



# **Best-bet research outputs for enhancing agricultural productivity in Eastern and Central Africa: Abstracts**

Lydia Kimenye and Alexander Bombom






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in Eastern and Central Africa

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# Acronyms

AHI	African Highlands Initiative
AMS	Africa Maize Stress
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASPS	Agricultural Sector Programme Support
CBO	Community based organisations
CBSD	Cassava brown streak disease
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (International Maize and Wheat Improvement Center)
C3P	Crop Crisis Control Project
CMD	Cassava mosaic disease
CRS	Catholic Relief Services
DIFBSS	Decentralized Informal Farmer-Based Seed System
DRC	Democratic Republic of Congo
EARRNET	Eastern Africa Root Crop Research Network
ECA	Eastern and Central Africa
ECABREN	Eastern and Central Africa Bean Research Network
ECAMAW	Eastern and Central Africa Maize and Wheat Research Network
ECARSAM	Eastern and Central Africa Regional Sorghum and Millet Network
ECAPAPA	Eastern and Central Africa Programme on Agricultural Policy Analysis
FAO	Food and Agriculture Organization of the United Nations
FICA	Farm Input Care
FFS	Farmer field school
GIS	Geographic information system
ha	Hectares
HPI	Heifer Project International
IARC	International agricultural research centre
ICRAF	World Agroforestry Centre (formerly the International Centre for Research in Agroforestry)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IR	Imidazolinone-resistant
K	Potassium
KARI	Kenya Agricultural Research Institute
KATRIN	Kilombero Agricultural Training and Research Institute
KEPHIS	Kenya Plant Health Inspectorate Services
M/B	Mother/Baby Trial Design
MDTF	Multi-Donor Trust Fund
N	Nitrogen
NAADS	National Agricultural Advisory Services
NaCRRRI	National Crops Resources Research Institute
NARI	National agricultural research institutes
NARO	National Agricultural Research Organisation

NARS	National agricultural research systems
NASECO	Nalweyo Seeds Company
NERICA	New Rice for Africa
NGO	Non-governmental organisations
NOFSP	Non-orange fleshed sweet potato
NPP	Networks, Programmes and Projects
NPT	National Performance Trials
NRM	Natural resources management
OFSP	Orange fleshed sweet potato
OPV	Open pollinated varieties
P	Phosphorus
PRAPACE	Regional Potato and Sweet Potato Improvement Network in Eastern and Central Africa
QPM	Quality protein maize
QPMD	Quality Protein Maize Development Project
R4D	Research for development
R&D	Research and development
RIU	Research into use
SAA-U	Sasakawa Africa Association Uganda
SACCO	Savings and credit cooperative
t	tonnes (metric tons)
TOFNET	Trees on Farm Network
TUUSI	Technology Uptake and Upscaling Support Initiative
UCA	Uganda Cooperative Alliance
UJA	Uganda Japan Association
WFP	World Food Programme



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We also wish to thank the consultants from Research Into Use (RIU) for their input in the design of the pro forma that was used to collect information on the research outputs from the NPPs.

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The views expressed are those of the authors and do not necessarily represent the position of ASARECA or its partners who support its programmes. The authors take full responsibility for any errors.

## Preface

The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) was established in September 1994 and comprises 10 member countries: Burundi, Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda.

ASARECA is a sub-regional not-for-profit organisation whose mission is:

*To enhance regional collective action in agricultural research for development, extension, training and education to promote economic growth, fight poverty, eradicate hunger and enhance sustainable use of resources in Eastern and Central Africa.*

This mission is a commitment to overcome poverty and hunger in the ECA region. ASARECA sees improved delivery and impact of scientific knowledge, policy options and technologies as a powerful instrument to drive the sub-region towards meeting the Comprehensive Africa Agricultural Development Programme (CAADP) which is the agricultural agenda of the African Union/New Partnership for Africa's Development (AU/NEPAD) and the Millennium Development Goals (MDGs).

The 10 ASARECA member countries have been and are currently investing in agricultural research, extension, education and training. While ASARECA mobilises operational finances for sub-regionally planned agricultural research activities, the partner national agricultural research systems (NARS) contribute their infrastructure, personnel and some funding towards the sustainable implementation of the programmes. One of the goals of CAADP is for each country in Africa to increase its share of the national budget for agriculture to 10%. The Heads of State of the 10 countries, along with all their counterparts in Africa, have committed themselves, to increase the share of their national budgets for agriculture to achieving this goal. The support provided to ASARECA by the development partners adds value to ongoing agricultural development efforts in the sub-region to achieve the goals of CAADP.

Over the past two years, ASARECA has reviewed its past performance, current status and future projections of agricultural performance in ECA and laid out strategic directions and priorities for ASARECA (2007–2016). The Association also laid out the Strategic Directions and Priorities for Agricultural Development in the region in the context of the CAADP and the MDGs.

ASARECA serves as a forum for promoting regional agricultural research and strengthening relations between NARS in ECA with each other and with the Consultative Group for International Agricultural Research (CGIAR). ASARECA has expanded its mandate to link agricultural research to the political dialogue through the Common Market for Eastern and Southern Africa (COMESA), the Forum for Agricultural Research in Africa (FARA) and AU/NEPAD. ASARECA monitors political and institutional change in the global research environment and provides representation in such fora to its member countries.

ASARECA adds value to the work of NARS in the sub-region through:

- The identification of shared goals and the promotion of economies of scale and scope through collaboration, specialisation and sharing of results.
- The identification of sub-regional public goods that would be under-produced in the absence of shared goals and a regional mechanism.
- Sharing of knowledge and experiences with institutional innovation for more effective agricultural research for development (AR4D), extension and agricultural training and education.

ASARECA has seven new programmes. These are:

1. Staple Crops
2. High Value Non-Staple Crops
3. Livestock and Fisheries
4. Agro-Biodiversity and Biotechnology
5. Natural Resource Management and Biodiversity
6. Policy Analysis and Advocacy
7. Knowledge Management and Upscaling

Central to the vision and the mission of ASARECA is the recognition of the value of regional collaboration and the need for regional collective action among member countries and their partners. Also central to the vision and mission is the notion that agricultural research, convened and facilitated by ASARECA, furthers development aims such as broad-based economic growth, poverty eradication and improved livelihood.

What is presented in this document are abstracts of best-bet research outputs generated through efforts of former research networks, programmes and projects (NPPs) of ASARECA in collaboration with other partners in the sub-region. The production of this document was started by the former Technology Uptake and Upscaling Support Initiative (TUUSI) and completed by the Knowledge Management and Technology Uptake Programme. I would like to thank Dr Lydia Kimenye, Manager, Knowledge Management and Upscaling Programme and the former NPP coordinators who provided the information that was used to compile this document.



**Seyfu Ketema**

Executive Director, ASARECA

## Foreword

This booklet contains abstracts of 37 proven best-bet agricultural technologies and innovations that are available for uptake and up scaling in the Eastern and Central Africa (ECA) sub-region. These were generated by former Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) research networks (NPPs) and their partners in the national agricultural research systems (NARS) in the sub-region. They represent a collection of well tried and tested technologies and approaches that have potential for up scaling to improve livelihoods. The abstracts, which have been grouped into eight thematic clusters, give brief accounts of the technologies, the intended end-users, areas where the technologies and innovations are currently being used, the dissemination and scaling out methods used and lessons.

The crop varieties cluster gives a brief account of technologies that address issues of low crop yield, pests, disease and environmental stress. These technologies also address product quality such as enhancing the nutritive content of the produce. The crop management practice cluster describes improved agronomic practices for enhancement of crop performance. These technologies aim to enable farmers improve their farming methods to boost production. The technologies cover areas such as improved tillage practices, water and soil fertility management, pest and disease management and the proper use of improved crop varieties within the context of existing farming systems. In the post-harvest processing and utilisation cluster, technologies focus on value addition to agricultural products with a view to increasing the potential to improve utilization, farmer incomes and livelihoods. The cluster on technology uptake approaches presents innovative pathways to uptake and adoption of agricultural technologies among farming communities, factors hindering technology uptake and how they can be addressed. The seed systems cluster provides innovative approaches to farmer-level production and distribution of improved seed of crops that are not attractive to private seed companies. Such crops include cassava, sweet potato, indigenous African vegetables, beans, rice and open pollinated maize varieties. The natural resource management cluster describes technologies aimed at filling in the knowledge gaps on sustainable management of natural agricultural resources. The seventh cluster has approaches for improving smallholder farmers' access to credit and to markets. In this cluster, the best-bet approach to credit systems describes a methodology for building the capacity of farmers to finance adoption of natural resources management based technologies. The last best-bet in this cluster is a case study describing an approach that was used to link smallholder potato farmers to a remunerative urban market. The last cluster has one best-bet research output on policy. It is a brief account of a case study on harmonisation of seed policies and standards among several countries in ECA.

The compilation of the research outputs, synthesis and production of the abstracts was started by the former ASARECA Technology Uptake and Upscaling Support Initiative (TUUSI). In 2009, TUUSI and its ongoing activities, which include production of this booklet, were integrated into the Knowledge Management and Upscaling Programme. The final production of this booklet is therefore done under the Knowledge Management and Upscaling Programme.

For each technology or innovation, contact details are provided for the organisation where further information can be obtained. In addition, a database of best-bet research outputs, which provides detailed descriptions of these technologies and processes, is available at <http://www.asareca.org/tuusi>.

Lydia Kimenye  
Programme Manager  
Knowledge Management and Upscaling  
ASARECA



## Cluster 1: Crop varieties

### 1.1 Sustaining smallholder livelihoods with improved cassava varieties

Cassava offers a cheap source of food to a multi-cultural population in sub-Saharan Africa. It is a source of food security for many rural households. However, in the late 1990s, its production in the sub-region came under serious threat from the cassava mosaic disease (CMD). Through research, the Eastern Africa Root Crops Research Network (EARRNET) developed and released several cassava varieties resistant to CMD in different countries. These include TMS60142 (NASE 1), TMS30337, TMS30572, SS4, SS5, TMS(2)1425, CE85, CE98, 30555-17, 95/NA-00063, 92/NA-2-TC1, MH95/0414, MH2961 and 00067 (Uganda); TME14, 95/NA/00063 and I92/0057 (Rwanda); MM96/5280, MM96/0619, MM96/7688, MM96/2266, ABBEY-IFE, MM96/2352 and MM96/5533 (Burundi); MM96/0287, MM96/7762 and MM96/7204 (Democratic Republic of Congo, DRC); clones 675, 75, 35 (Madagascar). EARRNET in collaboration with national agricultural research systems (NARS), non-governmental organisations (NGOs), farmer groups/organisations and other stakeholders multiplied and distributed the varieties through the Crop Crisis Control Project (C3P). By mid-2000, the varieties were being used by over 302,000 households in western Kenya and about 80% of the small-scale farmers in Uganda. Similar trends in uptake and adoption have been reported in Burundi, DRC, Madagascar, Rwanda and Tanzania. Some of these varieties, however, have been found susceptible to a new threat—Cassava brown streak disease (CBSD). Research to develop varieties that are tolerant of or resistant to CBSD is ongoing in the sub-region.

A key lesson was that early mitigation measures are crucial to averting crop loss due to disease and ensure sustainable livelihoods for farm families. Involvement of multiple stakeholders in the research encouraged ownership of the processes and helped to ensure relevance of the technologies.



For further details on this output please contact the International Institute of Tropical Agriculture-Uganda (IITA-Uganda), 15 Naguru East Rd, PO Box 7878, Kampala, Uganda. Tel: +256 414 2850064. Email: p.ntawuruhunga@iita-uganda.org

**Project Title:** *Cassava Mosaic Disease Resistant and High Yielding Cassava Varieties*

## 1.2 Improved rice varieties to combat Rice Yellow Mottle Virus Disease

Rice farmers in Tanzania can now rest assured their crop will not be destroyed by the devastating Rice Yellow Mottle Virus Disease. The release of two resistant rice varieties, Mwangaza and Kalalu, has boosted farmer production in Kyela, Kilombero and Mvomero districts. Farmer yields have gone up by 50% and so have the proceeds from the sale of rice. On-farm research trials and farmer-to-farmer interactions were used to disseminate the technology within the locality. Printed extension leaflets and the involvement of extension staff and other stakeholders made it possible to disseminate the varieties to other areas. However, low production and distribution of seed has limited widespread adoption among the intended beneficiaries: rural farmers. Besides this, uptake of the varieties has been slow in other areas because the disease is localised in nature.






