotato recipes
- Standardization of traditional sweetpotato recipes
- Consumption of sweetpotato in Uganda
- Methods for paste preparations
- Recipes for sweetpotato dishes served as main meal
- Recipes of sauces accompanying the sweetpotato dishes served as main meal.
- Final technical report, 1999 by Owori, C

Publication

Owori, C. 1999. Collection and standardization of Ugandan traditional sweetpotato recipes. *Final Technical Report, Post harvest programme, Kawanda Agricultural Research Institute, Kampala, Uganda.*

4.14 Standardisation and development of recipes for processing sweetpotato products

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| Objectives | <ul style="list-style-type: none">• To ensure processing of consistently high quality sweetpotato products that meet consumer requirements• To develop processes that will benefit processors through maximization of profits. |
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Research Period: June, 1996 - February, 1997

Implementing Agencies: National Agricultural Research Organization, Kawanda
Agricultural Research Institute

Donors: PRAPACE, NRI

Summary of Major Research Results

- Sixty percent boiled and mashed sweetpotato recipe in sweetpotato mandazi followed by 40% fresh grated sweetpotato recipe was most acceptable, while 30% sweetpotato flour recipe was least acceptable
- In sweetpotato cake, 20% fresh grated sweetpotato recipe was most acceptable, followed by 30% sweetpotato flour recipe
- Overall, sweetpotato products from all the recipes evaluated (sweetpotato flour, boiled & mashed sweetpotato recipe, grated sweetpotato recipe and sweetpotato flour recipe) were acceptable
- Capacity of small sized oven: 4 trays of 75 cm x 45 cm is 60 cookies and 60 burns fill one tray.

Outputs

- Sensory evaluation of sweetpotato products for acceptability by in-house panelists
- Consumer evaluation of sweetpotato products
- Comparative analysis of standard sweetpotato recipes and wheat flour recipes.
- Design, costs and performance of standard small-scale oven
- Final Technical Report by Owori *et al.*, 1996. KARI, Uganda.

Publication

Owori, C., Kigozi, J., and Mwesigye, A. 1996. Standardization and development of recipes for processing sweetpotato products. *Final Technical Report, Postharvest Program, Kawanda Agricultural Research Institute, Uganda.*

4.15 Promotion of improved technologies for sweetpotato pest management and processing techniques in Uganda

Sub-Title: Development and promotion of sweetpotato processed products with market potential.

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| Objectives | <ul style="list-style-type: none">• To reduce the costs and drudgery associated with peeling sweetpotato for processing into dried chips and flour |
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- To compare the flour yield from peeled and unpeeled roots of varieties Kakamega and Ejumula
- To compare the nutritional value of sweetpotato composite flours processed from peeled and unpeeled roots of varieties Ejumula and Kakamega
- To determine consumer acceptability of sweetpotato porridge made using composite flour from unpeeled roots

Research Period: June, 2002- June, 2003
Implementing Agencies: Kawanda Agricultural Research Institute,
Maganjo millers, Uganda, Makerere Univesrity, Kampala
Donor: PRAPACE

Summary of Major Research Results

- Dry matter content of appeared low for variety Ejumula
- Conversion rate and yield of dried chips from unpeeled roots was higher than that from peeled roots regardless of variety
- Conversion rates and yield from variety Ejumula were higher than that from variety Kakamega
- Overall, porridge from peeled roots of Ejumula and Kakamega were scored highly for acceptability though that from Ejumula was significantly more acceptable than the other porridge products
- No significant difference in the overall acceptability of porridge from peeled and unpeeled roots of both Kakamega and Ejumula
- Ejumula had more beta-carotene than Kakamega
- Ejumula is suitable for processing sweetpotato composite flours for porridge preparation.

Outputs

- Comparison of beta-carotene content of variety Ejumula
- Sensory tests in the overall acceptability and preference ranking of porridge prepared using peeled and the unpeeled sweetpotato roots
- Determination of a suitable variety for processing sweetpotato composite flours for porridge preparation
- Final Technical Report, 2003 by Owori, C.

Publication

Owori, C. 2003. Promotion of improved technologies for sweetpotato pest management and processing techniques in Uganda. *Final Technical Report, Postharvest Program, Kawanda Agricultural Research Institute, Kampala, Uganda.*

4.16 The effect of salting sweetpotato chips prior to drying on infestation by *Araecerus fasciculatus*

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| Objectives | <ul style="list-style-type: none">• To evaluate the efficacy of finely ground common salt in reducing and (or) controlling dried sweetpotato chip damage by <i>A. fasciculatus</i>• To establish the effect of salt dosage levels on the generation (development) time of <i>A. fasciculatus</i>• To establish the effect of different salt dosage levels on the weight of adult <i>A. fasciculatus</i> at emergence. |
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Research Period: 1998

Implementing Agencies: National Agricultural Research Organization, Kawanda
Agricultural Research Institute, University of Zimbabwe

