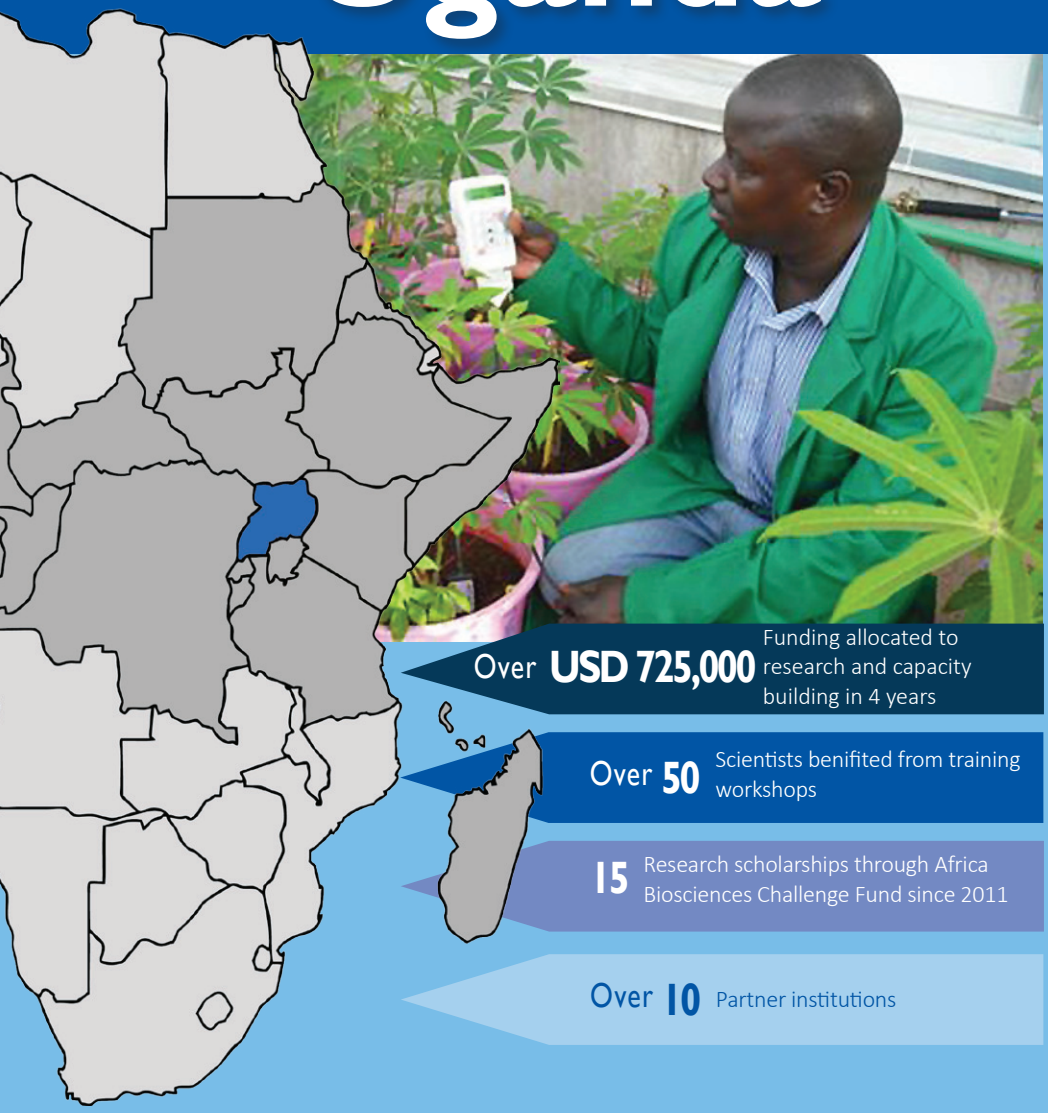
BecA-ILRI Hub in

Uganda



Over **USD 725,000** Funding allocated to research and capacity building in 4 years

Over **50** Scientists benifited from training workshops

15 Research scholarships through Africa Biosciences Challenge Fund since 2011

Over **10** Partner institutions

Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub was established in Nairobi, Kenya, with the aim of increasing the use of cutting edge bioscience technologies to address Africa's agricultural, health, and environmental challenges. There are 18 countries in the BecA region - Burundi, Cameroon, Central Africa Republic, Congo Brazzaville, Democratic Republic of Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Kenya, Madagascar, Rwanda, São Tomé and Príncipe, Somalia, South Sudan, Sudan, Tanzania and Uganda.