Among the lessons learned in disseminating these technologies was that widespread use of the mass media and involvement of local authorities to speak about the varieties can help reach more farmers. The varieties are currently being used by small-scale farmers in Tanzania, mostly concentrated around hot spot areas for the disease. These include Kilwa, Ngonga, Bujonde, Mwaya and Mababu villages in Kyela District. The technology is also spreading to other districts of Tanzania including Ifakara, Morogoro and Kilosa. Introductions and use of these two resistant varieties has also been reported in DRC and Kenya.

For further information please contact the Mikocheni Agricultural Research Institute, P.O. Box 6226, Dar es Salaam, Tanzania. Tel: +255 22 2700552. Email: aluzikih@yahoo.com

**Project Title:** *Mwangaza and Kalalu Rice Varieties Resistant To Rice Yellow Mottle Virus*

### **1.3 Participatory pest control—Involving farmers in varietal selection for *Striga***

Maize varieties tolerant of *Striga* infestation are now available to farmers in western Kenya thanks to the CLEARFIELD technology. The imazapyr-resistant maize technology combines low dose seed coating of STRIGAWAY (active ingredient imazapyr) applied to the imidazolinone-resistant (IR)-maize. Developed by BASF, the technology relies on herbicide resistance derived from a naturally occurring gene in maize. In a participatory rapid appraisal, *Striga* ranked first as a constraint. With active farmer participation, the technology has been applied to various maize lines and varieties. The result has been the release of four IR-maize hybrids and one Open Pollinated Variety (OPV) in Kenya and at least five hybrids given to the National Agricultural Research Organisation (NARO, Uganda) to include in the national performance trials (NPTs) and distinctness, uniformity and stability (DUS) tests. After these trials and tests, it is expected that some of the varieties may be released in Uganda and become available to farmers in the country. The IR-maize varieties yield up to 80% more than normal maize varieties under *Striga* conditions. Three seed companies—Western Seed Company, Kenya Seed Company and Lagrotech—are actively involved in the production and distribution of seed. The companies produce up to 100 tonnes (t) of commercial seed and are involved in the continual development and release of maize varieties. The varieties have been disseminated through demonstrations, field days, agricultural shows, farmer participatory evaluations, brochures, posters and the mass media. Over 200,000 farmers have been reached in western Kenya. IR-maize is currently being grown in the following areas: Kisumu, Siaya, Vihiga in Kenya; Mara, Tarime, Mwanza, Mvomero, Muheza in Tanzania; Busia, Palisa, Bugiri in Uganda and Shoa and Pawe in Ethiopia. Other possible users include PANNAR Seed and Seed-Co who have shown interest in the IR-maize inbred lines.



Scaling out was done through partnerships with national agricultural research institutes (NARIs), NGOs and the private sector, each playing a specific role in scaling out the varieties. IR-maize seed was made commercially available in the market from the onset of the short rains of 2007. A key lesson was that client participation and opinion were important considerations in developing technologies for the rural poor if wide scale uptake and adoption are to be achieved. Moreover, establishment of strategic partnerships with key stakeholders and obtaining government support in terms of appropriate policy is important to the success of these technologies.

For further information on this technology please contact CIMMYT-Kenya, PO Box 1041, Village Market-00621, Nairobi;  
Tel: +254 20 7224600. Email: f.kanampiu@cgiar.org  
or ILRI-Ethiopia Campus, PO Box 5689, Addis Ababa, Ethiopia.  
Tel: +251 116 462326. Email: z.mduruma@cgiar.org

**Project Title:** *Striga Tolerant Maize Varieties, Resistant (Ir) Maize, Farmer-Managed Trials, Participatory Imidazolinone Rural Appraisal*

## 1.4 Stress tolerant maize to boost smallholder productivity

Over 80% of the farmers in Eastern and Central Africa (ECA) depend on rainfed agriculture. Maize is a staple crop in the sub-region, grown mainly under rainfed conditions. This makes drought one of the major constraints affecting its production. Maize production is also affected by low levels of soil fertility, especially due to nitrogen deficiency. Through a framework of the Africa Maize Stress (AMS) project, Phases I and II, in collaboration with NGOs, farmers, NARS, the International Maize and Wheat Improvement Center (CIMMYT) and other stakeholders, the Eastern and Central Africa Maize and Wheat Network (ECAMAW), evaluated maize germplasm under controlled and rainfed stresses and various biotic stresses. The outcome was the release of three categories of maize varieties—early maturing; extra-early maturing; and drought and low nitrogen tolerant varieties. Some of these varieties include ECAVL1, ECAVL2, ECAVL16 STRS, ZM621, ZM521 and Espoir. Farmers were involved in the evaluations through use of farmer participatory research approaches using “mother–baby” trials. By the end of the project, seed production had been scaled up to 1500 t. This was done through collaboration with small local seed companies and community based organisations (CBOs).

Dissemination was done using promotional packets and demonstrations. Other methods used to disseminate information included field days, agricultural shows/fairs, brochures, posters, and the mass media including various local and international newspapers, and radio and television stations. Over 500,000 farmers in Ethiopia, Kenya and Tanzania were reached. Scaling out of the technology was carried out

through collaborative efforts among all stakeholders, facilitating the community based seed production and distribution, and the involvement of government through lobbying and advocacy. Several seed companies such as SUBA Agro, East Africa Seed Company and Zenobia, and various contract farmers in Tanzania were producing over 300 t of the released drought tolerant maize varieties like Situka 1 and Situka M1. By 2006, the stress tolerant varieties were being cultivated on an estimated 65,000 ha by over 100,000 farm families in Burundi, Ethiopia, Kenya, Tanzania and Uganda. However, through discussion fora, stakeholders realised that countries are at different levels in research and policy issues relating to variety release. There is therefore need to harmonize and streamline the standards and policies in order to enhance the up scaling and impact of these technologies across countries in the sub-region.

For further information please contact CIMMYT-Kenya, PO Box 1041, Village Market 00621, Nairobi. Tel: +254 20 7224600. Email: a.o.diallo@cgiar.org or ILRI-Ethiopia Campus, PO Box 5689, Addis Ababa, Ethiopia. Tel: +251 116 462326. Email: z.mduruma@cgiar.org

**Project Title:** *Drought and Low-N Tolerant Maize Germplasm and Varieties— Inbred Lines, Populations, OPVs, Hybrids*

## **1.5 Improved bean varieties benefit farmers in nutrient deficient areas**

Environmental stress has always been a major factor affecting bean production in ECA, specifically phosphorus deficiency. Five market-class bean genotypes, namely red kidneys, red mottled, white/navy, small red and pinto, were selected for tolerance to sub-optimal (low) soil phosphorus. The varieties yield approximately 1 t/ha at farm level with few inputs and meet the local people's taste and food preparation preferences. The involvement of traders in the selection process further ensured that market preferences were taken into account. This enhanced the marketability of the varieties. In this way, both farmers and traders would benefit in the long run. Currently, the varieties are being used in the Western Province of Kenya in at least 10 districts: Vihiga, Kakamega North and South, Kisumu, Kisii, Gucha, Siaya, Manga, Embu and Trans Nzoia. The methods used to disseminate the varieties included demonstrations and field days organised by the Ministry of Agriculture. They were able to reach up to 50% of the farmers in these communities. Scaling out of the technology was done through creation of awareness on the availability of low phosphorus tolerant varieties by the ministry extension department, and by sale of the varieties to other stakeholders involved in bean production and NGOs involved in extension work. Currently, the varieties have been adopted by up to 62 individual farmers, 3 farmer groups and 3 NGOs. Efforts are underway by the Kenya Agricultural Research Institute (KARI), Embu, to have the varieties tested



in the Central and Eastern provinces of Kenya. Outside Kenya, these varieties are being promoted in DRC, Rwanda and Uganda.

The use of individual farm and group demonstrations, farmer groups mobilised by NGOs and the Ministry of Agriculture extension department proved to be more effective methods for disseminating technologies that involve crop varieties. However, lack of adequate seed of the improved varieties limits the scaling out and widespread adoption. Promotion of community level seed production, multiplication and distribution therefore would provide alternative ways to deal with the constraint of inadequate seed and encourage widespread adoption.

For further information on this technology please contact KARI Grain Legumes Research Programme, PO Box 57811-00200, Nairobi, Kenya.  
Email: rachiergj@yahoo.com


**Project Title:** *Screening and Dissemination of Common Food Bean (Phaseolus vulgaris) Genotypes for Tolerance to Low Phosphorus Soil*

## **1.6 Promoting climbing beans in central and eastern highlands of Kenya**

Introduced into Kenya in the mid-1970s, climbing beans are gaining popularity among farmers in the central and eastern highlands of the country. Initial efforts to introduce the beans did not achieve much success because research then was in

favour of bush beans. Through the Eastern and Central Africa Bean Research Network (ECABREN), climbing beans have been promoted, adopted and disseminated over the years using participatory on-farm trials, education institutions, local farmer groups, and involving other collaborators. There are several factors that have led to the widespread acceptance of these beans. These include high grain yields (up to 5 t/ha), availability of inputs locally, the shrinking farm sizes which have made climbing beans more attractive than bush beans, relatively low cost of production, the ability of the beans to contribute to soil fertility in the region and the good environmental conditions available for its cultivation. Yields of climbing beans have gone up by 50% over a 10-year period in comparison to a 60% reduction in the yields of bush beans. Different kinds of dissemination methods were used. They included farmer group approaches in production and distribution of seed, participatory on-farm trials and demonstrations, on-station trials and demonstrations (both farmer and researcher managed), in-house and field training of partners on crop/grain and seed production, institutional (schools, other KARI centres, faith-based organisations, CBOs, NGOs, universities etc.) approach, and exhibition and distribution of planting materials in agricultural shows and field days. By the end of the project, the number of farmer groups and institutions growing climbing beans had grown by 80% over the 10 years. The varieties are currently cultivated by smallholder farmers, students within school garden projects, and by scientists as experimental crops. Uptake of the climbing beans is still spreading and, in areas





where the technology has been promoted, adoption rates of about 30% amongst farm families have been reported. In Kenya, the climbers are currently being grown in Embu, Thika, Meru South, Murang'a, Meru Central, Nyeri, Kirinyaga, Nyandarua, Kakamega and Kisii districts. These beans are also being introduced in other ECA countries including DRC, Rwanda, Tanzania and Uganda.

For further information on climbing bean varieties please contact the Kenya Agricultural Research Institute (KARI), PO Box 57811-00200, Nairobi, Kenya. Email: kariembu@salpha.co.ke

***Project Title:** Medium Altitude Climbing Bean Varieties [Varieties and Production Techniques]*

## **1.7 Quality Protein Maize—Answering the plight of marginalised farm families**

Farm families in the ECA region stand to benefit from the development and release of maize varieties high in two essential amino acids: lysine and tryptophan. Through the “Quality Protein Maize Development (QPMD) Project for The Horn and Eastern Africa”, efforts to increase the protein content of maize were initiated by CIMMYT working with NARS in Ethiopia, Kenya, Tanzania and Uganda in January 2003. The QPMD project goal was “improved food security, nutrition and farm income of resource-poor farming families”. The quality protein maize (QPM) varieties were developed through conventional breeding methods. Nine varieties of QPM have been released so far: Lishe K1, Lishe H1, Lishe H2, TAN H611Q, Longe-5 (Nalongo), BHQP542, KH531Q, KH631Q and WSQ104.