Donor: NRI

Summary of Major Research Results

- Significant differences ($P < 0.05$) in the mean number of adult *A. fasciculatus* that emerged in the chips treated at different salt dosage levels prior to drying; the highest being in the non-salt treated (controls) and none in those chips treated with salt at dosage levels of 4 and 5% (w/w)
- No significant differences ($P > 0.05$) in the mean number of *A. fasciculatus* which emerged in chips treated with salt dosage levels of 0.25 and 0.5% (w/w); 1, 2, 3, and also 2, 3, 4, and 5% (w/w)
- Weevils bred on non-salted chips were heavier than those from salted chips. The weights decreased with increasing salt dosage rates
- The generation time (time from egg laying to adult emergence) of *A. fasciculatus* increased progressively with increasing salt dosage rates up to 2% and decreased at 3%. The shortest was achieved in the controls (89.44 ± 2.63 days) and the longest was in chips treated at rate of 2% (w/w) (105.50 days) with only a single adult emergence
- The final moisture content (MC) of the chips after about four months of storage increased significantly ($P < 0.05$) with increasing salt dosage level. Chips treated at 5% (w/w) had the highest MC (17.30 ± 0.07 %) while the controls had the lowest (13.84 ± 0.29 %).

Outputs

- Efficacy of salting sliced sweetpotato chips prior to drying in reducing and (or) controlling damage levels of dried chips in storage by *A. fasciculatus*
- Effect of salt dosage levels on the generation (development) time of *A. fasciculatus*
- Effect of different salt dosage levels on the weight of adult *A. fasciculatus* at emergence
- Publication by Agona, J.A *et al* 1998. In: TROPICAL AGRICULTURE, Vol. 75 No.1. *Proceedings of the 11th ISTRC Symposium*; January 1998.

Publication

Agona, J.A., Nahdy, M.S., Giga, D.P and Rees, D. 1998. The effect of salting sweetpotato chips prior to drying on infestation by *Araecerus fasciculatus*. In: TROPICAL AGRICULTURE, Vol.75 No. 1. *Proceedings of the 11th ISTRC Symposium*, January 1998. pp 84-88.

4.17 Evaluation of processing technologies for quality improvement of sweetpotato flour for various food enterprises

Project No.	PRA 032
Objectives	<ul style="list-style-type: none">• To develop an efficient and effective process of producing sweetpotato flour• To identify sweetpotato varieties suitable for processing into flour• To develop sweetpotato flour based food products• To select suitable packaging material for storage of sweetpotato flour.
Research Period:	September, 1999 to June, 2000
Implementing agencies:	National Agricultural Research Organization, Kawanda Agricultural Research Institute, Ministry of Agriculture, Animal Industry and Fisheries
Donors:	CIP, PRAPACE, MAAIF

Summary of Major Research Results

- Moisture content and yield of sweetpotato flour from soaked and non-soaked slices increased but flour yield reduced with increased soaking time
- Soaking sweetpotato slices for 90 minutes significantly reduced the odour intensity of sweetpotato flour
- Drying conditions did not significantly affect the odour intensity of sweetpotato flour
- Browning in sweetpotato flour reduced with increased soaking time.
- Soaking sweetpotato slices consecutively without changing water increased the intensity of browning
- The nutrients reduced gradually with increased soaking time of sweetpotato slices
- No significant difference in the nutrient composition of flours that were dried using either sun dryer, firewood dryer or charcoal dryer
- In flours dried using biomass dryers, yeast was observed but *E. coli* was absent.
- Mould was present in most flour samples but all the observations were below the tolerable limit of 300 col/gram
- Soaking of slices in the same water had no significant effect on the microbiological quality of sweetpotato flour.

Outputs

- Changes in physical characteristics of sweetpotato flour from soaked and non-soaked slices determined
- Changes in the odour intensity of sweetpotato flour with soaking time; and effect of drying method on sweetpotato flour odour determined.
- Identification of changes in flour colour and discolouration of sweetpotato flour processed by soaking and drying slices in various agro-ecological conditions; and effect of soaking frequency on the colour of sweetpotato flour

- Nutrient composition of sweetpotato flour samples prepared from soaked and unsoaked slices compared
- Microbiological quality of sweetpotato flour processed in different sites (Soroti and Kawanda, Uganda) compared
- Final Technical Report (Sept 1999 - June 2000), Owori, C.

Publication

Owori, C. 2000. Evaluation of processing technologies for quality improvement of sweetpotato flour for various food enterprises. *Final Technical Report, Postharvest Program, Kawanda Agricultural Research Institute, Kampala, Uganda.*

4.18 Development and promotion of on-farm commercial processing of sweetpotato dried chips in Soroti District

Objectives	<ul style="list-style-type: none">• To conduct analysis of input markets and marketing to assess the potential for small scale commercial processing• To link farmers to the market to negotiate sweetpotato prices• To develop production plans for the raw material and sweetpotato dried chips• To assess the economic efficiency of new processing methods• To determine the profitability of small scale commercial processing of sweetpotato dried chips• To develop research strategies for achieving economic viability of sweetpotato dried chip processing and marketing
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Research Period: April 2002 to May, 2003

Implementing Agencies: Kawanda Agricultural Research Institute

Donors: PRAPACE, CIP

Summary of Major Research Results

- The introduced varieties 52, 178, Naspot 5, Kakamega and Ejumula were generally preferred for their high yield, orange flesh colour and good taste than the mainly grown local variety Haraka
- The introduced manual sweetpotato slicer improved the efficiency of slicing sweetpotato, however, the slices were too thin and suffered heavy weevil attack during storage
- Estimated cost of production and output per acre was U.Shs 244,500 and 35 sacks respectively

Outputs

- Processing practices of sweetpotato established
- Economic efficiency of new processing methods of sweetpotato assessed
- Determination of the profitability of small scale commercial processing of sweetpotato dried chips
- Final technical report, 2003 by Owori, C.

