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A QUARTERLY NEWSLETTER OF THE FOOD SECURITY AND CLIMATE CHANGE PROGRAMS

BecA-Sweden
PARTNERSHIP NEWSLETTER

Participants of the Results-Based Management workshop conducted by the BecA-ILRI Hub from 4-8 February 2014 in ILRI, Nairobi for the Sweden funded projects. (photo credit: BecA-ILRI Hub/Tim Hall)

this issue

A partnership for the future

During the review of the BecA-Sweden partnership programmes at the BecA-ILRI Hub in November 2013, Gity Berhavan, Senior Research Advisor/First Secretary: Regional Research Cooperation, Embassy of Sweden in Kenya, expressed her thoughts on Sweden's contribution to research for development in Africa and specifically about the partnership with the BecA-ILRI Hub.

Sweden's strategy for development cooperation with Africa, especially in the area of research, is to align itself with the African agenda. For example, the African Union's New Partnership for Africa's Development (AU/NEPAD) Comprehensive Africa Agriculture Development Programme (CAADP) agenda is to increase the productivity of the food and agricultural systems in Africa.

Partnering with the BecA-ILRI Hub (or BecA) is a strategic way of tapping into the wider African science agenda. The BecA-ILRI Hub is an African initiative that responds to this agenda by bringing together different national agricultural research institutions in collaborative research based on regional and national priorities, for the improvement of livestock and crop production.

By supporting BecA, the Swedish government is able to provide funding to increase the capacity of an array of African institutions to conduct high end agricultural research. A case in point BecA's programme to increase the use of bioinformatics to mine genomics and metagenomics data for the development of disease diagnostics tools. Through this programme, the knowledge and capacity in bioinformatics which is already at Hub is being extended to other institutions in the region, ensuring the sustainability of research in that area. The African Biosciences Challenge Fund (ABCF) is another exciting programme which is giving early career scientists in Africa access to training and skills that will enable them to design and lead bigger research projects on their own.

The highlight of the review, however, has been getting acquainted with the kind of research and capacity building alliances the BecA-ILRI Hub is building that are not limited to 'south-south', 'north-south' but also 'south-south-north' collaborations. These broad partnerships are what 21st Century research needs in order to find timely solutions to the challenges of global food insecurity.

Going forward, we would like to see the BecA-ILRI Hub engage more with policy makers and institutions responsible for the development of national Masters and PhD programmes curriculum development. A paradigm shift from training scholars for employment, to training scientists who will create jobs through innovative research will greatly accelerate development in the region.

We would also wish to see the constitution of the BecA advisory panel as laid out in the new BecA-ILRI Hub Business plan for 2013-2018. This panel will play a very critical role in providing dynamic strategic direction in the selection of projects and partners in the future.

biosciences eastern and central africa
SWEDEN
ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Improving food and livestock feed security in Africa

A research and development partnership between Africa and Sweden

Reviewing the BecA-Sweden Partnership

About the BecA-ILRI Hub

Located at and managed by ILRI in Nairobi, Kenya, the BecA-ILRI Hub provides a common biosciences research platform, research-related services and capacity building opportunities in Africa. The Hub increases access for African scientists to affordable, world-class research facilities, while creating and strengthening human resources in biosciences and related disciplines. The Hub activities focus on addressing key constraints in African agriculture.

The Hub is one of four biosciences centres for excellence that are part of the African Union-New Partnership for Africa's Development (AU-NEPAD) African Biosciences Initiative. It has been created under the Comprehensive African Agricultural Productivity Programme (CAADP) to service the needs of countries in eastern and central Africa. CAADP's goal is to support agriculture-led development that eliminates hunger and reduces poverty and food insecurity, generating agricultural growth.

(Left to right) Jagger Harvery, scientist, BecA-ILRI Hub; Appolinaire Djikeng, Director, BecA-ILRI Hub; Gity Berhavan, Senior Research Advisor/First Secretary: Regional Research Cooperation, Embassy of Sweden in Kenya; Timothy Holton, scientist, BecA-ILRI Hub; and Mats Isaksson, Technical Leader, Molecular Diagnostics, Swedish National Veterinary Institute (photo credit: BecA-ILRI Hub/Tim Hall)

The internal review of the BecA-Sweden partnership conducted from 19-20 November 2013 revealed exciting progress that has been made in various activities,m and highlighted the challenges to achieving set milestones. The review also presented an avenue to explore opportunities for expanding partnership activities in order to achieve greater impact on agriculture in the region.