Over 3400 QPM field demonstrations and 200 field days have been held and over 23,000 farmers have participated in promotional events in the dissemination exercise. QPM exhibits of seed and samples of food products made using QPM varieties have been displayed at agricultural shows and similar events and attracted more than 150,000 visitors. Other dissemination methods used included the mass media, which was used to broaden the scope of clients reached. Scaling out was done through lobbying and advocacy with government institutions such as ministries of health, and international agencies such as the Food and Agriculture Organization of the United Nations (FAO) and the World Food Programme (WFP); establishment of multi-disciplinary QPM working groups in each ECA country; and collaborations with the private sector, especially seed companies, women groups and extension service providers. Sasakawa Global 2000 in collaboration with other stakeholders spearheaded the promotion and distribution of QPM seed in various ECA countries. These efforts resulted in increased production levels from less than 1000 t in 2003 to over 1800 t in 2006. It is estimated that over 72,000 ha of QPM were planted in 2006 by over 144,000 farm families. This acreage resulted in an

estimated total QPM grain production of over 217,000 t of which, 78,000 t was consumed at the household level leaving a marketable surplus of approximately 139,000 t. QPM is grown by smallholder farmers in Ethiopia, Kenya, Tanzania and Uganda. Evaluation is on-going for release of QPM varieties in other countries such as in Burundi, DRC and Rwanda.

For further information please contact ILRI-Ethiopia Campus, PO Box 5689, Addis Ababa, Ethiopia. Tel: +251 116 462326. Email: d.friesen@cgiar.org; z.mduruma@cgiar.org

**Project Title:** *Quality Protein Maize Varieties (QPM)—Hybrids, Synthetics, Open Pollinated Varieties (OPVs). Use of Quality Protein Maize to Improve Human and Livestock Nutrition and Increased Household Income*

## 1.8 Improved rice varieties for Uganda's uplands

Recent initiatives in the development and improvement of upland rice varieties have renewed the optimism of rice farmers. The varieties, known as New Rice Varieties for Africa (NERICA), are moderately tolerant of multiple stress conditions, yield well and have the potential to improve farmer livelihoods. They include NERICA-1, NERICA-10 and NERICA-4. In Uganda, the varieties were developed by researchers at the National Crops Resources Research Institute (NaCRRI) working in collaboration with rice farmers, seed companies, the National Agricultural Advisory Services (NAADS) and agro-input dealers.

Three dissemination approaches were used: demonstrations and field days conducted in five districts (Wakiso, Luweero, Iganga, Kamwenge and Masindi); video documentary; and use of print materials both in the mass media and as brochures. Uptake was more evident among farmers in Masindi than in Wakiso. The reasons for this could not be easily established. Scaling out was achieved through the partnerships with NAADS, farmer associations, seed companies and NGOs. Farm Input Care (FICA), Nalweyo Seeds Company (NASECO), and Victoria seeds are actively involved in seed production, distribution and technology dissemination. Other organisations involved in scaling out include Sasakawa Africa Association Uganda (SAA-U), Uganda Cooperative Alliance (UCA) and Uganda Japan Association (UJA). All the seed companies, on average, sold 200 t of rice seed per year in 2004, 2005 and 2007. The varieties have been adopted by women groups in Iganga and farmers' associations in Masindi, Kamwenge, and Hoima. Other users include seed companies, agro-input traders and grain processors. Follow-up studies on uptake in 2006 revealed that 30% of tobacco farmers had turned to rice growing. In Mahyoro sub-county, Kamwenge District in western Uganda, the number of farmers who began to grow rice increased from 60 in 2002 to 400 in 2006. In addition, relief organisations introduced the technology to the displaced persons in northern Uganda in the districts of Lira, Gulu, Amuru,



**NERICA 4**



**NERICA 1**



**NERICA 10**

Pader and Kitgum as part of a resettlement programme for the farmers. About 600 t of rice were produced between 2004 and 2006 in Gulu alone generating about 36 million Uganda shillings (approximately US\$ 20,000). NERICA-4 is the most widely preferred variety with an estimated market share of about 70%. Among the reasons for the high uptake are its high yield, tolerance to multiple stress conditions and its semi-aromatic trait. Uptake of NERICA-1 and NERICA-10 has not been substantiated yet but there is potential for their wider use in the country.

To further improve scaling out of the technology and to increase its impact, there is need to set up collaborative demonstrations with the existing NAADS system at



the sub-county level. Furthermore, the delivery of inputs should also incorporate quicker methods of delivering information on the technologies. Such methods would include radio programmes in the form of folksongs, skits, talk shows and use of image libraries in different locations. These provide information and easy-to-learn ways of training. Other than targeting the sub-counties, demonstrations could be established in training institutions such as on school farms, agricultural training farms and university demonstration farms.

For more information on this technology, please contact the Cereals Programme, National Crops Resources Research Institute (NaCRRI), PO Box 7084, Kampala, Uganda. Email: lamo\_jim2000@yahoo.com

**Project Title:** *Three Commercial Upland Rice Varieties (Nerica-1, Nerica-10 and Nerica-4) For Uptake by Farmers*

## **1.9 Orange fleshed sweet potato varieties – Better health, better livelihoods**

Up to 50 million children in sub-Saharan Africa could benefit from the new orange fleshed sweet potato (OFSP) varieties. Adoption of these varieties could alleviate vitamin A deficiency for 85–95% of the children, in addition to the benefits for child-bearing women. Varieties being promoted by the Regional Potato and Sweet Potato Improvement Network in Eastern and Central Africa (PRAPACE) include Kakamega, Kemb 10, Zapallo, Serura, Muganda and Yanshu. These varieties have been widely tested in the sub-region for adaptability and acceptability with satisfactory performance. Women and children form the biggest group of end-users to benefit from this technology. Other users include medium- and small-scale food processing enterprises involved in value addition and animal feeds processors. High adoption rates of over 84% have been registered, with households increasing the area of land allocated to OFSP by 75–100%. Productivity gains in terms of increase in yield are between 56% and 103%. While the OFSP varieties mature early, their main benefit is their richness in pro-vitamin A. The varieties have been shown to contain 20–30 times more  $\beta$ -carotene than Golden rice does, providing richer sources of vitamin A. Kemb 10 is the most widely adopted variety dominating over 50% of the domestic market for sweet potato in East Africa and 30% of the exports to Europe. Besides the economic gains, Kemb 10 is widely adaptable across environments and has high yields. The variety helps boost farm family food security, nutrition and livelihoods. Methods used to disseminate the technology included farmer field schools (FFS), on-farm participatory research approaches, demonstrations and field days, field visits and the mass media. Scaling out was done through stakeholder participation and collaboration, especially among NARS, NGOs and CBOs, individual farmers and farmer groups/associations.



The technology is currently being used in the districts of Busia, Teso, Siaya, Kakamega and Vihiga in Kenya; Gitarama, Kibungo, Butare, Ruhengyeri, Gisenyi, Byumba, Kigali Rural, Kibuye and Cyangugu provinces in Rwanda; Morogoro, Sengerema, Ukerewe, Nyamagana and Ilemela districts in Tanzania; Kumi, Soroti, Katakwi, Mbale, Kamuli, Mpigi, Wakiso, Mukono, Kiboga and Luweero districts in Uganda; and in Gitega, Muramvya, Ngozi, Kayanza, Karuzi, Kirundo and Muyinga provinces in Burundi. Wider and faster adoption and utilisation of the technologies could be fostered by using dissemination methods that involve stakeholder participation, which ensures relevance of technologies and helps to create a sense of ownership of the technologies/innovations. The lessons suggest that dissemination and up scaling efforts should be based on an approach that is holistic and demand-driven with an emphasis on establishing strong public–private partnerships. The public sectors in the various member countries should play the roles of establishing the necessary infrastructure and providing overall guidance at national level, technical oversight and monitoring. The private sector should be the engine of development based on the “demand-driven, market-oriented” principles. However, in spite of the multi-stakeholder participation along the production–consumption continuum, effectiveness rather than the size or number of actors involved is paramount.


For further information on this technology please contact the Sweet Potato Programme, National Crops Resources Research Institute (NaCRRI), PO Box 7084, Kampala, Uganda. Email: [rmwanga@naro-ug.org](mailto:rmwanga@naro-ug.org)

**Project Title:** *Regional Orange-Fleshed Sweetpotato (OFSP) Sweetpotato Varieties*

## 1.10 Boosting food security with sweet potato

Improved non-orange fleshed sweet potato (NOFSP) varieties developed through regional efforts with stakeholders are helping to combat hunger in sub-Saharan Africa, including ECA. Compared with traditional varieties, improved NOFSP have a shorter growing cycle (3 months), yield 3–4 times higher than other varieties and can fetch over US\$ 300 per hectare. The varieties include Muganda, Kemb 10, Wagabolige, Yanshu, Kakamega and Zapallo. Collaborative efforts by NARS, NAADS, international agricultural research centres (IARCs) and NGOs have contributed to multiplication and distribution of clean planting material to farmers in most countries in the ECA sub-region. Dissemination has been achieved through farmer participatory research approaches, FFS, field days and visits and demonstrations. The farmer participatory breeding approach was especially useful in hastening generation and delivery of the improved technologies by NARS and IARCs to farmers. Muganda, Kemb 10 and Kakamega were the three most widely adopted varieties with adoption rates of between 60% and 70%. This is because of their high yield, early maturity, good taste, adaptability to different environments, longevity of storage in soil, potential utilisation in processing (especially in production of animal feeds) and market demand. About 95% of the end users of the improved varieties comprise small-scale farmers and women farmer groups. At least 60% of the farmers are aware of utilisation and processing technologies. Scaling out of the technology was done





using stakeholder participatory approaches involving key players in the entire production–consumption continuum with a thorough integration of actors and activities. The varieties have a huge potential impact on the population in terms of improving food security, especially in countries emerging from decades of civil strife. Productivity has improved by between 56% and 103%, while consumption of sweet potato per week has increased by 50–100%. The technology is being used in the districts of Busia, Siaya, Teso, Kakamega and Vihiga in Kenya; Gitarama, Kibungo, Butare, Ruhengeri, Gisenyi, Byumba, Kigali rural Kibuye and Cyangugu provinces in Rwanda; Morogoro, Ukerewe, Sengerema, Nyamagana and Ilemela districts in Tanzania; Kumi, Soroti, Katakwi, Mbale, Kamuli, Mpigi, Wakiso, Mukono, Kiboga and Luweero districts in Uganda; and Gitega, Muramvya, Ngozi, Kayanza, Karuzi, Kirundo and Muyinga provinces in Burundi.

Among the lessons are that fostering stakeholder participatory approaches encourages commitment to technologies amongst the actors and strengthens partnerships which are essential for successful technology development, dissemination and out and up scaling.

Further information on this technology can be sought from the Sweet Potato Programme, National Crops Resources Research Institute (NaCRRI), PO Box 7084, Kampala, Uganda. Email: [rmwanga@naro-ug.org](mailto:rmwanga@naro-ug.org)

**Project Title:** *Regional Non Orange-Fleshed (NOFSP) Sweetpotato Varieties*


## 1.11 Improved potato varieties for smallholder farmers

Potato farmers in ECA countries can now access improved potato varieties and improved seed potato. This will give the farmers the potential to increase productivity and improve their livelihoods. Through collaborative research with other stakeholders, PRAPACE developed and released which have since been officially registered. However, only a few are currently available to farmers. These include Victoria, Rutuku, Cruza, Sangema, Nakpot 10, Kabale and Tigoni. The varieties yield well (between 7 and 15.4 t/ha), are moderately resistant to bacterial wilt and late blight disease of potato, are versatile across environments and have attributes that enhance food and income securities. The improved varieties can ensure an average return of US\$ 600 per tonne compared with US\$ 160 per tonne for traditional or unimproved varieties.