Publication

Owori, C., 2003. Development and promotion of on-farm commercial processing of sweetpotato chips in Soroti district. *Final Technical Report, Post harvest Programme, Kawanda Agricultural Research Institute, Kampala, Uganda.*

Regional

4.19 Promotion of sustainable sweetpotato production and post-harvest management through Farmer Field Schools in East Africa

Objectives

- To increase the returns from sweetpotato through enhancing stakeholders' capacity in sustainable production and post-production management
- To put together the results on improved component technologies, and promote the knowledge farmers through the process of experiential learning
- Strengthen institutional linkages between the FAO pilot programs to promote FFS in East Africa
- To extend the results and lessons learnt to other countries in Eastern, Central and Southern Africa through PRAPACE and SARRNET networks
- To make available OFSP varieties on large scale, demonstrating the potential of crop based approaches in alleviating micronutrient deficiencies

Research Period:

May 2002 to March, 2005

Implementing Agencies:

National Agricultural and Animal Production Research Institute-Uganda, Ministry of Agriculture Animal Industry and Fisheries, Uganda, Ministry of Agricultural, Kenya, Ministry of Agriculture, Tanzania

Donors:

CIP, NRI, SOCADIDO,

Summary of Major Research Results

- Atleast 500 farmers have been trained in sweetpotato production and post-harvest handling

Outputs

- Two pilot sweetpotato integrated crop management FFS seasons were conducted; and 10, 8, 4 FFS were implemented in Kenya, Uganda and Tanzania respectively
- Two video films covering sweetpotato FFS activities have been developed
- Development of sweetpotato processing manual
- Publication of sweetpotato training manual

Publication

Stathers, T.E, Namanda, S., Kapinga, R., Khisa, G., Mwanga, R.O.M., Thomas, J and Van de Fliert., E. 2003. Promotion of sweetpotato production and post-harvest management through Farmer Field Schools in East Africa. In: *Proceedings of the International Society for Tropical Root Crops (ISTRC) Symposium, 2003*

4.20 The potential for extending the shelf-life of sweetpotato in East Africa through cultivar selection

Project No.	R 6507
Objectives	<ul style="list-style-type: none"> • To determine whether a sufficient range of storability exists within sweetpotato germplasm available in East Africa for breeding to be successful • To establish a suitable method for screening germplasm for storability • To identify physiological characteristics associated with storability and thereby facilitate cultivar selection
Research Period:	December 1996 to June, 1997
Implementing Agencies:	Lake Zone Agricultural and Development Research Institute-Ukiguru, Tanzania
Donors:	CIP, DFID, NRI

Summary of Major Research Results

- Damaged roots deteriorated at a faster rate than the undamaged ones
- Amount of weight loss and the amount of rotting were highly correlated
- A significant positive correlation was found between dry matter (DM) content and both weight loss and rotting
- Cultivar effects were very significant, and there was a wide range of perishability observed for the cultivars used
- Weight loss over a two-week period ranged from 8.4 to 30.6%, while the overall rotting score ranged from 1.44 to 2.82

Outputs

- Effect of damage on rates of deterioration of stored sweetpotato roots determined
- Relationship between DM content and rate of deterioration of sweetpotato roots
- Range of storability within both local and introduced sweetpotato germplasm
- Publication by Rees, D. *et al.*, 1998. In: 11th ISTRC *Symposium proceedings*

Publication

Rees, D., Kapinga, R., Rwiza, E., Mohammed, R., Quirien van Oirschot., Carey, E and Westby, A. 1998. The potential for extending the shelf life of sweetpotato in East Africa through cultivar selection. In: *TROPICAL AGRICULTURE*, Vol. 75 No. 2. *Proceedings of the 11th ISTRC Symposium*, January 1998. pp 208-211.

4.21 Storability of sweetpotato (*Ipomoea batatas* (L.) under tropical conditions: physiological and sensory aspects

Project No.	R 6507
Objectives	<ul style="list-style-type: none"> • To identify the characteristics that limit shelf life of sweetpotato under tropical conditions and determine their relative importance • To determine the range in storability that exists among germplasm available in East Africa • To investigate the basis of cultivar differences in storability
Research Period:	July 1996 to March, 1999
Implementing Agencies:	Lake Zone Agricultural and Development Research Institute-Ukiriguru, Tanzania
Donors:	CIP, ARI-Ukiriguru, Cranefield University, Silsoe