The BecA-ILRI Hub in Uganda

In empowering African researchers and institutions to to exploit biosciences opportunities, the BecA-ILRI Hub contributes to addressing key agricultural constraints in food production, nutrition and animal health in eastern and central African countries including Uganda. This is achieved through partnerships with the country's national agricultural research system, development organizations and other stakeholders. Since 2010, the BecA-ILRI Hub has contributed to NARS in Uganda through various engagements including:

Collaborative research

The projects, which include national partner-led research projects, are demand driven, responding to the high priority themes identified for increasing the productivity of food and improved agricultural systems in Uganda.

Fieldwork being undertaken to improve the understanding of African swine fever - part of the research done by Africa Biosciences Challenge Fund fellowship recipient, Charles Masembe from Uganda (photo credit: ILRI)

Controlling the spread of African swine fever in Uganda

African swine fever (ASF) is a devastating emerging disease of pigs that causes almost 90-100 percent mortality in pig herds.

Together with researchers from Makerere University and the Ministry of Agriculture, Animal Industries and Fisheries in Uganda as well as partners from Kenya, Australia and Spain, the BecA-ILRI Hub project on ASF is contributing to disease management strategies that will benefit smallholder farmers in more than 20 countries in eastern, central, western and southern Africa including Uganda. The project has developed a set of guidelines for controlling the spread of ASF in Uganda. Pig farmers are better linked to the local District Veterinary Services for advice

and support on general disease management and ASF outbreaks. There is also an increased awareness of biosecurity measures in pig production by farmers. Through the project's validation of rapid real-time field diagnostics kits, more rapid confirmation of ASF outbreaks is enabling veterinary authorities to implement control measures during outbreaks. A major finding regarding the non-detection of the virus through blood sampling due to its location in tissues is critical to disease surveillance and monitoring, and quarantine strategies.

Enhancing food security through tissue culture and diagnostics

Tissue culture is among the most widely used biotechnologies in African agricultural improvement. When applied correctly, it enables the large scale production of disease-free, high performing, farmer-preferred varieties. While there are tissue culture facilities in eastern Africa disseminating their products to small holder farmers, these laboratories only have a limited range of crop species and are not incorporating virus indexing to ensure that their end products are in fact disease-free.

The BecA-ILRI Hub has focussed on enhancing the operations of tissue culture facilities in Uganda, to enable them to provide disease free planting materials of a wider range of crop species to small holder farmers. Already, efficient methods for the transformation of passion fruit and yam from Uganda have been developed.

The tissue culture pojects are linked closely with the BecA-ILRI Hub's virus discovery and diagnostics development projects which are aimed at adapting a variety of existing diagnostics for developing country laboratories. The diagnotics research is being conducted in collaboration with national veterinary laboratories, research institutions and universities in Uganda.

Strategic partnerships

By engaging key researchers and strategic agricultural research institutions and universities in Uganda, the BecA-ILRI Hub is playing a key role in driving change in the country's agricultural research system. Technical and advisory support on best practices and cost effective management of facilities as well as institution specific interventions have resulted in enhanced agricultural biosciences capability.

Supporting molecular biology research at Gulu University, Uganda

The BecA-ILRI Hub carried out a mission to operationalize a new biotechnology laboratory at the Gulu University in northern Uganda. The exercise was led by the BecA-ILRI Hub's capacity building senior scientist and included the installation of bioscience equipment, and staff training in equipment operation and maintenance by a team of engineers from ILRI. This laboratory will support the human medicine, veterinary medicine, plant science and basic sciences faculties of the university.

The purchase of the equipment for the laboratory had been funded by a grant of USD 784600.00 from the World Bank and Government of Uganda channeled through the Uganda National Council for Science and Technology Uganda-Millennium Science Initiative program. The proposal to acquire these funds had been written in 2009 with the support of the BecA-ILRI Hub. The long-term Gulu-BecA partnership demonstrates the BecA-ILRI Hub's role of supporting and strengthening the capacity of African NARS to deliver on their mandate.

Catalizing international research connections for Ugandan scientists

The BecA-ILRI Hub sponsored the participation of Richard Echodu, Dean of the Faculty of Science, Gulu University, to a major research for development partnership borkering event—Agriculture Research Connections Workshop. The workshop brought together 75 scientists from Africa, Europe, USA, South America, Australia and Asia to foster scientific collaborations that will address challenges faced by African farming families in crop production. Through this workshop, Echodu connected with Prof. Hideaki Tsutsui from University of California, Riverside and this connection led to the successful application for funds from the Program for Emerging Agricultural Research Leaders (PEARLs) grant. The project will develop simple, low-cost diagnostic tools to detect the sweet potato virus. The tools, which will be adopted to suit resource-limited settings in research facilities across Africa, will facilitate effective disease management and production of virus-free planting materials for the sweet potato, an important crop for food security in Sub-Saharan Africa.