Over 100 diverse partners have participated in the dissemination of these varieties across various countries in ECA. Farmer participatory research approaches; FFS; demonstrations; field days and visits; training packages including manuals, posters, proceedings and journals; and the mass media were used in dissemination. Stakeholder participatory methodologies were used for out scaling. Small-scale farmers, seed producers and food processing firms are the primary end-users of

this technology. The varieties are being grown in the sub-region in areas including Mwaro, Muramvya, and Bujumbura-rural provinces in Burundi; Bandundu, Kahemba and Feshi districts and Bas-Congo, Kasai orientale and Kasai occidentale provinces in DRC; Wolemera, Degem, Gar Jarso, Jeldu, Dendi and Ada Berga districts in Ethiopia; Kiambu, Thika, Nyandarua, South Kinangop, Nyeri, Meru central, Nakuru, Bomet, Uasin Gishu, Keiyo, Marakwet and Laikipia districts in Kenya; Vakinanaratra district in Madagascar; Ruhengeri, Gisenyi, Byumba, Gikingoro, and Kibuye areas in Rwanda; Njombe, Makete, Iringa and Mbeya districts in Tanzania; and Kabale, Kisoro, Rukungiri, Kanungu, Mbarara, Mbale, Sironko, Mubende, Nebbi, Kabarole and Kapchorwa districts in Uganda. Adoption of the technology is limited despite the widespread distribution in





the region. This is mainly due to a lack of awareness on the availability of these varieties and the poor linkage of farmers to markets. Serious uptake is concentrated around areas where research stations are located owing to the influence of technology transfer projects and FFS conducted by the NARS in these areas. Tigoni, Victoria, Rutuku and Cruza are the most widely adopted varieties among the farming communities because of their high yield and because farmers prefer their taste. Potential also exists for value addition into processed chips which would boost incomes from farm enterprise. There is need for a wider scope and active involvement of stakeholders and their commitment to ensure uptake. There is also need to increase publicity to enhance awareness about where these varieties can be accessed. Furthermore, farmers need to be trained in good production and management practices in order to reap dividends from the technology.

For further information about this technology please contact Kabale Zonal Agricultural Research Development Institute (KAZARDI), Kachwekano, or NARO, PO Box 295, Entebbe, Uganda. Email: [wwagoire@infocom.co.ug](mailto:wwagoire@infocom.co.ug) or the National Agricultural Research Laboratories Centre Nairobi. Email: [z.kinyua@scientist.com](mailto:z.kinyua@scientist.com)


***Project Title:*** *Regional Potato Varieties [for East and Central Africa]*

## Cluster 2: Crop management practices

### 2.1 Improving rice yields through an integrated approach to combat Rice Yellow Mottle Virus Disease

Rice yields in Tanzania are affected by the Rice Yellow Mottle Virus Disease with reported crop losses of 50–100% and reduction in average production to 1.5 t/ha. Although resistant varieties have been developed, resistance alone has not proved a sufficient and an effective control measure for the disease. Scientists, working with farmers, have developed an integrated approach that incorporates the use of resistance with other agronomic practices including manipulation of planting date and herbicide use. The technology was validated on farm through farmer managed participatory research trials. Farmer-to-farmer interaction played a big role in disseminating the approach amongst participating and non-participating farmers within the locality. Other methods used were publications of reports and extension booklets for farmers and extension staff. Stakeholder meetings held at the end of the project to develop a strategy for the way forward also helped spread the knowledge. Exchange visits involving farmers from different villages enabled the sharing of experiences and knowledge. FFS and demonstration plots were also used. The approach was developed at the Agricultural Research Institute, Uyole, in





Tanzania. It is currently being used by both small- and large-scale farmers in Kilwa, Ngonga, Bujonde, Mwaya and Mababu villages in Kyela District. However, uptake of the technology within Tanzania has been limited due to inadequate awareness and knowledge by farmers outside the project sites. The project recommended use of a combination of other dissemination methods: publications (booklets, brochures and posters); the mass media (including television and radio); and involvement of district authorities as stakeholders through advocacy as a strategy to enhance the uptake and up scaling of the technology. Outside Tanzania, there are reports that the technology is being used by some farmers in DRC and in Kenya.

For further information please contact the Agricultural Research Institute, Uyole, PO Box 400, Mbeya, Tanzania. Email: [fmwalyego@yahoo.com](mailto:fmwalyego@yahoo.com)

**Project Title:** *Integrated Disease Management Technological Options for Rice Yellow Mottle Virus*

## 2.2 Integrating soil amendments in the control of *Striga*

Upland rice production in Tanzania is seriously affected by *Striga* (*Striga asiatica*), a parasitic weed. Yield losses of over 80% have been attributed to *Striga*. As a result, some farmers abandoned their fields or switched to production of other crops such as cassava and sweet potato. *Striga* thrives well in depleted soils, a scenario prevalent in many rice producing areas of Tanzania. With the introduction of NERICA varieties in Tanzania, integrated management strategies to reduce the effects of *Striga* were developed and made available to farmers. The integrated package includes use of the new (NERICA) varieties which are high yielding, drought tolerant, mature early and are aromatic. In addition, the farmers use green manure from *Crotalaria* sp. and plant pigeon peas in rotation with rice. The practice has proved effective in reducing *Striga* infestation, improving soil fertility and subsequently boosting rice yields. The integrated approach is being used by smallholder farmers in Kyela, Matombo and Morogoro districts in Tanzania. The scale of use of the technology is increasing as NGOs such as CARE in Morogoro District are engaged in the distribution of *Crotalaria* seeds to farmers. On-farm research and farmer managed plots were used to validate the technology. FFS, report publications, extension materials like posters and brochures, exchange visits between villages and districts, radio and television helped to spread knowledge on this new approach.

As a best practice, the technology shows potential for larger out scaling in other parts of the ECA sub-region, in particular Uganda where production of NERICA rice is increasing. Key benefits of the technology include an improvement in soil fertility because of the use of organic manure, reduction in *Striga* intensity in the fields, and the output from the pulses such as pigeon peas used at rotation crops. These crops provide a good source of protein or can be sold to earn income.






Animal manure could supplement or be used as an alternative in areas where farmers cannot afford *Crotolaria* as a source of organic manure. Although the pressure from other weeds will increase, benefits from soil improvement outweigh the weed problem.

For further information on this technology please contact the Agricultural Research Institute, Uyole, PO Box 400, Mbeya, Tanzania.  
Email: [ambwaga@yahoo.co.uk](mailto:ambwaga@yahoo.co.uk)

**Project Title:** *Integrated Striga Management in Upland Rice Ecosystem*

### **2.3 Involving farmers in testing recommended agronomic practices against *Striga***

*Striga* is a serious weed which has been shown to result in yield reductions of between 65% and 100% in cereal crops. Scientists have developed improved technologies for dealing with the *Striga* problem, providing proven ways for farmers in ECA to sustain their cereal crop yields. The technology involves the use of new sorghum or millet varieties in combination with well defined agronomic practices to manage the *Striga* problem. A number of varieties that are tolerant of *Striga* have been released in several countries in the sub-region. These include Wahi and Hakika, which have been released in Tanzania but are still under evaluation in Uganda and Sudan; Seredo released in Kenya and Uganda; Gobiye, Hormat and



Abshir in Ethiopia; and SRN 39, *Striga* 1 and *Striga* 2 in Sudan. The agronomic practices used in combination with these varieties are moisture conservation, fertility management techniques, intercropping and weed management.

To minimise the effects of the weed, extension staff and NGOs are promoting the use of *Striga* tolerant varieties and the integrated management approach to farmers to. Other users of the technology are Western Seed Company and KARI seed unit, grain and feed processors (Maganjo Industries, Uganda) and Power Foods in Rwanda. Companies that depend on cereals for brewing also use it in their farms. The technology was disseminated through on-farm demonstrations, FFS, field days, workshops and seminars, posters, brochures and leaflets, and radio and television programmes. Scaling out within the sub-region was through the regional network (Eastern and Central Africa Regional Sorghum and Millet Network; ECARSAM), and NGOs and CBOs with regional cross-border activities. So far, no definite figures on adoption rates have been established within countries in ECA, however, there is evidence of use of the technology in Harerge, Welo, Tigray and South Omo districts in Ethiopia; Homa Bay, Karachuonyo, Kisumu, Bondo, Siaya and Busia districts in Kenya; Gedarif and Blue Nile (Rank) districts in the Sudan; Singida, Kongwa, Iramba and Dodoma districts in Tanzania; and Kumi, Soroti and Palisa districts in Uganda. A key lesson was that in managing the *Striga* problem, the views and opinions of farmers need to be taken into consideration as they understand the magnitude of the problem better than extension and research staff do.

For further information please contact Agricultural Research Institute, Uyole, PO Box 400, Mbeya, Tanzania. Email: ambwaga@yahoo.co.uk

**Project Title:** *Integrated Striga Management for Small Holder Farmers in the ECA*

## 2.4 Reaping the benefits of integrated agronomic practices in drought prone agriculture

Drought is a major constraint to rainfed agriculture. It affects the livelihoods of about half a billion people in sub-Saharan Africa with losses in crop yield of up to 100%. As a result, NARS in the sub-region have developed technologies that can help farmers deal with the problem of drought in the production of sorghum and millets. The technologies include improved varieties of sorghum and millet, and a combination of cultural practices for improved plant growth. This combination includes conservation tillage, soil amendments, timely planting and weed management. The available sorghum varieties included Milo, Aross-Elremal, Arosh, Macia, Wahi, Hakika, Framida, IS76T1#23, KARI Mtama-1, KARI Mtama-3, IS76#23, Gadam el Hamam, Serena and Seredo. The available millet varieties include Ashana, Tadesse, KAT PM-1, KAT PM-2, KAT PM-3 (ICMV221),

KAT FM-1, Okoa and Shibe. The varieties have gained widespread acceptance across countries in the sub-region because of their tolerance to the prevailing environmental conditions and short maturity period.

Smallholder farmers, breweries that use sorghum, extension agents, seed companies (such as Western Seed Company), KARI seed unit, grain and feed processors (Maganjo Industries, Uganda, and Power Foods, Rwanda), development and relief NGOs are among the end-users of the technology. Farmer research groups, FFS, demonstrations and field days, workshops and seminars, posters, brochures and extension leaflets, television and radio programmes are among the approaches used to spread information on the availability of the new varieties and on the integrated approach. Scaling out was done through ECARSAM, and international and national NGOs and CBOs with cross-border agricultural activities. The development of regional projects on drought that targeted more than two countries further provided an opportunity for germplasm exchange testing and for technology and information sharing. The varieties are currently being grown in Harerge, Welo, Tigray and South Omo districts in Ethiopia; Kisumu, Bondo, Siaya, Busia, Machakos, Kibwezi, Meru (Tharaka), Mwingi, Kitui and Taveta districts in Kenya; Gedarif, Elfasher and Elobiet districts in the Sudan; Singida, Kongwa, Iramba, Dodoma and Chunya districts in Tanzania; and Kumi, Soroti, Palisa and Karamoja districts in Uganda.

For further information on this technology please contact the Kenya Agricultural Research Institute (KARI), PO Box 27, Embu.  
Email: [bmkanyenji@yahoo.com](mailto:bmkanyenji@yahoo.com) or the International Crops Research Institute for Semi-Arid Tropics (ICRISAT), PO Box 39063, Nairobi, 00623, Kenya.  
Email: [m.mgonja@cgiar.org](mailto:m.mgonja@cgiar.org)

**Project Title:** *Integrated Drought Management Technologies for Improved Sorghum and Millet Productivity*

## 2.5 Improved cultural practices for better rice yields

Upland rice has become a major cash and food crop in Uganda. To minimise crop loss from poor crop management practices the Cereals Programme at NaCRRI, Namulonge, in partnership with farmers, seed companies, NAADS, and agro-input dealers tested three commercial rice varieties—NERICA-1, NERICA-2 and NERICA-4—with various sets of agronomic practices for optimal productivity. The NERICA varieties yield well and are tolerant of major environmental stresses. The cultural practices tested for were seed cleaning methods, crop establishment methods, weed management, proper fertiliser application rates and post-harvest management. In all, three seed cleaning methods (winnowing, the rotary bower and the floatation method) were assessed. The planting methods tested were drilling, dibbling and broadcast. Weed management was assessed by screening



different commercial herbicides. Similarly, different fertiliser application rates for nitrogen (N), phosphorus (P) and potassium (K) were assessed. Post-harvest methods included in the assessment were panicle clipping and low cut of the grains. The threshing methods evaluated were motorised and manual threshing. Participatory evaluation processes involving the farmers were used to determine the optimal cultural practices for these different operations. The results came up with the following combination as optimal cultural practices: Use of drilling and dibbling for planting; 60:23:0 (N:P:K) for fertiliser application and 8 litres/ha with Satunil herbicide; the low-cut method using sickles; and the mechanical thresher as the post-harvest practice.