Summary of Major Research Results

- Sweetpotato with high rates of water /weight loss were more susceptible to rotting
- Wound healing ability and weight loss were the major factors for the shelf life of sweetpotato
- Lignification of wounds as measured by phloroglucinal staining correlates with reduced susceptibility to weight loss, water loss and microbial attack
- Changes in sensory aspects were not a limiting factor for storage of sweetpotato
- Sweetpotato weight losses were approximately linear with storage time and surface area/ mass ratio of the roots
- Weight losses of sweetpotato stored under tropical conditions were high and ranged from 5 to 15% per week
- Cultivars with good storability were Yanshu 1, KSP 20, BPI-SP-2 and Caplina (from Kenya), and Bilagala, Kagole and 440088 (from Tanzania)
- Respiration contributed only 5 to 15% of the total weight loss, except for cultivar Shinamugi for which it was 22%
- Sprouting occurred especially in cultivars with low weight loss
- Permeability for water vapour through undamaged periderm as measured with a porometer was between 25 and 50 mmol.m².s⁻¹ just after harvest and decreased during subsequent storage

Outputs

- Interrelationships between periderm thickness, transpiration and storability of sweetpotato
- Relationship between weight loss and rotting, sprouting, and marketability
- Effect of pruning and periderm thickness on susceptibility of sweetpotato to damage
- Physiology of sweetpotato wound healing under tropical conditions
- Effect of relative humidity and DM on wound healing
- PhD Thesis. Van Oirschot, Q. 2000. Cranefield University, Silsoe

Publication

Van Oirschot Quirien. 2000. Storability of sweetpotato (*Ipomoea batatas* (L.)) under tropical conditions: physiological and sensory Aspects. PhD Thesis, Cranfield University at Silsoe.

4.22 Assessment of sweetpotato cultivars for suitability for different forms of processing

Project No.	R7520
Objective	<ul style="list-style-type: none"> To develop methods to assess and evaluate cultivars for cooking quality and suitability for processing into crisps, dried chips and sweetpotato flour
Research Period:	2000
Implementing Agencies:	University of Nairobi, National Agricultural Research Organization, Uganda Regional Research Center, Kakamega, Kenya
Donors:	NRI, DFID

Summary of Major Research Results

- Among the varieties evaluated, SPK 004, NASPOT 1 and Haraka were considered to have particularly good cooking qualities as they had high dry matter content and yet did not take long to cook
- There was a significant negative correlation between oil content and dry matter content of fried sweetpotato crisps
- The varieties that were considered to have greatest potential for processing into crisps were those with a high dry matter; and crisps of low oil content had high acceptability. These varieties were identified as SPK 013, Kemb 36, Kemb 33, Kemb 20, Kemb 23, SPK 004, 440050 and 440129
- The dried chips of all the 13 varieties screened were susceptible to *Araecerus fasciculatus* infestation, but to varying degrees
- There was a wide range in browning among cultivars
- There was no relationship between dry matter content and rate of browning
- Cultivars with a high dry matter content which showed lower browning (i.e.
- SPK 004, Wendo, Modhial, 188001.2 and 440078, were considered as having the greatest potential for processing into flour

Outputs

- Assessment of sweetpotato cultivars for cooking qualities and suitability for crisp production
- Assessment of cultivar suitability for dried chip processing in terms of resistance to insect infestation
- Studies on variation in root browning among the sweetpotato cultivars evaluated

Publication

Owori, C and Agona, A. 2003. Assessment of sweetpotato cultivars for suitability for different forms of processing. In: Rees, D., Van Oirschot, Q and Kapinga, R (eds.). *Sweetpotato Post harvest Assessment: Experiences from East Africa*. Chatham, UK: Natural Resources Institute. Pp 103-111

4.23 Extending the root shelf life during marketing by cultivar selection

Project No.	R7520
Objectives	<ul style="list-style-type: none"> • To determine the main forms of deterioration for sweetpotato roots during marketing • To determine the extent to which sweetpotato cultivars vary in susceptibility to damage • To determine the extent to which sweetpotato cultivars vary in their intrinsic perishability and the physiological factors that control root perishability • To determine whether it is possible to breed for cultivars with longer shelf life
Research Period:	1996-1998
Implementing Agencies:	Makerere University, Kampala, National Agricultural Research Organization, Uganda, Kenya Agricultural Research Institute, Sokoine University of Agriculture, Ministry of Agriculture, Tanzania, Cranfield University, Silsoe College
Donors:	CIP, DFID, NRI

Summary of Major Research Results

- Under conditions typically experienced during marketing in East Africa, the main forms of deterioration in sweetpotato roots are water loss and rotting
- There is a wide range in shelf life among cultivars, which seems to be primarily due to differences in susceptibility to water loss
- Susceptibility to water loss in cultivars is relatively consistent between seasons. The consistency between environments is less clear, but there are some cultivars that consistently do better than others
- Greatest water loss from roots occurs through wounds
- The two major factors controlling susceptibility to water loss are: reaction of the root to wounding and the susceptibility of roots to damage
- Roots of rounded (i.e. not elongated) are less susceptible to breakages, and roots with thick periderms are less susceptible to surface damage (scuffing)

Outputs

- Determination of the main forms of deterioration in sweetpotato storage roots under East African marketing conditions
- Study on cultivar differences in keeping quality (weight loss and rotting) under simulated marketing conditions
- Examination of cultivar variation in susceptibility to damage

Publication

Rees, D., Van Oirschot, Q.E.A., Kapinga, R.E., Mtunda, K., Chilosa, D., Mbilinyi, L.B., Rwiza, E.J., Kilima, M., Kiozya, H., Amuur, R., Ndondi, T., Chottah, M., Mayona, C.M., Mende, D., Tomlins, K.I., Aked, J and Carey, E.E. 2003. Extending root shelf life during marketing by cultivar selection. In: Rees, D., Van Oirschot, Q and Kapinga, R (eds.). *Sweetpotato Post harvest Assessment: Experiences from East Africa*. Chatham, UK: Natural Resources Institute. Pp 51-66.