Presentations were made on all sub-components in the food security programme, the climate change mitigation and adaptation programme as well as the capacity building activities that are supported through this partnership.

Capacity Building

The investment in capacity building is aimed at increasing the capability of institutions and individuals in Africa to conduct biosciences-related research, and to develop and deliver new technologies. The presentations by three beneficiaries of the Africa Biosciences Challenge Fund (ABCF) fellowship programme demonstrated that this investment is already beginning to pay off and that the new leaders in agricultural biosciences are emerging.

Excitement was generated by the presentation of former ABCF Fellow, now a Bill & Melinda Gates Foundation (BMGF) funded Postdoctoral Scientist, Alexander Bombom. Bombom's research, which now forms part of the BecA-ILRI Hub portfolio of projects, focuses on developing maize-sorghum hybrids with the aim of transferring desirable traits between sorghum and maize. Once fully developed, the sorghum x maize technology will be transferred to national agricultural research systems (NARS) and other national partners for use in their breeding programmes.

Lilian Wambua, whose research was co-sponsored by the ABCF and the African Women in Agricultural Research and Development (AWARD) fellowship programme, demonstrated how her study of the *malignant catarrhal fever virus* (MCFV) in Kenya has led to a better understanding of the virus. Malignant catarrhal fever (MCF) is a viral disease which poses a threat to dairy and beef cattle production in both intensive and pastoral agricultural systems globally. In eastern and southern Africa, the MCFV is transferred to cattle from wildebeest, causing an acute and fatal disease which leads to sudden death of infected cattle within 7-14 days of symptomatic illness. Lillian's research, on the genetic

diversity of MCFV in Kenya, has led to a better understanding of the disease in cattle and wildlife reservoirs of the virus. Looking forward, Lilian's findings will contribute to the design of easy-to-use, field-friendly tools, to aid in rapid detection and improved control of MCF.

Tesfamichael Abraha, an ABCF fellow who is co-sponsored by the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) talked about his research on developing drought tolerant sorghum. Tesfamichael, who is currently studying for his PhD at the Jomo Kenyatta University of Agriculture and Technology in Kenya (JKUAT), is a senior plant breeder at the Hamelmalo Agricultural College in Eritrea where sorghum is a major staple food. Extreme drought in the country has led to 70 - 100% yield losses, a situation that heavily compromises the nation's food security. For this reason, farmers in the country prefer local varieties that are well adapted in stress environments and able to produce some yield even in difficult conditions. By integrating genomics, physiology and breeding, Tesfamichael is improving these farmer preferred varieties so that they are not only drought tolerant, but also high yielding.

Funding for capacity building activities from Sweden through this partnership is part of a larger investment by other global donors including the Australian government, BMGF and the Syngenta Foundation for Sustainable Agriculture. Co-funding is also received from agencies promoting science and technology education in the region including ASARECA, the International Foundation for Science (IFS) and the United Nations Educational Scientific and Cultural Organization (UNESCO).

Harnessing genetic diversity for improved goat productivity

The BecA-ILRI Hub-led project on goat improvement is focused on using a better understanding of the diverse genetic make-up of goats to increase productivity in smallholder farming systems in selected countries.

Through various presentations given by team members from the BecA-ILRI Hub and partners from Ethiopia and Cameroon, the team demonstrated not only the technical progress that they had made in laboratory work but also how the participation of farmers and other stakeholders (through the innovation platforms) in the design of research activities will positively influence the uptake and adoption of anticipated innovations.

In Ethiopia, farmers participated in the design of breeding schemes, which involved selecting their preferred parents. These community based breeding plans are now being implemented in eight villages. In Cameroon, a dynamic innovation platform (IP) has been established, with players from various aspects of goat keeping including breeding, health, production systems, economics and research. The stakeholders in this IP are drawn from national public livestock and agriculture programmes; international, regional and national NGOs; veterinarians and veterinary attendants; and regional goat keepers' federations which represent more than 1000 members.

A pedigree ascertainment tool developed by the team is already being tested and a fecundity trait assay (evaluation procedure) is under development - both tools, once fully developed, will be deployed to help breeding programmes.

Beyond the current project partnerships, the team has established new partnerships with institutions involved in research on goats e.g. the African Goat Improvement Network (AGIN) and Foundation of Netherlands Volunteers (SNV)

Plant tissue culture and transformation projects

The tissue culture programme is developing techniques to support the production of clean planting materials for underutilized plant species that are important to food security and nutrition in Africa.