Technology dissemination was done through field demonstrations and field days, video documentary and use of brochures, posters and leaflets. Distribution of seed and scaling up of the recommended cultural practice was conducted by seed companies such as FICA, NASECO Victoria Seeds, SAA-U, UCA and UJA. Further up scaling was achieved through NAADS. The technology has been taken up by individual smallholder farmers and farmer associations that grow rice seed for marketing and is currently being used in Kamwenge, Masindi, Hoima, Lira, Oyam, Apach, Gulu, Amuru, Pader, and Kitgum districts in Uganda. Adoption rates of the recommended cultural practices were 30–70% in August 2006 up from 16% in 2002. Potential exists for out and up scaling to other countries in ECA including Tanzania where the NERICA varieties have been introduced. A key lesson was

that involving multiple stakeholders who have a commitment to technology development and dissemination enhances the potential for uptake and up scaling of new innovations of this nature in ECA.


For further information on this technology please contact the Cereals Programme, National Crops Resources Research Institute (NaCRRI), Namulonge, PO Box 7084, Kampala, Uganda  
Email: lamo\_jim2000@yahoo.com; lamojim@gmail.com

**Project Title:** *Recommended Management Options for Three Commercial Upland Rice Varieties (Nerica-1, Nerica-10 and Nerica-4) For Small-Scale Farmer Production in Uganda*

## 2.6 Improving soil quality through agroforestry

Soils in many parts of ECA are depleted of nutrients due to continuous cultivation with minimal application of fertilisers. As a result farmers are faced with the challenge of how to sustain or improve crop yields under conditions of poor soil fertility. Agroforestry has provided farmers with options to improve soil fertility without incurring the often high cost of inorganic fertilisers. It is reported that there are currently hundreds of thousands of rural smallholder farmers in different countries in ECA who are using agroforestry based technologies to revitalise their soils and in the process cutting down on the costs of inorganic fertiliser application and labour, while boosting their crop production. The technology uses leguminous trees which fix nitrogen in the soil and generate large quantities of biomass that is used as green manure to improve soil quality. The innovation is being used by an estimated 300,000 maize farmers. Other beneficiaries of this technology include traders and entrepreneurs, private sector and development agencies (such as NGOs and CBOs) and extension agencies involved in seed multiplication distribution and dissemination activities. Once established, the leguminous trees are easy to maintain.

Dissemination was achieved through on-farm research and development (R&D) approaches, a participatory on-farm research for development (R4D) approach, FFS, local networks for seed multiplication and distribution, the mass media, field days and exchange visits. Technology up scaling is being done with the help of technology packaging strategies such as use of fertiliser tree technology handbooks for field education; field visits, participatory technology platforms such as group discussions, e-conferencing and decision support; application of geographic information system (GIS) tools; and technology system modelling. Further promotion of the technology has been enhanced by the Millennium Development Projects that are currently introducing improved agroforestry technologies through Millennium Village Programs in a bid to improve livelihoods farm households in different countries in the sub-region. Among the lessons learned was that technology



development must be client demand driven involving all stakeholders to ensure sustainability and ownership. Furthermore, networking among stakeholders is important for successful technology dissemination and service delivery. Therefore, the level of infrastructure development and policy environment in a given country is an important variable that can influence the rate of up scaling these types of technologies. The technology is currently being used in Embu, Vihiga, Siaya, Machakos, Kitui, Kisumu, Kibwezi and Makueni districts in Kenya; Mukono and Mbale districts in Uganda; Kilimanjaro, Shinyanaga and Moshi districts in Tanzania; and Ahmara and Awassa regions in Ethiopia. The technology has potential for wider out scaling into other parts of the sub-region including Rwanda and Burundi.

For further information please contact the National Food & Nutrition Policy & Food link Resources. Email: [foodlink@nbi.ispkenya.com](mailto:foodlink@nbi.ispkenya.com); [agrisocial@yahoo.com](mailto:agrisocial@yahoo.com)

**Project Title:** *Restoration of Soil Fertility through Agroforestry Technologies and Innovations by Reducing Chemical Fertilizer Reliance in the ECA Sub-Region*

## 2.7 Tied ridges for better crop yields

Farmers in drought prone areas of ECA now have the means to address the problem of inadequate moisture for crop production under rainfed agriculture. With ridge cultivation/tillage, crops are planted on ridge tops, along ridge sides or in the furrow. Tied ridging is a type of surface configuration whereby the ridges are “tied” to each other at regular intervals by cross-dams, blocking the furrow. The ridges can be used to prevent surface water run-off. The basic concept involves dragging a shovel over the bottom of the furrow and collecting the soil formed by lifting the shovel. Simpler units (also suitable for animal traction) operate a shovel attached to a frame which jumps at regular intervals as a result of the action of a triangular or off-centre support wheel. The technology has been successfully used in West Africa in Mali and Niger to improve soil moisture conditions and physical properties with significant benefits obtained by cotton, maize, cowpea, millet and sorghum producers in semi-arid areas. Compared to the flat or open ridged fields, tied ridges have been shown to result in yield increases of about 40% in maize trials with improved varieties. Grain yield increases of about 63% and 37% were observed with maize varieties ACV-6 and Melkassa-1 in Ethiopia.

Tested by farmers under local farming conditions, the technology was developed by CIMMYT/ECAMAW and disseminated through field demonstrations and field days, print extension material such as leaflets and brochures, the mass media, and annual review meetings to share experiences among researchers and other stakeholders. Up-scaling approaches that were used involved farmer exchange visits, training and education sessions facilitated by extension agencies and other partners from NGOs, and collaboration with local designers to modify the ridgers



to suit local farmer conditions. The technology is currently being used in Ethiopia, Kenya and Tanzania but with limited uptake among farmers so far. In this regard, future research is needed to identify the socio-economic factors that limit wide uptake and adoption of the technology. One of the lessons learned is that research and technology development should target both the ecological conditions and the farmers' socio-economic conditions.

For further information please contact the ILRI-Ethiopia Campus,  
PO Box 5689, Addis Ababa, Ethiopia; Email: [d.friesen@cgiar.org](mailto:d.friesen@cgiar.org);  
[z.mduruma@cgiar.org](mailto:z.mduruma@cgiar.org)

**Project Title:** *Soil Moisture Conservation in Maize Based Cropping Systems Using Tied-Ridges in ECA Region*

## 2.8 Improved herbicide use to reduce weed burden in rice farming

Weed infestation has been a major constraint to rice farmers in Tanzania. It contributes to the proliferation of other production constraints such as pests, diseases and nutrient deficiency from competition for resources among other problems. *Oryza punctata* and *O. longistaminata* are the two major weed species found in rice producing areas. They affect both flooded and lowland rice alike.



The farmers' practice of controlling the weeds is to use hand hoes and hand pulling of the weeds. Tested on station, the improved technology involves applying glyphosate at a rate of 3 litres/ha for the control of *O. punctata*, 4 litres/ha for the control of *O. longistaminata* and the application of 2,4-D 21 days after emergence. The results showed significant reductions in wild rice and other weeds, a rise in yield of more than 4 t/ha and an increased cost–benefit ratio at all test sites. With the introduction of NERICA varieties, the technology will serve to reduce farm labour in weed management, boost yield and increase net farm incomes.

The use of demonstration plots, farmer-to-farmer interactions, extension teaching materials and publications from research helped to spread this new knowledge. Up-scaling initiatives were undertaken through farmer exchange visits enabling them share experiences and knowledge about the technology. Though effective, the method has had low adoption with little coverage of the rice infested areas. Large-scale producers are the main beneficiaries of this technology as it is cost effective for them to use herbicides. Currently, this innovation is being used in the districts of in Kyela, Kilombero, Mvomero and Bagamoyo in Tanzania with the potential for up scaling to DRC. For significant uptake and adoption to be realised, training and education on herbicide use would be an important step. Furthermore, apart from the technology, efforts should target seed production and seed exchange between farmers because use of unclean seed is a major source of wild rice in non-infested areas. Knowledge on the biology of wild rice, production of quality declared seeds and efficient farmer-to-farmer seed exchange mechanisms would also help alleviate this problem.

For more information please contact the Tanzania Official Seed Certification Institute, PO Box1056 Morogoro, Tanzania. Tel: 255 23 2600797. Email: hmtwaenzi@yahoo.co.uk

*Project Title: Wild Rice Control in Low Land Rice*




## Cluster 3: Post-harvest processing and utilisation

### 3.1 Improved processing technology for cassava means better quality, better markets for farmers

Industrial utilisation of cassava remains low in ECA. This is partly due to the lack of improved processing technologies, lack of awareness on the alternative uses of cassava and lack of technical know-how on processing. Traditional splitting/slicing and drying of cassava chips on bare ground, as practised by most smallholder farmers, often compromises product quality and falls short of the standards required in regional or international markets. Through collaborative efforts, however, EARRNET, NARS and the private sector are promoting improved mechanised cassava chipping and drying technologies, which produce high quality cassava chips that are acceptable to feed millers. The machines produce chips of uniform particle size and increased surface area for speedy drying. In addition, they are portable and reduce human drudgery because of the speed of mechanized chipping and the shortened drying period by about 8 days on average.





The technology was introduced in a participatory manner through mobilisation, sensitisation and training; conducting cost–benefit analysis and quality assessment; and using the collective marketing approach to sell the products. The EARRNET project promoted the improved cassava processing technology in three countries: Kenya, Rwanda and Uganda. Over 200 farm households in Uganda and over 150 in Kenya and Rwanda are estimated to be using the technology at pilot sites. The cassava chippers are currently being used in Migori and Kilifi districts in Kenya; Ruhango and Busegera provinces in Rwanda; and Bukedea and Masindi districts in Uganda. The method used to disseminate the technology involved the farmer group/association approach. This approach enabled farmers to achieve the quality standards required to access markets for cassava chips; to have stronger bargaining power through collective marketing; and to sell in bulk to bigger markets that initially were out of their reach. No significant up-scaling initiatives have yet been undertaken as the technology is still being piloted at selected sites in the different countries.

For further information on the technology please contact the International Institute of Tropical Agriculture-Uganda (IITA-Uganda), 15 Naguru East Rd.; PO Box 7878, Kampala, Uganda. Tel: +256 414 2850064; Email: [earnnet@iita-uganda.org](mailto:earnnet@iita-uganda.org); [p.ntawuruhunga@iita-uganda.org](mailto:p.ntawuruhunga@iita-uganda.org)

**Project Title:** *Improved Cassava Processing Technology for High Quality Cassava Chips*

### 3.2 Poultry farmers turn to cassava as an alternative energy source

Poultry farmers in ECA have been looking for alternative cheaper energy sources in their feed. Maize, as a major source of energy, is experiencing scarcity and erratic production due to unpredictable weather patterns in the sub-region and competition from human consumption. Cassava has recently been recognized as a main staple with stable production and yields of between 40 and 60 t/ha. The cassava tubers are a source of carbohydrate, while the foliage is rich in protein, vitamins and minerals. EARRNET, in collaboration with Ugachick Poultry Breeders Ltd., experimented with cassava as a substitute for maize in production of animal feeds. The goal was to determine the proportion of cassava that could be incorporated in chicken feeds and to link farmers/processors of high quality cassava chip with feed millers. Experiments on processing methods were conducted at selected pilot sites and chicken feeding trials were carried out at Ugachick poultry breeders. The results showed no significant difference between the growth rates of birds fed on maize-based feeds and those fed with feeds where cassava was substitute for maize. Broiler growth rates from all feeds followed a similar trend with a body weight of approximately 2 kg at 42 days of age. In feeds for layers, cassava can substitute for maize up to 20%, however, oil must be added to the feed to reduce dustiness.



Dissemination of this research output was done through national stakeholder workshops; sensitisation using electronic media, and publishing newsletters, handouts and newspapers; community mobilisation at the pilot processing site; and organising field days. No up-scaling efforts were undertaken as the project is still in the pilot stage. Currently, Ugachick in Uganda and Sigma in Kenya are the main users of the research output although a few other feed millers in Uganda have also started incorporating cassava into their feeds. Only the farmers/processors at the pilot sites are producing the desired quality chips and are linked with Ugachick. Small-scale backyard feed millers near the pilot sites are also taking up the technology.