4.24 Curing and the Physiology of wound healing

Project No.	R7520
Objective	<ul style="list-style-type: none"> • To determine whether variability in rates of root weight loss and rotting in Tanzania was due to the characteristics of root wound healing
Research Period:	1996-1998
Implementing Agencies:	Makerere University, Kampala, National Agricultural Research Organization, Uganda, Kenya Agricultural Research Institute, Sokoine University of Agriculture, Ministry of Agriculture, Tanzania, Cranfield University, Silsoe College
Donors:	CIP, DFID, NRI

Summary of Major Research Results

- Under sub-optimal humidities (65% ± 10) the wound healing process in sweetpotato follows a similar pattern to wound healing under curing conditions
- The thickness of the desiccated cell layer, and hence the depth of the lignified layer, is affected by both cultivar and humidity
- Some cultivars consistently failed to produce a lignified layer while in others; the layer is often not continuous
- The continuity of the lignified layer is more important for effectiveness of wound healing than the actual thickness
- Wound healing efficiency as measured by lignification was found to be a major factor in the shelf life of sweetpotato cultivars. Lignification of wounds correlates with reduced rate of weight loss and fungal infection

Outputs

- Studies on physiology of wound healing in sweetpotato at sub-optimal humidities
- Studies on the continuity and depth of the lignified layer as an indication of wound healing efficiency in sweetpotato
- Testing the validity of the lignification index as an indicator of wound healing and storability of sweetpotato
- Screening of sweetpotato germplasm using the lignification index

Publication

Van Oirschot, Q.E.A., Rees, D., Aked, J., Kihurani, A., Lukas, C., Maina, D., Mcharo, T., and Bohac, J. 2003. Curing and the physiology of wound healing. In: Rees, D., Van Oirschot, Q and Kapinga, R (eds.). *Sweetpotato Post harvest Assessment: Experiences from East Africa*. Chatham, UK: Natural Resources Institute. Pp 67-84

CHAPTER FIVE: INTEGRATED CROP MANAGEMENT - GENERAL

The competitiveness, food security and income from sweetpotato in East Africa is reduced by several biotic and abiotic factors as well as technology and socioeconomic constraints. Farmers require integrated crop management (ICM) strategies to overcome them, involving interdisciplinary research that combines natural resources and socio-sciences, to develop basic scientific knowledge and management components related to seed, soil, diseases and insects. East Africa researchers, in collaboration with various partners, carried out research on different aspects of sweetpotato, ranging from participatory variety evaluation to sweetpotato crop improvement.



Contributors

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Tanzania

5.1 On-farm testing of sweetpotato varieties in the Lake Zone

Project No.	Q/3/15/95/3
Objectives	<ul style="list-style-type: none">• To test on-farm selected sweetpotato varieties for good level of resistance to sweetpotato weevils, high root yield and good root characteristics• To encourage farmers to participate in the selection and evaluation of varieties that would satisfy their needs and expectations• To assess the performance of new varieties under traditional cropping systems• To understand attributes desired by farmers and develop complementarities between farmers' evaluations and those of researchers in order to maximize the selection efficiency• To assess the acceptability of introduced varieties relative to local cultivars.
Research Period:	1995 to 1996
Implementing Agencies:	Maruku Agricultural and Development Research Institute, Ukirriguru Maruku Agricultural and Development Research Institute
Donors:	CIP, Government of Tanzania, Farming System Research, Lake Zone

Summary of Major Research Results

- Except for variety SPN/O, other varieties showed good resistance to sweetpotato weevils
- Generally, weevil attack was low both on crown and storage roots
- Varieties SPN/O, Biganana, Iboja and Mwanamonde performed well in terms of yield
- No significant differences in foliage vigour between farmers' plots for different sweetpotato varieties assessed

- Variety Iboja gave the highest mean vine weight of 5.9 t/ha followed by SPN/O and Budagala
- Variety Mwanamonde gave the highest overall mean vine yield on average across both sites
- Number of fresh storage roots in Kagera region was much higher than those in Mwanza region
- Variety Budagala had the best flesh colour, followed by Sinia and SPN/O.

Outputs

- Assessment of sweetpotato foliage vigour, vine yields, storage root yield, number of fresh storage roots, resistance to pests and diseases, root flesh colour, cooked root appearance and taste
- Project report by Kapinga *et al*, 1996.