Partner institutions

- Ministry of Agriculture, Animal Industries and Fisheries,
- National Agricultural Research Organization (NARO)
- National Crops Resources Research Institute (NaCRRI)
- National Animal Disease Diagnostics and Epidemiology Centre (NADDEC)
- Central Veterinary Laboratory
- Department of Livestock Health
- Gulu University
- Makerere University
- Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)
- The Eastern and Central African Bean Research Network (ECABREN) coordinated by the International Center for Tropical Agriculture (CIAT)

Prof. Joseph Okello-Onen, Gulu University (3rd right) during the visit by the University's engineers to the BecA-ILRI Hub in Nairobi (photo: BecA-ILRI Hub\Ethel Makila)

Capacity building

The BecA-ILRI Hub is expanding the base of expertise in agricultural research in Uganda by hosting scientists and graduate students to conduct research, and by conducting training programs. Research placements combine training in the latest technologies, as well as opportunities to conduct research on topics addressing food and nutritional insecurity and livestock health.

There are four main categories of capacity building and training activities that have involved several scientists and graduate students from Uganda:

Post graduate students

Post graduate students (MSc and PhD candidates) have conducted research at the BecA-ILRI Hub either by being attached to existing research projects or through their stand-alone thesis projects.

Small group training and short-term visiting scientists

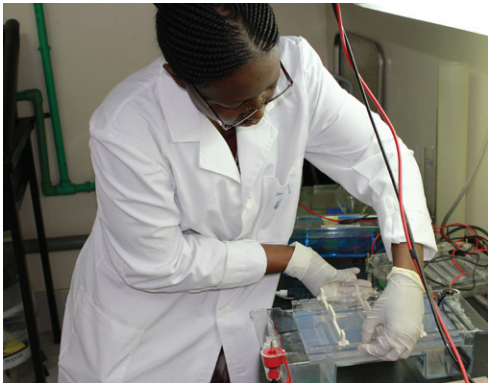
Smaller groups of up to five participants have also received tailor-made training and laboratory work programs. Visiting scientists from Ugandan universities or other research institutes have come to the BecA-ILRI Hub to use the facilities to advance their research projects.

Training workshops

A number of Ugandan scientists have benefited from group training workshops which emphasize problem-solving, hands-on training, seminars, discussions and laboratory practical work. These trainings are developed within the BecA-ILRI Hub's core competencies such as genomics, bioinformatics, diagnostics, molecular marker development and applications, DNA sequencing and genotyping, and scientific paper writing.

Africa Biosciences Challenge Fund (ABCF)

This is a competitive fund which facilitates access to the BecA-ILRI Hub for scientists and students from African National Research Institutes and universities. Through this program, Ugandan scientists have received support for their research fellowships, pilot project grants and training.



Harriet Angwech, lecturer, Gulu University conducting research on trypanosome infections of domestic livestock in the post conflict districts of Amuru and Nwoya, northern Uganda under the Africa Biosciences Challenge Fund (ABCF) fellowship program at the BecA-ILRI Hub in Nairobi (photo: BecA-ILRI Hub\Valerian Aloo)

Ann Nanteza, Makerere University (r) and Fredrick Kabi, National Livestock Resources Research Institute (NaLIRRI) who conducted research on East coast fever through the ABCF fellowship program with Diaeldin Hassan, Veterinary Research Institute Sudan (l) (photo: BecA-ILRI Hub\Valerian Aloo)

Building science leadership of national researchers

African leader in livestock disease research

Charles Masembe is a veterinarian and an Assistant Professor in the College of Natural Sciences at the Makerere University in Uganda.

In 2010 and 2011, Dr Masembe conducted research at the BecA-ILRI Hub on genetic factors linked to the transfer of African swine fever (ASF) in Uganda. The country has the largest pig population (3.2 million) and most rapidly growing pig production in eastern Africa.

This thriving industry is threatened by ASF, the devastating viral disease with regular outbreaks that kill 90–100 percent of herds affected.

Through his research at the BecA-ILRI Hub, Masembe, shed light on the existence of the *Ndumu virus* in domestic pigs, a phenomenon which had not been previously observed. Building on that discovery, he continued to lead key research efforts on understanding ASF and has now been awarded a five-year Wellcome Trust Public Health and Tropical Medicine fellowship. He will investigate the distribution patterns, and full genome characteristics that influence the maintenance and transmission of African swine fever at the livestock-wildlife interface in Uganda.

