



Empowering African bioscientists for agricultural transformation

The BecA-ILRI Hub
Biennial Report

2018
2019

hub.africabiosciences.org



A scientist wearing a white lab coat and glasses is shown in profile, looking down at a tablet computer. The scene is dimly lit with a strong blue light source, likely from a laboratory hood or a specialized light. The scientist's face is partially illuminated by the light from the tablet. In the background, there are some laboratory glassware items, including a petri dish and a beaker, on a surface. The overall atmosphere is focused and professional.

The BecA-ILRI Hub has continued to strengthen the capacity of African scientists to address key agricultural development challenges, including increased productivity, food safety and climate change adaptation and mitigation.

Empowering African bioscientists for agricultural transformation

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2018
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biosciences
eastern and central africa



ILRI
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LIVESTOCK RESEARCH
INSTITUTE



A man wearing a white cap with a logo that says 'TALK DON'T SHOOT' and a light-colored jacket is holding two young goats. The background is a dry, open landscape under a clear blue sky. The text is overlaid on the left side of the image.

The Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub is a co-creation of the African Union's New Partnership for Africa's Development (AU/NEPAD) and the International Livestock Research Institute (ILRI).

The BecA-ILRI Hub's **vision** is to contribute towards improving the livelihoods of millions of resource-poor people in Africa using biosciences-based technologies that improve agricultural productivity, increase incomes and improve food and nutritional security.

The BecA-ILRI Hub's **mission** is mobilizing bioscience for Africa's development by providing a centre of excellence in agricultural biosciences, which enables research, capacity building and product incubation, conducted by scientists in Africa and for Africa, and empowers African institutions to harness innovations for regional impact.

In this issue, you will read about:

Our bioinformatics Community of Practice (CoP) created from an alumni community of more than 300 National Agriculture Research Systems (NARS) researchers. This is a collaborative effort between BecA-ILRI Hub and UK institutes, the John Innes Centre (JIC) and Earlham Institute.

African researchers that have gone through the Africa Biosciences Challenge Fund (ABCF) program and have grown into positions of influence within their institutions. Six of our alumni are featured detailing their experience while at BecA-ILRI Hub and the impact that their fellowship had on their careers.

We continue to conduct demand driven research focused on breeding and genetics for crop and livestock improvement that focuses on the Science Agenda for Agriculture in Africa. We highlight our work with climate-smart Brachiaria grass and our research on African swine fever.

Our cutting-edge technology platforms that have provided numerous opportunities for researchers from CGIAR centres, NARS and the private sector to access advanced technologies that support their research.

A conversation with Cathrine Ziyomo who heads the Integrated Genotyping Service Support (IGSS) platform that began in 2014 and that provides rapid, high quality and affordable genome profiling services to a diverse cadre of breeders.

Our advisory panel and a tribute on the late Prof. Diran Makinde, a member of the advisory panel until his untimely passing in 2019 that has dealt a blow to the bioscience community in Africa.

Resources including new staff.

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Jimmy Smith

Director general, ILRI



Jacob Mignouna

Director, BecA-ILRI Hub

BecA-ILRI Hub's activities in 2018 and 2019 were focused on contributing to agricultural transformation in Africa through harnessing science and investing in the continent's expertise in laboratories.

Fore

Established in 2000, the BecA-ILRI Hub has over the years endeavoured to strengthen the capacity of African scientists to bring about agricultural transformation on the African continent.

We are pleased that biosciences applications such as modern biotechnology are making significant contributions towards transforming African agriculture. Agricultural trends in Africa have been upward over the last decade, offering a glimpse of the desired transformation that positions agriculture as the engine of economic growth, development and well-being. According to the New Partnership for African Development (NEPAD), agricultural production has increased by 160 percent over the past 30 years, far above the global average of 100 percent.

These are impressive developments that should be widely acknowledged. However, there is room for much more to be done to ensure Africa feeds itself without overreliance on imports. BecA-ILRI Hub's activities in 2018 and 2019 were focused on contributing to agricultural transformation in Africa through harnessing science and investing in the continent's expertise in laboratories. Our contribution towards this revolved around three key areas:

- i. Building the capacity of the next generation of African agricultural research leaders and scientists;
- ii. Enabling research to harness the potential of the biosciences to contribute to increasing agricultural productivity and improving food and nutritional safety and security; and

word

- iii. Promoting the development, delivery and adoption of new technologies to address key agricultural productivity constraints through our technology platforms.