Publication

Kapinga, R and Van de Barte Piters, 1996. On-farm testing of sweetpotato varieties in the Lake Zone. In: *Root and Root research Programme. Progress report for 1996 and workplans for 1997; Ministry of Agriculture and Cooperatives Research and Training Department, Tanzania.*

5.2 Integrated on-farm packages for increased productivity of sweetpotato

Project No.	Q/3/15/95/3
Objectives	<ul style="list-style-type: none">• On- farm testing of new sweetpotato varieties resistant to sweetpotato weevils.• To encourage farmers to participate in the selection and evaluation of varieties that would satisfy their needs and expectations• To assess the performance of new varieties under traditional cropping systems• To understand attributes desired by farmers so as to discover their principal selection criteria• To assess the acceptability of introduced varieties relative to local cultivars• To demonstrate the effectiveness of cultural practices for weevil control and assessment of varieties from research by farmers• To establish feedback flow among breeders, extensionists, and farmers, and develop complementarity between farmers' evaluations and those of researchers to maximize selection efficiency
Research Period:	1995 to 1996

Implementing Agencies: Maruku Agricultural and Development Research Institute,
Ukiriguru Agricultural and Development Research Institute
Donors: Government of Tanzania

Summary of Major Research Results

- Sweetpotato weevil mean crown damage score was highest in Mwampulu (3.1) with variety Sinia giving the highest mean score followed by Iboja and Mwanamonde both with mean scores of 3.1; Budagala and SPN/O gave mean scores of class 2.9 and 2.6 respectively
- Mwangala had a mean damage score of class 3.0 with SPN/O leading with class 3.2, followed by Sinia and Budagala both with mean scores of class 3.0, while Iboja and Mwanamonde had 2.8 each
- Rough weevil damage evaluation mean scores for treatment under each location and across locations indicated low rough weevil damage of below class 2
- All varieties showed high resistance to diseases
- Variety SPN/O was found susceptible to pests
- Hilled up ridges were less attacked by sweetpotatootato weevils compared to roots obtained from uncontrolled ridges.

Outputs

- Evaluation of rough weevil damage
- Sweetpotato weevil mean crown damagedetermined
- Assessment of sweetpotatootato resistance to pests and diseases
- Assessment of agronomic characteristics of sweetpotato
- Project report, Kapinga *et al.*, 1996.

Publication

Kapinga, R., Van de Barte., Kileo, R., Chirimi, B., Nyango, A., and Mutalemwa, M. 1996. Integrated on-farm packages for increased productivity of sweetpotato. In: *Cassava and sweetpotato agronomy, Progress Reports for 1995/1996. ARI Ukiriguru, Mwanza*. Pp 3-21.

5.3 Preliminary observations on the potential for long-term storage of fresh sweetpoatoes under tropical conditions

Project No.	R7520, R7498
Objective	<ul style="list-style-type: none">• To identify and understand the relationship between store design and successful storage of sweetpotato
Research Period:	December, 1999 to June, 2000
Implementing Agencies:	Ukiriguru Lake Zone Agricultural Research and Development Institute
Donors:	NRI, DFID

Summary of Major Research Results

- Damage had the greatest effect on quality
- Best storage was in pits without a grass lining
- Non-ventilated stores were slightly better than stores with extra ventilation
- Pit stores are better than clamp, and use of grass lining did not have any beneficial effects
- Extra ventilation provided by extra pipes did not have a beneficial effect on root quality
- Before storage choice of cultivar had a significant effect ($P = 0.009$) on the estimated market value of roots

Outputs

- Relationship between store design and successful sweetpotato storage
- Significance levels of the factors affecting the estimated market value of stored sweetpotato
- Effect of storage time, cultivar and damage on the estimated market value of sweetpotato roots
- Effect of store design, lining with extra grass and extra ventilation pipes on the estimated market value of stored sweetpotato
- Publication by Van Oirschot *et al.*, 2000. In: *Potential of Root Crops for Food and Industrial Resources; 12th ISTRC, Symposium*, Tsukuba, Japan

Publication

Van Oirschot, Q.E.A., Ngendello, T., Amour, R., Rwiza, E., Rees, D., Tomlins, K.I., Jeffries, D., Burnett, D and Westby, A. 2000. Preliminary observations on the potential for long-term storage of fresh sweetpotato under tropical conditions. In: *Nakatani, M and Komaki, K (eds.). Potential of Root Crops for Food and Industrial Resources. Twelfth symposium of the International Society for Tropical Root Crops (ISTRC)*. Sept. 10-16, 2000; Tsukuba, Japan.