For further information please contact the International Institute of Tropical Agriculture-Uganda (IITA-Uganda), 15 Naguru East Rd, PO Box 7878, Kampala, Uganda; Tel: +256 414 2850064; Email: [p.ntawuruhunga@iita-uganda.org](mailto:p.ntawuruhunga@iita-uganda.org)


***Project Title:*** *Incorporation of Cassava in Animal Feeds: A successful collaboration between IITA-EARRNET and Ugachick Poultry Breeders Ltd in Uganda*



### **3.3 Improved processing and utilisation to boost sorghum and millet production**

For some time, millet and sorghum were regarded as crops and food for the poor. This limited their widespread production and use. More recently, however, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has been promoting the use of millet and sorghum as food security crops, especially in the drought prone areas of ECA. To further improve their uptake and utilisation, processing technologies that add value to the grain were initiated. These technologies produce quality products such as “Super Mtama”, a rice-like product, which consumers prefer to the standard sorghum meal. Other by-products are bran, germ and grits which are used in animal feeds. Further milling of the main product results in a flour that could be used as fine flour or as a constituent component of composite flours.

Training courses and workshops on new recipes and product formulations for food outlet operators, breastfeeding mothers, small-scale bakery operators and brewers; displays of millet and sorghum products during agricultural shows; field days; and public “barazas” were used to disseminate the technology. The success of these methods is reflected in the increased sale of millet and sorghum products and increased availability of their products (such as beer and feed) in the market



on a large scale. Up scaling was done through stakeholder linkages, conducting stakeholder workshops to agree on common goals and enhancing the utilisation of composite millet and sorghum among ECA countries. End-users of the technology include farmers, micro- and macro-processors, feed industries, breweries and food processors. These utilisation technologies have widespread application with small- to large-scale industrial use such as brewing, confectionery and feed processing. It is currently in use in Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda.

For further information, please contact the Ethiopia Institute of Agricultural Research (EIAR), Holeta Research Center, PO Box 2003, Addis Ababa, Ethiopia; Tel: +251 11 2370300. Email: Syetneberk@yahoo.com; University of Nairobi, PO Box 29053-00625, Kangemi, Kabete, Kenya; Tel: +254 20 2055126; Email: b.mitaru@cgiar.org; rad@uonbi.ac.ke

***Project Title:*** *Processing and Utilization Technologies of Sorghum and Millets*

## Cluster 4: Technology uptake approaches

### 4.1 Partnerships—A first step to technology uptake and adoption

A wide range of proven best-bet practices including traditional and modern techniques for effective natural resources management (NRM) exist. However, adoption rates remain low, especially among poor smallholder farmers and resource managers. In an effort to enhance uptake, the African Highlands Initiative (AHI), in collaboration with a number of partners, developed methods for district level multi-stakeholder processes. These processes strive to enhance farmer focus in the development of NRM strategies. This helps farmers understand the risks that they might face and the incentives needed to improve uptake. The new multi-stakeholder processes also strive to improve learning processes for all key stakeholders.

Three dissemination strategies were used to help spread the multi-stakeholder NRM processes. The first is the development of a multi-disciplinary team of facilitators comprising researchers, extension agents and farm leaders linked to existing farmer learning processes. The second strategy was integration of NRM methods at district level to serve as guides for all stakeholders involved in NRM. The third strategy was the use of case studies among various institutions involved in sustainable NRM. Up-scaling activities involved regional training events, publications and the development of the land care chapters in Kenya, Uganda and Tanzania. The multi-stakeholder processes to NRM strategy development and promotion have been tested in Kapchorwa, Bundibugyo and Kabale districts of Uganda; and in Machakos and Nyando districts in Kenya. Other areas are AHI benchmark sites in Ethiopia and Lushoto in Tanzania. NARS, local governments and NGOs are the prime users of this technology, scaling up its use in Rwanda through self-led institutional change processes there. From the lessons learned, the promoters of the approach recommend the need to ensure that there are mechanisms within the approach to get feedback from the various actors. The feedback mechanisms should articulate action taken to address specific issues and responsibilities amongst the various actors. These mechanisms should also give indication of the outcome of the NRM intervention and possible next course of action. The lessons further emphasise the importance of involvement of local governments in the NRM processes since this will inform future research interventions by providing a link between current and past initiatives.

For further information, please contact the African Highlands Initiative(AHI)/ ICRAF, PO Box 30677, Nairobi 00100, Kenya. Tel: +254 20 7224000; Email: j.tanui@cgiar.org; J.mowo@cgiar.org

**Project Title:** *Enabling Demand-Driven Technology and Information Systems in INRM through District Level Multi-Institutional Processes*

## 4.2 High value agroforestry tree species complement smallholder farming systems

Research has shown that high value agroforestry tree species have potential to improve the livelihoods of thousands of smallholder rural communities in the ECA sub-region. There are several initiatives promoting these trees within ECA. The Millennium Development Projects are promoting the technology through Millennium Village Programs. The former ASARECA Trees on-Farm Network (TOFNET) and partners promoted different types of high value agroforestry tree species. The trees include grafted fruit trees, biofuel tree crops, fodder trees such as *Calliandra* (which can be used for protein supplementation fodder) and medicinal trees. The aim is to increase market access for sale of the agroforestry products for income generation and improved livelihoods.

Various approaches have been used to disseminate production of these high value trees. These include participatory on-farm R4D; FFS; farmer-to-farmer training; and establishment and strengthening local seed networks to improve farmers' access to seed. The technology has also been disseminated by use of print materials such as posters and leaflets; CD-ROMs; the mass media; community meetings; field days; workshops; seminars; open days; and school programmes. Forest and agricultural extension officers have been used to disseminate the technology. Different efforts have been used to scale agroforestry trees out and up. For example, through technology packaging: high value trees and handbooks for field education; and technical demonstration: on-farm demonstrations and farmers exchange visits to other sites. Establishment of technology knowledge platforms including e-conferencing to facilitate the sharing and exchange knowledge and information is another approach that has been used to scale up the technologies. Other approaches have included: group discussions and application of GIS tools, policy briefs and technology system modelling; awareness creation through the mass media and public debates; and dissemination of information through newsletters and websites.

The technology is being used by smallholder farmers and farmer groups, private sector investors, researchers, extension agencies, development agencies, capacity building institutions, traders and entrepreneurs, and government policy makers and planners. It is being up scaled widely in Ethiopia, Kenya, Rwanda, Tanzania and Uganda. Lessons learned suggest that participatory technology development is key for effective uptake. The development and promotion of the technologies must involve multiple stakeholders and be client-oriented to ensure ownership, sustainability and increased production. In addition, advocacy for market access, appropriate infrastructure and policies are necessary for sustained adoption and scaling out.

For further information please contact the Kenya Forestry Research Institute (KEFRI), PO Box 13828, Nairobi 00100, Kenya. Tel: +254 20 2011650.  
Email: kefri-ln@africaonline.co.ke or the Millennium Villages Project-Ruhira;  
Email: john.okorio@undp.org; okorio@utlonline.co.ug

**Project Title:** *Increasing Uptake of High Value Agroforestry Tree Species in the Farming Systems of ECA Sub-Region*

### 4.3 Fodder tree technologies benefit livestock farmers

TOFNET, in partnership with the World Agroforestry Centre (ICRAF), has been promoting the growing of fodder trees for livestock fodder supplementation. The trees have the added advantage of improving soil fertility through nitrogen fixation. However, not many farmers in the ECA sub-region are utilising this technology. To address this, TOFNET, ICRAF and other partners have consolidated the information and developed technological packages on the fodder tree technology appropriate for the mixed farming systems in ECA. In addition to information packaging and dissemination, other efforts have been made to develop capacity of stakeholders for better access to the seeds and output markets in order to enhance adoption. The technology is based on highly nutritious tree species, namely *Calliandra calothyrsus*, *Leucaena diversifolia*, *Gliricidia sepium*, *Morus alba*, *Sesbania sesban*, *Chamaecytisus prolifer* and *Leucaena trichandra* among others. The trees provide quality fodder rich in protein which improve milk production and generally serve to improve livelihoods through provision of sustainable income. The fodder shrubs also help to improve soil fertility and in turn help to improve crop productivity and food security. Furthermore, the shrubs provide fuel wood, serve as bee forage, provide stakes for climbing beans and can control soil erosion.

Dissemination is done using an on-farm R&D approach; FFS; farmer-to-farmer interactions; local seed networks for sustained production and distribution of fodder tree seeds; Type one and Type two farming extension practices; use of forestry and agricultural extension staff; and promotion through school agricultural programmes and the mass media. Scaling up was achieved through on-farm demonstrations and field visits, participatory technology platforms such as e-conferencing, production of fodder shrub handbooks and decision support application of GIS tools, policy briefs and technology system modelling. Smallholder farmers, investors and entrepreneurs, extension and development agencies, research institutions (such as NARIs), and capacity building institutions are the current users of the technology in the sub-region. The use of the technology is reported in Ethiopia, Kenya, Uganda, Rwanda, Tanzania and Burundi. Lessons indicate that multi-stakeholder participatory involvement and client-oriented technology development are crucial factors for enhanced technology uptake among smallholder rural farmers and for up scaling in the ECA sub-region.



For further information please contact the Maseno Regional Research Centre of (KEFRI), PO Box 13828, Nairobi 00100, Kenya; Tel: +254 20 2011650; Email: cobonyo@hotmail.com

**Project Title:** *Increasing Uptake of Tree Fodder Technologies and Innovations for Farmers in ECA Sub-Region*

#### 4.4 Packaging innovations to suit farmer conditions

One of the reasons advanced for limited adoption of technologies and innovations by farmers is that often technologies and associated management practices are promoted piecemeal. Such an approach does not create significant impact. Research has shown technologies that promise immediate benefits such as high yielding varieties should be used as entry points to build farmers' confidence. These should be combined with more complex innovations such as soil and water conservation strategies, which by themselves do not translate into immediate outcomes in terms of productivity and effect on livelihoods. This approach of linking technologies involves first the identification of entry points, that is, technologies that can bring about immediate benefits. These should be based on the community's needs which must be identified and prioritised in a participatory way. The next step in the approach is carrying out participatory testing of the technologies by the farmer groups. The approach enhances systems thinking, calls for teamwork and addresses the needs of diverse social groups.

Demonstration plots were most effective in disseminating information to farmers followed by exchange visits and market visits as farmers became more convinced by observation. Scaling up was achieved by preparing briefs, regional and international conferences, website publications and posters. The innovation is being used by smallholder farmers and NGOs in the sub-region. In applying this approach, the Heifer Project International (HPI) is linking provision of improved dairy animals as the entry technology with soil conservation practices as the follow-up innovations. The follow-up innovation involves establishment of fodder crops such Napier grass to stabilise bench terraces and to provide fodder for the cows. The soil conservation technology is relatively more complex and does not produce immediate outcomes. Similarly, in the case of irrigation projects the provision of irrigation technology (equipment and crop varieties) could be linked with innovations on soil and water conservation. The innovation is in use in Ethiopia, Kenya, Tanzania and Uganda. As part of the lessons learnt, the approach helped strengthen partnership arrangements and improved coordination amongst participating stakeholders.

For further information contact the African Highland Initiative (AHI)/ ICRAF, PO Box 30677, Nairobi 00100, Kenya; Tel: +254 20 7224000; Email: wickama@yahoo.com


**Project Title:** *Linked Technologies for Increasing Adoption and Impact*

## 4.5 Speeding up crop improvement in partnership with farmers

The Mother/Baby Trial Design (M/B) is a novel participatory breeding approach. It involves farmers, research (namely NARIs) and development agencies (such as NGOs), extension and the private sector. The method enables breeders to take into account farmer perceptions of constraints and preferences. It is possible to accommodate the participation of many farmers (ranging from 50 to over 300 farmers) in the selection process of a new variety of a crop such as maize within a country. The farmers evaluate the new varieties for yield and qualitative preferences such as taste in un-replicated trials of 3–4 treatments referred to as baby trials. The scientists manage replicated trials of 9–16 treatments at various locations referred to as mother trials. These are evaluated by scientists on quantitative attributes such as disease resistance, drought and nutrient tolerance. Using this technique, NARS in Tanzania managed to release a total of seven new maize varieties in 2001. Similarly, Kenya was able to release six extra-early drought and low-N tolerant maize varieties in 2004. TanSeed International Seed Company in Tanzania also applied this approach and released three varieties in 2006. More recently, at a stakeholders' training workshop on how to assess the varieties in the M/B trials in Tanzania, five farmer preferred varieties were identified and recommended for release through the National Seed Release Committee meeting held at the end of 2007. Seed production and multiplication is implemented by the seed companies; about 1500 t of seed have been produced.