Already, clean taro planting material has been developed by eliminating viruses

A young boy herding goats in the Ethiopian highlands (photo credit: BecA-ILRI Hub/Sarah Osama)

from infected taro plants from Burundi. The clean taro plants have been transferred back to Burundi for multiplication and distribution to farmers. The work on taro was achieved through the collaboration of ABCF research fellows Donatien Bigirimana and Gaspard Ndarubayemwo, assistant researchers in the plant biotechnology laboratory at the University of Burundi; and Pierre Niyonzima, research assistant at the Burundi Agricultural Research Institute (ISABU).

Development of procedures for micro-propagation of the African baobab and in vitro propagation of select passionfruit varieties from Uganda is ongoing at the Hub.

Healthy crops and livestock: Diagnostics tools to detect and facilitate control of diseases of selected crops and animals

In collaboration with the Colorado State University, the diagnostics team reported on a Loop-mediated isothermal amplification (LAMP) assay for rice bacterial leaf blight. The team has created and validated four sensitive tests to detect *Xanthomonas oryzae* Pathovars in rice. These assays will benefit seed and quarantine officers and allow early on-field detection of the bacterial contamination.

African Bioscience Challenge Fund recipient, Titus Kathurima from Kabete Technical Training Institute in Kenya, demonstrated how his work to validate a simple, rapid, accurate and sensitive molecular diagnostic tool for *Cassava brown streak virus* will have an impact not only on cassava but on other plants. Once validated, the technique will be transferred to regional laboratories to help rapidly detect plant pathogens

Box 1: DNA testing to ascertain paternity Community based goat improvement programs

Animal breeding is a core component of managing and maintaining a flock of superior productivity. Classical breeding involves selecting animals whose superior productivity is demonstrated by their performance or that of their ancestors. The selected individuals are than used as parents for the next generation. The process is continued repeatedly until the intended objective is attained. Evaluation of the subjects based on accurate records of production and pedigree is critical to this process. However, in the traditional small holder based systems, the accuracy of record keeping is low and often males and females browse together and mate freely, resulting in poor knowledge of the pedigree.

We elicited farmers' knowledge of the pedigrees of their flocks and tested 22 index animals and their parents (sire and dam) using a simple set of DNA markers so as to establish paternity of the index animals. The aim was to determine the concordance of the farmer's knowledge of their animal's sires and the true paternity as established by DNA testing. Of the 22 tests conducted only one of the farmer-determined paternities could be supported by DNA testing. The implication is that farmers' ability to trace the pedigrees of their flow is not sufficiently accurate to use in breeding programmes and that better control of the mating process or recording needs to be taken into account.

We recommend that when implementing a breeding program in a community set up, selected candidate sires should be genetically tested to establish ancestry and to trace pedigreed relationships. The procedures needed to perform the test would be implemented as part of a management routine and the DNA profiles returned to the breeders with a turnaround time of one week. Incorporating DNA testing for paternity would then be an entry point into future introduction of marker assisted breeding technologies for other production traits.

Given the success of BecA's collaboration with the Swedish University of Agricultural Sciences (SLU) in strengthening the bioinformatics platform, a partnership was initiated with the Swedish National Veterinary Institute (SVA) to enhance BecA's diagnostics capabilities. In this context, Mats Isaksson, Technical Leader, Molecular Diagnostics at SVA presented a talk on the BecA-SVA partnership and the adaptation of modern diagnostic techniques to low technology laboratories. Through the BecA-SVA collaboration, a team working on BecA's Australian funded research on African swine fever (ASF) in Kenya and Uganda was able to establish a mobile diagnostics laboratory that conducted screening for ASF virus on the field. Results of these tests run from the mobile laboratory working out of the back of a field car were replicated in conventional labs in ILRI, Busia and Nairobi, and are applicable to many animal health care needs.

All these tools and others under development constitute components of the BecA diagnostics platform which is focussed on adapting the latest diagnostic techniques to develop tools for use in low technology laboratories and in the field.

Climate-smart Brachiaria grasses for improving livestock production in East Africa

Within a short time of its inception, the *"Climate-smart Brachiaria grasses for improving livestock production in East Africa"* programme has begun to generate much excitement both from laboratory and field based activities. The engagement of smallholder farmers who are interested in the potential of the grasses being developed was well recognized as a major achievement during the review.

Different varieties of brachiaria grasses planted in an experimental field in ILRI, Nairobi (photo credit: BecA-ILRI Hub\ Collins Mutai)

Aside from increasing forage availability in Kenya, Rwanda and eventually other semi-arid and arid regions, the programme team plans to train and empower smallholder farmers in brachiaria grasses seed production as an income generating project. The early involvement of end users greatly increases the uptake likelihood of forage varieties that will be developed through this programme.