5.4 Effect of host resistance and application of cow manure on yield of sweetpotato and sweetpotato weevil damage

Objectives

- To determine whether there is any difference among cultivars grown in the Lake Zone, in terms of their resistance to weevils
- To determine if there is added yield advantage of using farmyard manure as well as sweetpotato weevil control

Research Period:

1992 to 1993

Implementing Agencies:

Ukiriguru Agricultural and Development Research Institute, Sugarcane Research Institute-Kibaha, Lubaga, Shinyanga, North Carolina State University

Donors:

Government of Tanzania

Summary of Major Research Results

- Application of manure had no significant effect on SPW damage across locations both on storage roots and crowns

- High damage was observed in improved cultivars, SPN/O and TIS 8250
- Although improved cultivars SPN/O and Mwanamonde gave better yields than local cultivars.
- Internal crown damage was negatively correlated to total yield, indicating that considerable yield reduction is likely to occur as a result of sweetpotato weevil damage on the crowns
- Manure application increased storage root size of all cultivars

Outputs

- Sweetpotato weevil damage on different sweetpotato cultivars grown in the Lake zone of Tanzania
- Effect of manure and sweetpotato weevil control, and yield

Publication

Muhanna, M.J and Collins, W.W. 1995. Effect of host resistance and application of cow manure on yield of sweetpotato and sweetpotato weevil damage. In: Akoroda, M.O and Ekanayake, I.J (eds.). *Root Crops and Poverty Alleviation. Proceedings of the Sixth Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch*. 22-28 October 1995, Lilongwe, Malawi. Pp 453-456

5.5 Sweetpotato uniform yield trial

Project No.	Q/3/14/96
Objectives	<ul style="list-style-type: none">• To evaluate the performance of sweetpotato clones for their storage root yield, disease and pest resistance and their adaptability over a wide range of environments• Assessment of the acceptability of the clones by farmers
Research Period:	1996 to 1997
Implementing Agencies:	Maruku Agricultural and Development Research Institute, Uyole Agricultural and Development Research Institute, Tengeru Agricultural and Development Research Institute
Donors:	CIP

Summary of Major Research Results

- No apparent symptoms of sweetpotato mosaic virus disease at both Ukiriguru and Maruku.
- Pest damage on storage root was only serious at Ukiriguru, where clones SP 93/2 and SP 93/23 both had scores of 4, while the rest had 3
- No weevil infestation was observed at Maruku
- No visible symptoms of sweetpotato mosaic virus disease at both Ukiriguru and Maruku.
- Clones performed better in both vine and root yield at Maruku than Ukiriguru
- Mild pressure of weevil infestation at Uyole, and varieties were resistant to moderately resistant to sweet potato virus disease

Outputs

- Sweetpotato pest damage assessed
- Assessment of the agronomic performance and adaptability of the sweetpotato clones over a range of environments
- Project report by Kulembeka *et al.*, 1997. In: *Root/Roots Programme Progress Report for 1996/1997*

Publication

Kulembeka, H., Mayona, C..M., Rugutu, C.K.M, Ndoni, T., Tarimo, F and Mohamed, R. 1997. Sweetpotato uniform yield trial. *Root / Roots Programme Progress Reports for 1996/1997 and Proposals for 1997/98; Ministry of Agriculture, Department of Research and Training, Tanzania*. Pp 75-82. Presented to the Tanzania Root/Roots Coordinating Committee Meeting, 3rd-4thDecember 1997. Hort Tengere, Arusha.

5.6 Effect of leaf harvesting frequency on growth and yield of sweetpotato in the Lake Zone of Tanzania

Objectives

- To assess the effects of leaf harvesting frequency on growth and yield of sweetpotato
- To determine the suitable varietal types for users as source of leaf vegetable
- To determine the suitable leaf harvesting frequency (cies) for reduced detrimental effects on growth and yield of sweetpotato

Research Period: 1996 to 1998

Implementing Agencies: Ukiriguru Agricultural and Development Research Institute, Kibaha Agricultural and Development Research Institute, TCST-Dar es salaam

Donors: CIP, Government of Tanzania

Summary of Research Results

- Overall, significant differences existed between varieties (Budagala, Mwananjemu, SPN/O and Bigana) and harvesting frequencies
- Harvesting at one-month intervals for three times gave the highest leaf vegetable production although the yield was tremendously affected
- Harvesting twice in a growing period proved the best in leaf production as well as root yields
- Mean total leaf weight at Ukiriguru was higher than at Kibaha for all varieties
- Leaf harvesting of variety Mwananjemu gave the lowest vine yield at both Ukiriguru and Kibaha while variety Budagala gave the highest
- Leaf harvesting had limited impact on rootous yield of sweetpotato
- Slight root yield for variety Mwananjemu following leaf harvesting, followed by SPN/O and Budagala respectively

Outputs

- Effects of leaf harvesting on sweetpotato leaf vegetable production, storage root yield and vine yield production
- Determination of suitable varieties for use as source of leaf vegetable
- Publication by Kiozya *et al.*, 2001. In: *African Crop Science Journal*. Vol. 9. Thirty First Issue.