Below are highlights on progress made around our three key pillars that will feature in this report:

Capacity building

Through the Africa Biosciences Challenge Fund (ABCF) Fellowship Program, whose purpose is to develop capacity for agricultural biosciences research in Africa, BecA-ILRI Hub awarded 78 ABCF fellowships to early career scientists from 12 countries in sub-Saharan Africa (SSA) in 2018 and 2019. The ABCF program helps scientists acquire knowledge and skills in newer molecular genetic techniques and traditional research methods.

Another key capacity building initiative is the bioinformatics Community of Practice (CoP) that seeks to strengthen the capacity of bioinformatics practitioners, to introduce and train them on new genotyping technologies and to enable them to cope with high volumes of data generated. In April 2018, the BecA-ILRI Hub formed the first CoP, comprising of 14 early career scientists from eight African countries with the aim of training the “few” to train the “many”. The nine-month training was executed in three phases dubbed, Build, Empower and Amplify.

Research

Our *Brachiaria* grass project is on course to achieving its goal of increasing livestock productivity and sources of income for smallholder farmers by increasing the availability of climate resilient and high-quality forage. In 2018 and 2019, national agricultural research systems (NARS) from 12 SSA countries received technical support on *Brachiaria* grass. All the beneficiary countries, except Somalia, initiated the evaluation of the three improved *Brachiaria* grass cultivars - *Basilisk*, *Piata* and *Xaraes*.

Another milestone for the project was the first nation-wide survey of *Brachiaria* grass diseases in Rwanda that revealed leaf blight, leaf spots and leaf rust as major diseases. The project also carried out exploration studies for *Brachiaria* seed production potential in Africa. Initial results indicate possibilities of *Brachiaria* seed production in West Africa.

Technology platforms

BecA-ILRI Hub hosts 12 technology platforms, that provide opportunities for researchers from the CGIAR, NARS

and the private sector to access advanced technologies. This is accompanied by training, development and validation of new tools for adoption.

In 2018, the International Institute of Tropical Agriculture’s (IITA) used the genetic transformation and genome-editing platform that is hosted at the BecA-ILRI Hub, to successfully develop genetically modified bananas that are resistant to bacterial *Xanthomonas* wilt disease, a major production constraint of the crop in Eastern Africa.

In another milestone, the IITA team developed a genome-edited banana streak virus (BSV) resistant plantain. This work was published in *Communications Biology* (Nature Research Journal) in 2019 and is the first report on generation of genome-edited crops in Africa. It is also the first global report on the application of genome editing of banana for disease control.

All these achievements were possible due to the hard work and dedication of BecA-ILRI Hub’s staff, the leadership team, the Advisory Panel, the ILRI Board of Trustees, partners and our investors. We thank you for contributing towards these impressive results.

Joyce Musyoka, a research associate in the Nutrition and Mycotoxin platform performs analysis of multi-mycotoxins in rice.



Capacity



building

There has been significant increase in the number of researchers working in national agricultural research systems (NARS) in Africa. The 47 NARS in Sub Saharan Africa collectively employed 14,221 full-time-equivalent (FTE) researchers in 2011. This is according to International Food Policy Research Institute's Agricultural Science and Technology Indicators (ASTI) initiative. This represented a five-fold increase over the 1971 total of 2,981 FTEs according to the International Food Policy Research Institute. As a result, there has been an increase in the number of early-career agricultural researchers needing further training and mentoring.

BecA-ILRI Hub has over the years invested in a new generation of early to mid-career African scientists. These scientists require significant training and experience to build their capacity and ability to effectively conduct bioscience research on issues that are important to agricultural transformation in their countries.

A significant activity towards this has been through the Africa Biosciences Challenge Fund (ABCF) fellowship program whose purpose is to:

- i. Develop capacity for agricultural biosciences research in Africa;
- ii. Support research for development projects that contribute towards increasing food and nutritional security and/or food safety in Africa, and
- iii. Facilitate access to the BecA-ILRI Hub facilities by African researchers and their partners.

The fellowships are offered to applicants with innovative research projects of up to 12 months aligned with national, regional or continental agricultural development priorities and CGIAR research for development strategies.

In 2018 and 2019, BecA-ILRI Hub awarded 78 ABCF fellowships to early career scientists from 12 countries in SSA. In addition to gaining access to advanced research facilities and expertise, being hosted at the Hub enables the researchers to form

networks of collaboration and expertise that cut across national boundaries.