The results of his research will contribute to the development of effective control strategies for this devastating disease that is impeding the development of the pig industry in Uganda.

Exploring new frontiers in crop research

In 2011 Ugandan scientist Alexander Bombom, who had successfully crossed maize and sorghum as part of his PhD studies in Makerere, joined the BecA-ILRI Hub to further his research through an Africa Biosciences Challenge Fund (ABCF) fellowship. A proposal for funding of a project to generate novel sources of genetic variation by crossing maize and sorghum based on this work attracted funding for research which Bombom now leads at the BecA-ILRI Hub.

Genetic gains in crop improvement for traits, including, but not limited, to yield increase, pest and disease resistance, plant and grain quality, and resilience to climate change factors are limited by a narrow germplasm base in breeding programs worldwide. Maize and sorghum, important staple cereals in sub-Saharan Africa, have a variety of uses including food, feed, fuel and as industrial grain crops, and contribute significantly to food and nutrition security in the region. Sorghum can grow in marginal soils and with stands heat and drought stress. Maize has important grain quality attributes that would be beneficial for sorghum grain quality improvement such as digestibility.

The following Ugandan scientists have benefited from the Africa Biosciences Challenge Fund fellowship program since 2010:

Charles Masembe
Lecturer, Makerere University
8 November-6 December 2010; 5 June-28 July 2011
Project title: Pig diseases and food security: Next-generation DNA sequencing of *African swine fever virus* (ASFV) in Uganda

Alexander Bombom
Graduate Fellow, Makerere University
6 September-16 December 2011; 14 February-15 June 2012
Project title: Molecular characterization of maize-sorghum hybrids

Harriet Angwech
Lecturer, Gulu University
26 March–28 July 2012
Project title: Epidemiology and characterisation of trypanosome infections of livestock and tsetse flies in the post conflict districts of Amuru and Nwoya, northern Uganda

Robert Opiro
Assistant Lecturer, Gulu University
26 March–28 July 2012
Project title: The Characterization of trypanosome infections in tsetse flies in the post conflict West Nile Districts of Adjumani and Moyo, Uganda

Benius Tukahirwa
Graduate Research Assistant, National Crops Resources Research Institute (NaCRRI)
16 April–16 August 2012
Project title: Characterization of type III secretion effector genes responsible for hypersensitive response and pathogenicity of *Xanthomonas vasicola pv. musacearum*

Abel Byarugaba Arinaitwe
Research Officer/Plant Pathologist, National Agricultural Research Organazation (NARO)
15 June 2013–31January 2014
Project title: Regeneration and transformation of two potato varieties from Uganda for resistance to potato late blight disease caused by Phytophthorainfestans

Sandra Kamenya
Lecturer, Christian University
4 November 2013–4 August 2014
Project title: Developing genomic tools for Solanum aethiopicum breeding and gene discovery

Peter Akoll
Lecturer, Makerere University
1 July 2013–20 December 2013
Project title: Investigation of bacterial diversity and contribution to the rapid identification of pathogenic bacteria in catfish hatcheries in Uganda

Alexander Ssamula
PhD student, Makerere University
10 November 2013–10 May 2014
Project title: In vitro micro-propagation of elite passion fruit varieties in Uganda

John Walakira
Researcher, National Fisheries Resources Research Institute-NARO
1 July 2014–15 April 2015
Project title: Developing a SNP panel as tool to determine the genetic diversity and guide domestication of African lungfish-

Jacinta Akol
Researcher, National Crops Resources Research Institute
18 August 2014–17 February 2015
Project title: Development of tissue culture protocol for production of quality farmer preferred yam planting material

Rachel Aye
Teaching Assistant, Gulu University
9 March 2015–8 December 2015
Selection of Mycoplasma mycoides subsp. Mycoides candidate vaccine molecules through the identification of monoclonal antibodies that inhibit pathogen-host cell adhesion

Robert Mwesigwa
Researcher, National Agricultural Research Organisation
1 July 2014–30 December 2014
Project title: Abundance and diversity of fungal endophyte communities associated with local Brachiaria ecotypes

Fred Bwayo Masika
Research Assistant, Christian University
1 September 2015–31 August 2016
Single nucleotide polymorphism discovery and validation in Solanum aethiopicum

In addition, to the fully funded ABCF fellows, over 10 visiting scientists and graduate students from Uganda have conducted their research at the BecA-ILRI Hub in key priority research areas including crop improvement; food safety and improved nutrition; livestock productivity; climate change reslience; and low input crop and livestock for alternative nutrition and income sources.

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