Bioinformatics and genomics platforms

The BecA-ILRI Hub bioinformatics and genomics platform was established to meet the growing bioinformatics and genomics needs of researchers in eastern and central Africa. This platform is providing scientific informatics support for research projects led by NARS, universities and other research institutions in the region.

A highlight of genomics platform was the acquisition and installation of the Illumina MiSeq System as well as the training of several BecA-ILRI Hub and ILRI Biosciences staff on its use. The MiSeq is now being used to support various research projects including projects on environmental metagenomics, transcriptomics, whole genome sequencing, and the BecA-ILRI Hub led "Plant Virome/ Microbiome Ecology in African Farming Systems" project.

The vast database of plant and animal pathogens derived from the National Center for Biotechnology Information (NCBI) that is stored on the bioinformatics platform is also availing data on animal and plant diseases and infectious and genetic diseases, which can be utilized in the design of diagnostics, drugs and vaccines.

Capacity building of scientists in the region is the core component of the bioinformatics and genomics platforms, and through two annual courses in bioinformatics, "Introduction to molecular biology and bioinformatics" and "Advanced genomics and bioinformatics", researchers are being equipped with knowledge of the principles and the potential applications of bioinformatics which can be used to drive agricultural research.

The bioinformatics team has also successfully developed an E-biokit - a portable, locally hosted web service that gives teams of scientists access to databases and tools necessary for bioinformatics analyses without necessitating an internet connection. The kit which includes tutorials was successfully installed in Mikocheni Agricultural Research institute (MARI) - Tanzania, following a workshop conducted to demonstrate its use, and will be distributed to other agricultural research institutions across eastern and central Africa. Increased outputs of research are anticipated with the enhanced capabilities in analysis of biodata by scientists in the region.

Plant Virome Ecology in African Farming Systems: Assessing Food Security

Through the plant virome project, small mixed-crop farming ecosystems have been surveyed for crop pathogens detection and discovery. The project team is focusing on the 'maize mixed' farming system, typically including maize and a selection of different crops (potatoes, banana, rice, sorghum, cassava, etc.) which is most common in Kenya.

Preliminary results obtained from Illumina MiSeq total RNA sequencing of samples from Bomet district (one of the target areas) revealed the presence of rich pathogen diversity in maize and several other crops. In particular, the *Maize Chlorotic Mottle Virus* (MCMV) and *Sugarcane Mosaic Virus* (SGMV) that are responsible for the Maize Lethal Necrosis Disease (MLND) which is causing up to 100% crop loss for smallholder maize farmers in Kenya and other eastern and central African regions, have been detected with a high genome coverage. The BecA-ILRI Hub-led plant virome research is contributing to efforts by a national task force in the control of MLND and other emerging diseases affecting food crop production in Kenya. It is anticipated that the next generation (NextGen) sequencing tools available on the genomics platform could provide a significant lead in the understanding of these and other emerging or re-emerging crop diseases, the discovery of new pathogens and the relationship between viruses, their hosts and vectors.

Six million dollar "Christmas gift"

Sweden increases funding to the BecA-ILRI Hub for research towards food security

Swedish Ambassador to Kenya, HE Johan Borgstam and ILRI Director General, Jimmy Smith sign the funding agreement for SEK 40 million

The BecA-ILRI Hub received supplemental funding from the Swedish government in November 2013. The funding was given to enhance research and capacity building activities in the BecA-Sweden partnership on food security and climate change.

The funding agreement was signed at the Swedish Embassy in Nairobi on 22 November 2013 by Swedish Ambassador to Kenya, HE Johan Borgstam and ILRI Director General, Jimmy Smith following a review of the BecA-Sweden partnership projects.

"The signing of this agreement is a testimony to the commitment the team has collectively demonstrated to deliver on existing agreements," said BecA-ILRI Hub Director, Appolinaire Djikeng.

Gity Behravan, Senior Research Advisor/First Secretary: Regional Research Cooperation, Embassy of Sweden in Kenya, commended the progress of the partnership saying "Everyone has been very impressed with the research and capacity building collaborations the BecA-ILRI Hub has established with different national institutions through the BecA-Sweden partnership."

"We are also very encouraged with the broader 'south-south-north' institutional cooperation that the Hub is now fostering. These are the partnerships 21st Century research needs in order to find solutions to food insecurity", she said.

The supplemental funding will also support the strengthening of shared technology platforms (genomics, bioinformatics, nutrition analysis and diagnostics) established by the Hub and will contribute to the development of research capacity in selected regional National Agricultural Research institutions.