By close of 2019, the program that started in 2010, had footprints in 26 African countries. Especially encouraging is the sustained interest in young women scientists in the program.

Building a strong bioinformatics community in Africa

The BecA-ILRI Hub has created an alumni community of more than 300 NARS researchers in Africa. To enhance the sustainability and multiplier effects of the program, it has for the past three years mobilized the alumni into synergetic partnerships, or Communities of Practice (CoPs). Each CoP is centred around a priority research theme common in at least three countries. So far, 13 CoPs have been established, all of them aimed at advancing and accelerating research by harnessing the opportunities in high-end bioscience applications available at the BecA-ILRI Hub.

The fellowships are offered to applicants with innovative research projects of up to 12 months aligned with national, regional or continental agricultural development priorities and CGIAR research for development strategies.

Dorine Kabange from University of Lumbumbashi, DR Congo and Collins Muli from University of Nairobi, Kenya prepare RNA libraries (using TruSeq) for targeting potty viruses in the common bean.



Amel Ghouila facilitates a session on the FAIR principles of open science during a soft skills workshop for the Empower phase of the bioinformatics CoP.

As these CoPs were established, the need to create one focused on bioinformatics data analysis that cuts across other CoPs became evident. This led to a collaboration between BecA-ILRI Hub and two UK institutes, the John Innes Centre and the Earlham Institute, under an umbrella initiative, the Alliance for Accelerated Crop Improvement in Africa. This is the first bioinformatics capacity-building effort geared towards agriculture in Africa.

The bioinformatics frontier

The first CoP cohort of 14 early- to mid-career researchers from eight countries, began its work in April 2018. The scientists are from the Democratic Republic of the Congo, Ethiopia, Kenya, Nigeria, Sudan, Uganda, Tanzania and Zimbabwe.

The selection criteria for the group was based on their capacity to integrate new knowledge, their desire to utilize bioinformatics as a key domain to enhance and empower agricultural biosciences in Africa. Also considered was their stability at their home institutions and their willingness to be key players in the formation of a sustainable network of agriculture-oriented bioinformatics experts in Africa.

The formal training modules were conducted by experts from advanced research institutions and mentors for the practical sessions. Twenty six instructors from six countries and 10 institutions participated in the training.

A three-phase approach

The program is implemented in three phases: Build, Empower and Amplify. The 'Build' phase was designed to equip the scientists with core bioinformatics skills pertaining to the analysis of genomics data in various forms. This phase, built around seven in-depth training modules, began in April 2018 and ended in October 2018.

Feedback from the first phase was extremely positive. *'As a researcher based in an African institution, being a part of the Bioinformatics Community of Practice is an opportunity to learn and build capacity in the much-needed area of bioinformatics while building collaborations with other researchers. This will enhance my contribution to the improvement of the agricultural landscape and also help me in building capacity in my home institution.'* said Henry Osaiyuu Osamede, University of Ibadan, Nigeria.

Mukani Moyo Okoba, a molecular biologist from Zimbabwe, was equally laudatory: *'With the skills I'm learning, I can now teach students at my institution different methods of data analysis, enabling them to be self-reliant when they undertake projects that generate huge datasets that would have previously required a bioinformatics 'expert' to analyse.'*

The 'Empower' phase began in October 2018 and ended in April 2019 with a soft skills workshop. The workshop covered topics such as scientific communication to peers, scientific communication to the public, grant proposal writing, working efficiently in teams and setting up a research group.

Key to the 'Empower' phase were the development and implementation of three research projects, designed and led by CoP trainees with guidance from the CoP management team. One of the projects consists of the sequencing and annotation of an African orphan crop, the African yam bean. It provided the opportunity for the trainees to get acquainted with various genomics platforms (Illumina MiSeq and Oxford Nanopore MinION) at the BecA-ILRI Hub. Through this, the participants and BecA-ILRI Hub's staff further developed

CAPACITY BUILDING *...continued*

their expertise in nanopore sequencing. This project, spanning across the 'Empower' and 'Amplify' phase, has led to conference presentations by CoP members and is expected to yield a strong publication in 2020.

The final phase 'Amplify' began in April 2019. Under this phase, besides the continuation of the work on the research projects, one basic bioinformatics training course was conducted at Addis Ababa University, Ethiopia in October 2019. Several CoP members acted as trainers under the leadership of the steward, Helen Nigussie and support from BecA-ILRI Hub and the Swedish University of Agricultural Sciences (SLU) bioinformaticians. An eBioKit was procured and handed over to Addis Ababa University to support data analysis at the University and neighbouring institutions.