Publication

Kiozya, H.C., Mtunda, K., Kapinga, R., Chirimi, B and Rwiza, E. 2001. Effect of leaf harvesting frequency on growth and yield of sweetpotato in the Lake Zone of Tanzania. In: *Adipala, E., Ogenga-Latigo, M.W and Tenywa, J.S (eds.). African Crop Science Journal, Vol. 9 No. 1. Thirty First Issue.*

5.7 Contribution of sweetpotato to household food security in Eastern Tanzania

Objective	<ul style="list-style-type: none">• To evaluate and identify sweetpotato varieties suitable for short rain season having the following characteristics: resistance to important pests and diseases, high and stable yield per unit area of land and time, early maturity and adaptation to various and specific agro-ecologies
Research Period:	2001-2002
Implementing Agencies:	Kibaha Sugarcane Research Institute, Mikocheni Agricultural Research Institute, Sokoine University of Agriculture
Donors:	CIP

Summary of Major Research Results

- Little damage by weevils (*Cy/as* spp.) was observed in all 12 varieties evaluated, with year two (2002) having higher incidences
- Infestation of sweetpotato by weevils increased during dry conditions
- Due to its long neck, variety Elias is less susceptible to weevils
- SPVD was the most important disease
- Variety Elias was the most affected by the SPVD during both main and short rains, with mean score at Kibaha being 2.7, and 3.3 at SUA, expressing mild symptoms on many plants and some stunting
- Elias had significantly higher yields than the check material Simama while Sinia UKG had significantly lower yield than other varieties

Output

- Sweetpotato pest and disease evaluation

Publication

Mtunda, K.J., Muhanna, M., Masumba, E.A., Msolla, S.N and Ngereza, A. 2003. Contribution of sweetpotato to household food security in Eastern Tanzania. In: Kinabo, D.B., Malimbwi, R.E., Lyimo-Macha, J.G., Makungu, P.J., Nyaki, A.A., and Madata, C.S (eds.). *Towards FOOD*

SECURITY research on production, processing, marketing and utilization. Proceedings of the second Collaborative Research Workshop on Food Security; Organised jointly by Sokoine University of Agriculture and the Ministry of Agriculture and Food Security. 28-30 May, 2003. TARP II SUA PROJECT. Pp 88-96.

Uganda

5.8 Evaluation of promising sweetpotato genotypes for high altitude, cool, moist agro ecologies of Uganda

Objective	<ul style="list-style-type: none">To identify sweetpotato genotypes with adaptation to high land agro ecologies with special reference to resistance to <i>Alternaria</i> blight
Research Period:	November, 1995 to June, 1997
Implementing Agencies:	National Agricultural Research Organization

Summary of Major Research Results

- There was high significant differences ($P = 0.05$) in storage root yields and *Alternaria* disease in the two trials
- Four clones namely 137, 192, 218, and 324 showed high levels of resistance to *Alternaria* blight and high yields than the local check Magabari
- Genotype 69 was slightly resistant to *Alternaria* attack
- Dry matter content was high during 1995A season's trial ranging from 29.2% for variety Wagabolige to 37.7% for variety Sowola while local check Magabari had 37.5%
- At high elevation, major constraints to Sweetpotato are mainly leaf and stem blights caused by *Alternaria bataticola*, few adapted cultivars, and low soil fertility

Outputs

- Sweetpotato genotypes adapted to highland agroecologies and resistant to *Alternaria* blight identified
- Major constraints to sweetpotato at high elevation identified
- Publication by Turyamureeba *et al.*, 2000 in: *Uganda Journal of Agricultural Sciences* 5: 40-42

Publication

Turyamureeba, G., Mwanga, R.O.M and Carey, E.E. 2000. Evaluation of promising sweetpotato genotypes for high altitude, cool, moist agro ecologies of Uganda. *Uganda Journal of Agricultural Sciences*, 5: 40-42

Regional

5.9 Improving long-term storage under tropical conditions: Role of cultivar selection

Project No.	R7520
Objective	<ul style="list-style-type: none"> To examine the extent to which cultivar selection might affect the success of long-term storage of sweetpotato in terms of resistance to roots, low respiration rates, and a reduced tendency to switch to anaerobic respiration
Research Period:	1996-1998
Implementing Agencies:	Ukiriguru Agricultural and Development Research Institute, Sugarcane Research Institute-Kibaha, Lubaga, Shinyanga, North Carolina State, Kenya Agricultural Research Institute, Makerere University Kampala, Sokoine University of Agriculture, Cranfield University, Silsoe College, National Agricultural Research Institute, Uganda
Donors:	CIP, DFID, NRI

Summary of Major Research Results

- Sweetpotato cultivars differ in their susceptibility to pathogens responsible for rotting when maintained at high humidity, and this is at least partly due to the induction of antifungal chemicals
- Differences in respiration rate exist, but there was no evidence of a difference in tendency to switch to anaerobic respiration
- Cultivar Polista had a higher rate of respiration than Sinia and SPN/O

Outputs

- Assessment of cultivar differences in keeping qualities under long-term storage conditions
- Study on susceptibility of sweetpotato cultivars to rotting, and tissue defence mechanisms against rotting
- The physiological basis for differences in sweetpotato cultivars in susceptibility to rotting
- Assessment of cultivar respiration rates, and cultivar susceptibility to switch to anaerobic respiration

Publication

Rees, D., Van Oirschot, Q.E.A., Mbilinyi, L.B., Muhanna, M and Tomlins, K.I. 2003. Improving long-term storage under tropical conditions: role of cultivar selection. In: Rees, D., Van Oirschot, Q and Kapinga, R (eds.). *Sweetpotato Post harvest Assessment: Experiences from East Africa*. Chatham, UK: Natural Resources Institute. Pp 85-92.