Improved goat productivity in Ethiopia: Q&A with Dr Tadelle Dessie

The Swedish funded "Harnessing genetic diversity for improved goat productivity" project is part of a program on livestock improvement through genetic diversity studies. The main goal of this project is to exploit existing genetic diversity in goats to improve goat productivity in Ethiopia and Cameroon.

Dr Tadelle Dessie, a scientist in animal genetics and breeding based at ILRI's Addis Ababa campus, heads the Ethiopian component of BecA-ILRI Hub led project. In this interview, Dessie sheds light on the significance of the research activities being carried out in Ethiopia.

Q Why Ethiopia?

A Ethiopia has a population of nearly 24 million goats, seventy-five per cent of which are found in the arid or semiarid regions of the country. Ethiopia's indigenous goats are very well adapted to the harsh environment, surviving and reproducing in an environment with a scarcity of feed and water, and without proper health care, housing or feeding. These animals support the livelihood of the poorest of the poor, in fact, it is commonly said in Ethiopia, "goats are the poor man's cow".

The large population and role of goats in supporting the livelihoods of poor people means that there is a critical need to improve productivity in order to sustainably provide income and food. This is the justification for this project.

Q What does the Ethiopian component entail?

A The project has five interlinked objectives: to define the breeding goals and selection objectives for various goat breeds and production systems in collaboration with the communities; to establish at least one functional breeding programme per goat breed; to develop a methodological framework for the implementation of community based breeding programmes for smaller producers, including institutional arrangements; to assess the

Dr Tadelle Dessie (right) at an International Center for Agricultural Research in the Dry Area (ICARDA)-ILRI goat genetics resources training course, Addis Ababa, 20-21 December 2012 (photo credit: ILRI/Liya Dejene).

About the BecA-Sweden Partnership

With funding from the Swedish Ministry for Foreign Affairs and the Sida, the BecA-ILRI Hub, together with partners from National Agricultural Research Institutions (NARIs), African universities and regulatory bodies, private sector, international research institutes, foreign universities, CGIAR and other participants designed a number of unique research projects focused on two major issues with which agricultural developments in Africa are concerned – achieving food security and climate change mitigation.

impact of the breeding programmes at an individual, flow, regional, and national level once they are established; and finally through a better understanding of the current challenges, to alleviate the constraints to market access experienced by goat keepers.

Q Where in Ethiopia is the project based?

A The activities in this project are being conducted in five sites - three in the northern regions of Amhara and Tigray; one in central Ethiopia near Addis Ababa; and one in the southern Omo region near Kenya .There are large differences in goat production and farming systems between these regions, and three different goat breeds (two of the breeds are found in two sites each). Farming techniques range from keeping five goats to keeping 2000 goats. In some predominantly goat producing areas individual families keep 500 to 1000 goats, whereas in the south where goat keeping is complimentary to other farming activities smaller herds of four or five goats per household are more common.

Q Who is conducting the research in this project?

A We have a total of five students, two studying for MSc and three PhDs. The MSc students are working on production system and phenotypic characterization of the different goat breeds across our five project sites. The three PhD students' are conducting research that is interlinked; one student is working on breeding goat definitions using ranking experiments and developing a selection index. Using the resultant data from the first PhD student's research, the second student is conducting flow productivity studies, simulation studies, and implementing the breeding plans in the host study communities. In parallel the third student will undertake molecular characterization of the fourteen goat breeds present in Ethiopia. His study will help confirm the large variability in production and productivity within and between the goat breeds which has been observed in the phenotypic and farming system characterization studies.

Results-Based Management

Focusing on achievement of outputs, outcomes and impacts

Rick Williams gives a presentation during the Results-Based Management workshop organized for the Sweden funded projects at the BecA-ILRI Hub, 4-8 February, 2014. (photo credit: BecA-ILRI Hub/Tim Hall)

The BecA-ILRI Hub conducted a Results-Based Management (RBM) training workshop from 4 – 8 February 2014 in Nairobi. This workshop brought together the scientists; international and Africa national agricultural research system partners; collaborators, and target representatives working on the Sweden funded projects.

The training was facilitated by Rick Williams from Associates of International Management Systems (AIMS), Florida, USA who was contracted to help the teams refine their project management strategies. During the workshop, the various teams produced log-frames that would help them focus project implementation properly, monitor their progress, collect data and record the success stories arising from their research.

Results-Based Management is an approach that links project activities to expected outcomes; helps research teams correct problems during implementation of projects; and facilitates credible reporting.

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