This approach was promoted through training of the country coordination unit members in the maize programme and of partners and stakeholders managing the trials. Demonstrations, field days, brochures and posters were used to promote the technology. Scaling up of the improved maize varieties developed through this approach was done through collaboration with private seed companies, extension and development agencies and women groups at the various locations, and through strengthening of seed production and distribution systems. Strengthening production and distribution was done through fostering public–private partnerships. The aim of strengthening the seed systems was to ensure that farmers in remote areas that are not well covered by the large commercial seed companies could also access seed of the improved maize varieties..

A key factor noted that can affect application of this approach was that countries in the ECA are at different levels of policy institutionalisation with regard to germplasm release and evaluation—some have strict release procedures, others none, while others are more advanced in farmer participatory evaluations. Nonetheless, the approach is being used in Melkassa and Bako in Ethiopia; Embu, Machakos, Kakamega and Mtwapa districts in Kenya; Hai, Arumeru, Babati, Morogoro, Kilosa, Kondoa, Mpwapwa, Monduli, Kongwa, Kiteto, Mwanga, Mwanza and Moshi Rural in Tanzania; and Iganga and Wakiso districts in Uganda.



For further information contact CIMMYT-Kenya,  
PO Box 1041, Village Market-00621, Nairobi, Kenya. Tel: +254 20 7224600;  
Email: m.banziger@cgiar.org; CIMMYT-ILRI Ethiopia Campus,  
PO Box 5689, Addis Ababa, Ethiopia; Tel: +251 116 462326;  
Email: z.mduruma@cgiar.org

**Project Title:** *Participatory Variety Evaluation Using Mother and Baby Trial Technique*

## Cluster 5: Seed systems

### 5.1 Empowering farmers to take charge of their own seed requirements

Seed provides a vital link between cropping seasons and is important in diffusion of new varieties. However, access to quality and affordable seed remains a challenge for many smallholder farmers. The Decentralized Informal Farmer-based Seed System (DIFBSS) is an informal farmer-centred method of multiplying and distributing quality planting material of improved potato and sweet potato varieties. It is aimed at empowering farmers to produce quality seed with minimum technical and financial intervention. Developed with farmer participation, important concerns such as low multiplication rates, pathogen contamination, perishability of planting material and limited sustainability of farm level supply systems were taken into account. DIFBSS is a best-bet approach that can be up scaled as “best practice” for farm level seed system for smallholder potato production systems. The approach has been used to produce seed potato that has fetched as much as four times more

income than ware or table potato. Similarly, the sale of vines of improved sweet potato varieties can fetch up to 16 times more returns than what can be earned from selling fresh roots in local markets.



Overall, DIFBSS is a mechanism that has improved access to improved technologies by farmers and other stakeholders. The approach also increases the quantity of quality seed bridging the gap between demand and supply. Dissemination was achieved through farmer participatory research approaches, posters and the mass media. Scaling out was done by creating strong public–private partnerships that are both holistic involving all relevant stakeholders and are demand driven. Surveys from

DRC, Ethiopia, Kenya, Rwanda, Tanzania and Uganda have shown over 80% adoption rates of the DIFBSS approach. A total of 64% of the farmers interviewed commended the approach for its ability to minimise the problem of perennial shortages of seed while 69% reported that DIFBSS relieved them of and the worry of travelling long distances in search of seed. The technology is currently being used in DRC, Ethiopia, Kenya, Madagascar, Rwanda, Tanzania and Uganda.

Further information on this technology please contact the National Potato Research Centre, PO Box 7084, Kampala, Uganda. Email: wakahiumw@yahoo.com or Kachwekano ARDC, National Agricultural Research Organization (NARO), PO Box 295 Entebbe Uganda; Email: wwagoire@infocom.co.ug

**Project Title:** *Decentralised Informal Farmer-Based Seed Systems (DIFBSS) for Potato and Sweetpotato Production in Eastern and Central Africa*

## 5.2 New cassava multiplication technique enhances farmer livelihoods

No formal seed system exists for the multiplication of cassava in ECA. The approach was developed in western Kenya to restore cassava production after the cassava mosaic pandemic. It is a three-tier, informal farmer-centred cassava multiplication and distribution technique, which aims to establish and improve cassava multiplication systems, and to develop effective and sustainable systems for delivery of improved varieties to farmers. The technique uses primary, secondary and tertiary multiplication sites. Primary multiplication is done on station and aims to increase the multiplication rate tenfold in a space of about 6 months over a period of 2–3 years. Secondary multiplication sites are either regional or district based and receive healthy planting material from the primary sites. The location of the secondary multiplication sites is strategically planned usually within the farming community in order to minimise transport and to ease the distribution of the planting material to farmers. Tertiary multiplication sites are managed by individual farmers or groups of farmers. These are used to ensure a sustainable supply of planting material for farmers to buy and to boost production and improve livelihoods. The seed voucher system introduced by the Catholic Relief Services (CRS) to facilitate access to planting material by resource poor households, complements the three-tier technique. Poor farmers present the vouchers to certified/vetted seed producers or traders and acquire the planting materials. The seed producers/traders then redeem the vouchers for cash.

The technology was disseminated through informal sharing of ideas and collaboration with partners, especially NARS and NGOs. The seed voucher system was promoted through the C3P programme of CRS. Up scaling was done through the formation of working partnerships in different countries in the sub-region. The



involvement of CRS through the C3P project further enhanced the integration of the seed voucher system into the three-tier multiplication technique. NGOs are promoting the three-tier approach in Burundi, western Kenya, Madagascar, Rwanda, Tanzania and central Uganda. The approach has enabled smallholder farmers to have access to improved cassava varieties. Over 302,000 households in western Kenya are growing improved varieties

whose planting materials were distributed in this manner. In Uganda, improved varieties are used by at least 80% of the smallholder farmers in all the cassava growing areas of the country. Similar uptake and adoption rates of improved varieties by small-scale farmers have been reported in Burundi, DRC, Ethiopia, Madagascar, Rwanda and Tanzania.

For further information on this technology, please contact the International Institute of Tropical Agriculture- Uganda (IITA-Uganda), 15 Naguru East Rd, PO Box 7878, Kampala, Uganda. Tel: +256 414 2850064.  
Email: p.ntawuruhunga@iita-uganda.org

**Project Title:** *Technology Transfer Mechanism: Three-Tier Cassava Multiplication Approach Complemented by the Seed Voucher System*

### 5.3 Better quality seed for rice farmers

Unlike other crops such as maize, sorghum and to a limited extent sunflower, rice is not that attractive to large commercial seed companies. Thus rice farmers in Tanzania have not had adequate access to quality rice seed. Rice farmers often resort to using their own saved seed, which in most cases is not pure, is of low quality and is susceptible to diseases. The Agricultural Sector Programme Support (ASPS) in collaboration with Msimba Seed Farm and the Kilombero Agricultural Training and Research Institute (KATRIN) have embarked on the production of quality declared seed for farmers. Large-scale farmers have been identified and contracted in pilot areas to produce and supply quality declared seed (QDS) in anticipation of the impending rise in demand following the introduction of the NERICA varieties in Tanzania. The QDS does not go through the normal certification process. Farmers are trained to produce seed following most of the required procedures except certification. The seed is inspected and its quality parameters indicated on the

labels on the packages. The technology is being used by small- and large-scale farmers who produce rice for food and income security. There is potential for some of these growers to be used by the private sector to produce QDS. The lessons call for strong collaboration among stakeholders to enhance the sustainability of the QDS system.

No dissemination and up-scaling initiatives have yet been undertaken as the innovation is still being validated at other pilot sites in the districts of Kilombero, Ulanga, Mvomero and Iringa in Tanzania.


For further information please contact the Tanzania Seed Certification Institute (TOSCI), PO Box 1056, Morogoro, Tanzania;  
Tel: +255 23 2600797. Email: tznmaingu@yahoo.com;  
delphimamiro@yahoo.com

***Project Title:*** Production of Quality Declared Seed for Rice

#### **5.4 Public–private partnerships in seed production improves farmers’ access to seed**

Participatory varietal development and selection involving farmers, and the public and private sectors has been proved to be an effective approach for development and release of improved crop varieties. Lagrotech Seed Company and Consultants has used this approach to test and release bean varieties in Kenya. The company





has worked with farmers using on-farm and multi-location trials to test bean varieties developed by NARIs. Through these arrangements, the farmers select the varieties they prefer and recommend them for inclusion in the NPTs. After this, they can be officially released. The selected varieties are usually high yielding, and respond well to environmental stress. Following NPTs and varietal release, seed of selected varieties are distributed to NGOs, CBOs and farmers for evaluation and further multiplication. Some of the bean varieties released this way are Katumani Bean 1 (KAT B1), Katumani Bean 9 (KAT B9) and Katumani X56 (KAT X56). Seed companies have so far produced over 400 t of improved certified bean seed released by the Kenya Plant Health Inspectorate Service (KEPHIS) in 2000. The varieties are shown to be rich in iron and zinc. It is estimated that over 10 million smallholder farmers in the Eastern, Western and Central provinces in Kenya are using the bean varieties released through this process. Other users of the technology include NGOs, consumers, NARIs and about 100 contracted seed growers in eastern and western Kenya.

The formal variety release system and informal dissemination through farmer organisations, NGOs and CBOs helped promote the innovation. Other dissemination methods included field days, promotional materials, contact farmers, participatory farmer research breeding methods and the mass media. In addition, the private–public sector relationship developed at the onset of this work ensured incorporation of a private-sector marketing strategy that guaranteed rapid dissemination of new crop varieties. Up scaling of the bean varieties was undertaken by Lagrotech Seed Company and Consultants in the production and multiplication of breeder and foundation seed. In addition, contracted smallholder farmers were engaged to produce bean seeds for certification by KEPHIS. This approach worked well and resulted in large quantities of certified bean seed being available in the market. Other actors involved in scaling up were farmer groups, NGOs and CBOs. Observations from this work reveal that in order to satisfy clients’ demand, the breeding and selection processes must ensure the participation of the farmers. This helps to ensure that the clients’ preferences are addressed. The innovation is in use in Machakos, Makueni, Mwingi, Kitui, Mbeere, Thika, Embu, Kisumu, Homa Bay, Migori, Rachuonyo, Suba, Kisii, Kakamega, Vihiga, Busia and Butere-Mumias districts in Kenya with potential for its up scaling in Tanzania and Uganda.

For further information please contact Lagrotech Seed Company and Consultants, PO Box 1244 Kisumu, Kenya; Email: [lagrotech@lagrotech.org](mailto:lagrotech@lagrotech.org) or [lagrotech@africaonline.co.ke](mailto:lagrotech@africaonline.co.ke)

**Project Title:** *Private–Public Research Collaboration for Rapid Dissemination of Improved Seeds with End Users through Formal and Informal Methods*



## Cluster 6: Natural resource management

### 6.1 Decision-making tools—A guide to legume integration in farming systems

Grain legumes are major protein sources for animals and humans. The legumes are also a source of soil nutrients. However, at harvest farmers remove both the grain and stover leaving very little residue on the soil. Over time, this practice has a profound effect on soil fertility. A critical question is how to integrate legume crops into the farming systems of smallholders in ways that can improve soil fertility and offer benefits to the farmers. A possible solution is integration of multi-purpose legume cover crops, feed and food legumes into the smallholder farming systems. Through participatory research conducted over several years and across different countries, information on the perception of farmers on cultivation of multi-purpose legume cover crops, feed and food legumes and factors affecting their adoption as well as possible niches within a farm where the integration of these crops could be done were studied. The research established that, as a guideline, the most important socio-economic criteria which farmers apply to make decisions on which legumes to integrate into their niches (across different sites in their farms and over time) were land productivity, farm size, land ownership, access to market and need for livestock feed. These indicators can be used to develop draft decision guides for integration of legumes into multiple cropping systems within the East African highlands.

Some decision support tools have been developed to help farmers identify which legumes to integrate into their farming system. The support tools are based on socio-economic criteria that include land productivity, farm size, land ownership, access to market and the need for livestock feed. These criteria were determined based on past research, conducted over several years at different locations, on farmer perceptions of farm multi-purpose legume cover crops, food and feed legumes, socio-economic factors hindering adoption and potential niches for legume integration. The innovation has potential to improve food and livelihood security of many vulnerable smallholder farmers within ECA. Application of these criteria to advise farmers on integration of legumes into the smallholder farming systems of the East African highlands has potential to improve food and livelihood security of food insecure farm households within ECA.

This approach was disseminated through the use of posters, flyers, stakeholder workshops and publications in journals and book chapters. Little up scaling has taken effect as the technology is still limited to areas around research sites. Specifically, the decision tools are being used by small-scale farmers and extension personnel in Areka in Ethiopia; Kakamega in Kenya; and Tororo District in Uganda.

Based on lessons from past projects in pilot sites, improvements on locally acceptable technologies and allowing for client-oriented technology development are crucial, as communities become empowered to seek and demand technologies that best address their needs.


For further information please contact the African Highlands Initiative (AHI)/ ICRAF, PO Box 30677, Nairobi 00100, Kenya. Tel: +254 20 7224000; Email: t.amede@cgiar.org

**Project Title:** *Guidelines for Integration of Legumes into the Farming Systems of East African Highlands*

## 6.2 Blending knowledge for decision making in natural resource management

Livelihoods in rural farming communities stand to be improved following recognition of the contribution that indigenous knowledge can make to technology development when integrated with scientific knowledge. For a long time research has overlooked the role of indigenous knowledge and local practices in generating practical solutions that can be adopted easily by smallholder farming





communities. This work aimed at merging existing local knowledge and practices with scientific knowledge generated from agricultural research for sustainable NRM. Examples from Lushoto in Tanzania have shown that farmers use a local shrub, *Vernonia subligera* (tughutu) as a suitable source of green manure. In Areka, Ethiopia, a nocturnal pest of maize, the porcupine is similarly being controlled using indigenous knowledge. Integrating these with improved pest and better crop management practices will enhance farmer productivity.

AHI facilitated the spread of this innovation through demonstrations, exchange visits and farmer-to-farmer interactions. Up-scaling initiatives were undertaken through AHI briefs, working papers, and journal and website publications. The technology is being used by smallholder farmers and extension and research institutions in the ECA region including Ethiopia, Kenya, Tanzania and Uganda. Based on lessons from this project, farmer participation in constraint identification and prioritisation is vital as is the need to acknowledge the contribution of indigenous knowledge in the R&D process. Having this in perspective generates an interest in the innovation by the farmers/end-users and boosts the potential for adoption of local practices in NRM.


For more information please contact the African Highlands Initiative (AHI)/ ICRAF, PO Box 30677, Nairobi 00100, Kenya. Tel: +254 20 7224000; Email: j.mowo@cgiar.org; jgmowo@yahoo.com

**Project Title:** *Improving Research–Development Linkages: The Use of Scientific and Local Knowledge to Ground Decision-Making in Natural Resource Management*

### 6.3 New approaches for sustained natural resource management

Management of natural resources has always focused on individual problems such as erosion control or watershed management and solutions formulated to address specifically identified problems. AHI has embarked on testing new approaches for integrated natural resources management through partnerships with national stakeholders involved in agricultural development and the communities involved. This effort has resulted in increased adoption rates, localised livelihood impact, has generated new methods and approaches to enable such localised impacts to be scaled up and institutionalised within R&D institutions in ECA. The process emphasises integrated approaches to landscape and/or watershed management and collective action in NRM. In this way, it calls for the simultaneous application of innovations in the technology, social, policy and marketing arenas.

The dissemination of information to other areas was achieved through collaborative efforts from NARS, local governments and NGOs operating in the sub-region. Field days and the media were also used to disseminate the information. Up-scaling



initiatives were undertaken using regional training events for ASARECA member countries and the use of AHI publications and website. The approach is being used by NARS, NGOs, extension agencies, and farmers. It is being used at all AHI benchmark sites in Ethiopia, Tanzania and Uganda and there is potential to scale this up in Rwanda.

As part of lessons learnt, methodological innovations cannot be solely demand driven. Rather, a review of current practices and deficiencies hindering impact of the technology need to be taken into consideration. Demand articulation must therefore integrate diverse approaches in technology development and dissemination in order to register impact in the community.

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***Project Title:*** *Approaches for Fostering Integrated Natural Resource Management at Landscape Level and for Mobilizing Collective Action in NRM*


## Cluster 7: Access to credit and markets

### 7.1 Savings and credit associations—Empowering farmers to utilise agricultural technology and innovations

Investment in agricultural technologies by smallholders is often limited by financial constraints. Banks and other money lending institutions have always considered agriculture to be risky. Agricultural credit from commercial banks and other formal financial institutions is generally expensive. Smallholder farmer often lack the acceptable collateral needed to secure credit from these institutions. In 2005, AHI facilitated the formation of a community based savings and credit cooperative (SACCO) in Kwalei village, Lushoto District, Tanzania, to help build the financial base of the farmers in the village. The aim was to provide capacity for farmers to finance adoption of NRM technologies in soil conservation. The SACCO comprised 34 members. AHI facilitated linkages between farmers and district cooperative officers, development of the SACCO constitution and the opening of a bank account.

This innovation was disseminated through farmers' workshops, village meetings, training sessions and exchange programmes to other SACCOs that function profitably. Scaling up was through negotiation with formal financial institutions like the local CRDB Bank to extend more loans to the members of the SACCO and to recruit members from Baga watershed and not just from one village. There are





now 256 households across five villages (Kwalei, Mbelei, Kwadoe, Kwekitui and Kwehangala) benefiting from this SACCO, up from 34 households at its formation. The capital has similarly grown from US\$ 30 in 2002 to US\$ 34,000 in 2007. The SACCOs are expected to expand from the current watershed of Baga into Mamba Ward, bringing its total membership close to 1000. Farmers borrow money to finance implementation of NRM technologies such as soil conservation, purchase of improved seeds, horticulture, financing education for their children and for household improvement.

Based on the AHI experience in Tanzania, community demands need not conform to researchers' work ethics. In this case it was learned that inadequacies in farmers' ability to invest in agricultural technologies could be boosted by empowering them in groups and building their capacity through mobilisation to enable them to own a micro-credit scheme that could cater for their financial needs. This initiative has the potential to spread and be up scaled in other areas of Tanzania and other countries in ECA.

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**Project Title:** *Building the Financial Capital for Enhanced Natural Resource Management among Mountain Communities: AHI Experiences in Lushoto, Tanzania*

## 7.2 Organising smallholder farmers for improved market access

Accessibility to profitable markets remains a major challenge for many smallholders in rural sub-Saharan Africa today. Experiences from past initiatives in linking farmers to markets may have failed due to lack of knowledge and the necessary skills among smallholders to exploit such opportunities. In addition, the top-down approach used by development agencies lacked an effective process of community learning and empowerment. In recent years, researchers working with other partners have embarked on developing participatory approaches to market access where they focus on the entire production–consumption chain. This approach encourages the formation of farmer organisations, which provides opportunity for farmer empowerment and for making them more competitive in the market. The case study on the experience of the Nyabyumba United Farmers group in Kabale District, Uganda, illustrates the potential benefits from organising for collective marketing. The Nyabyumba United Farmers group began in 1998 as a farmer field school with the aim of producing seed potato. Today, the group comprises six FFS with 120 members, 80 of whom are women. In 2002, an upsurge in ware potato production coincided with a reduction in demand for seed potato. Marketing the

ware potato became a major challenge for the farmers' group. Partnerships were initiated with NARO, PRAPACE, the International Center for Tropical Agriculture (CIAT) and Africare as R&D partners, and a participatory market chain research analysis was conducted. With technical assistance from their service providers, the Nyabyumba farmers group identified Nandos, a fast foot restaurant in Kampala, as a potential market for their potatoes. They received training in production and collective marketing and how to meet the market requirements in terms of quality, quantity and ensuring timely supply. The group currently markets, on average, 7.5 t of potato to Nandos in 125-kg bags every fortnight through forward contracts and has registered a return on investments of up to 70%. Nandos records a 50% reduction in losses because the company no longer has to purchase poor quality potato from the open market.

Poor group organisation and quality of the product supplied by members were among the initial challenges faced by the farmers. However, stringent commitment to learning and experimentation has contributed to their success as a group in sustaining the market linkage. Dissemination of this innovation was by means of publications in the form of reports and highlights on websites ([www.ciat.cgiar.org](http://www.ciat.cgiar.org)) and radio broadcast on Farm Radio International (<http://www.farmradio.org/>). Up scaling took the form of radio broadcasts and farmer-to-farmer meetings. Important lessons drawn from this experience include: (1) farmers' attitude and commitment to producing for a niche market is important for successful linkages to high value markets; (2) capacity of development partners in building farmer capacity, especially that of women, is vital to consolidating sustainable relationships with buyers/markets; (3) access to innovations at critical points in the enterprise process is vital to success; (4) enterprises must be based on analyses of sound technical and economic information; (5) and the participatory approach permits farmers to make better decisions and to obtain a better understanding of the challenges faced by each actor in the market chain. The innovation is being used by individual and farmers groups in and around Kabale. There, however, exists potential for out and up scaling in other potato producing areas and for trying out the approach with other agricultural commodities.

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**Project Title:** *Linking Smallholders to Remunerative Markets—How Smallholder Potato Producers in a Remote District of Uganda Market their Potatoes to Nandos in Kampala*


## Cluster 8: Policy

### 8.1 Enhancing agricultural trade through harmonisation of seed policies and regulations

The commercial seed sector in most of sub-Saharan Africa accounts for less than 2% of the estimated levels of the global seed trade. The seed sector in the region is characterised by high costs, with a narrow range of crops and market differences in seed policies, laws and regulations. The result of these factors is inefficient seed systems with low effective demand for seed and low agricultural productivity. Agricultural research, and varietal development, release and dissemination have been constrained by the existing laws and regulations in the different countries. These differences are a challenge to the free movement of germplasm and seed trade in the sub-region. In a drive to improve agricultural productivity and seed trade in ECA, the Eastern and Central Africa Programme for Agricultural Policy Analysis (ECAPAPA) commissioned a pilot project in 1999 to rationalise and harmonise seed policies, laws and regulations in selected countries in ECA. Key areas of rationalisation were variety evaluation, release and registration; seed certification; phytosanitary regulations; plant variety protection and seed laws and regulations (import and export). The ECAPAPA Policy-Change cycle that encompasses policy agenda establishment, data collection, analysis, dialogue and policy action was applied. The outputs were draft agreements broadly categorised as procedural and legal. Procedural agreements required no alteration in legislation and offered potential for immediate implementation. Legal agreements, however, required changes in legislation and approval by law makers (Parliament) or fast track action from attorneys general. The pilot project covered Kenya, Tanzania and Uganda.

Dissemination of this output has taken the form of newsletters, workshops, conference proceedings, consultative meetings, reports and publications and short online briefs with a considerable measure of success. The outputs are being scaled out to cover the other countries in the ASARECA region in what is referred to as second and third phase countries. So far, the agreements reached in the pilot phase are being adopted. Methods used to scale up the outputs of the pilot phase included workshops and consultative meetings that provided for information and knowledge sharing and exchange. Among the achievements of the rationalisation process are the establishment of national seed trade associations in the region, the transformation of the Regional Seed Working group into the East African Seed Committee, the revision of seed acts by respective countries in the region (including Burundi, Kenya, Sudan and Tanzania), a reduction in the period it takes to release a variety from 3 years to 1 season, and a cutback in the number of quarantine pests from 33 to only 3. Policy makers, farmers, the private and public sectors and research institutions are among the range of end-users for this innovation.





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