The eBioKit is a stand-alone educational platform that hosts numerous tools and databases for bioinformatics research and allows training to take place in a controlled environment. A key advantage of the eBioKit over the existing training methods and solutions is that all the required software and databases

are locally installed on the system, significantly reducing the dependence on the internet. This makes it a computing platform of choice for resource-poor environments.

In 2019, the bioinformatics platform trained over 130 African scientists. Trainees included 34 ABCF placements at the BecA-ILRI Hub, 17 participants from the BecA-ILRI Hub-ASPIRE partnership, 37 eBioKit trainees, 39 participants from the One Health Regional Network (HORN) and three scientists from Rwanda Agriculture Board (RAB).

Building capacity of RAB laboratory technicians in new diseases diagnostics

BecA-ILRI Hub held a four-week Training of Trainers (TOT) workshop for three laboratory technicians from Rwanda Agricultural Board (RAB) at ILRI, Nairobi in August 2019. The workshop was aimed at providing the RAB agricultural biosciences laboratory technicians with the working knowledge in new diseases diagnosis in parasitology, bacteriology, mycology, virology and serology.

The training involved lectures and hands-on training in livestock

laboratory diagnostics, specifically, serology and molecular diagnostics such as DNA purification, polymerase chain reaction (PCR), DNA sequencing and bioinformatics, and nutritional analysis of milk for aflatoxins and antibiotic residues.

The workshop was an outcome of an investment in 2016 by International Fund for Agricultural Fund (IFAD) in the Rwanda Dairy Development Project (RDDP) to increase competitiveness and profitability of the dairy sector. Through the initiative small-scale producers will provide quality products to domestic and regional consumers, thus improving their livelihoods, food security and nutrition while building overall resilience.

The eBioKit is a stand-alone educational platform that hosts numerous tools and databases for bioinformatics research and allows training to take place in a controlled environment.

RAB trainees (from left) Angelique Ingabire, Lydia Murerwa and Vestine Musanyire attended the training of trainers workshop at ILRI, Nairobi.





Hako B.A. Touko Cameroon

An immunogeneticist by profession, he is the vice president in charge of Academic Affairs and Industrial Partnerships in the School of Agriculture and Natural Resources, Catholic University of Buea in Cameroon.

He worked on a project that explored the molecular bases of disease resistance in Cameroon's native chicken populations, characterization and phylogenetic analysis. He worked towards the development of new chicken varieties resistant to Newcastle disease that causes huge losses to poultry farmers. The research provided a means to explore and upgrade the genetic potential of local breeds for disease resistance and increased productivity.

From the work, he published two papers and mobilized resources that enabled him to continue with the project at different levels. Since attaining his fellowship at BecA-ILRI Hub, Touko attests that he has grown beyond research into leading research teams.

"Two things give credence to BecA-ILRI Hub's impact on research in the region. First is the professional growth and the positions occupied by those who have been part of the ABCF fellowship program. Second is the quality and quantity of their scientific outputs including publications and their global networks."

Hako B.A. Touko

Catholic University of Buea,
Cameroon



Building capacity for positions of influence

Over the years, the ABCF program has supported several researchers who have now grown into positions of influence within their institutions.



Nina Wambiji Kenya

As the assistant director of the Fisheries Program at the Kenya Marine and Fisheries Research Institute (KMFRI) and the Kenya country coordinator for the Western Indian Ocean Marine Science Association, Wambiji is the epitome of a scientist who has grown in leaps and bounds.

As a young researcher, Wambiji secured the African Women in Agricultural Research for Development (AWARD) fellowship and advanced science training placement at BecA-ILRI Hub with the support of the ABCF program. This gave her the chance to conduct her research on the application of next generation sequencing approaches to assess the genetic diversity of *Siganus* species (rabbit fish or tafi) from Kenya whose stocks have been dwindling.

Wambiji has been key to KMFRI's research mandate by contributing to research knowledge, data and projections needed for strategic planning. She also manages research programs by coordinating proposal developments for research work, planning research teams, coordinating research reporting and reviewing research performance.

"Besides assisting me to conduct my research, the training equipped me the knowledge and skills molecular techniques that I have continued to apply in extracting and processing of total RNA, cDNA synthesis, DNA, gene expression analysis, cloning procedures and sequence analysis."

Nina Wambiji

Assistant Director,
Fisheries Program,
KMFRI





Pius Lazaro Mwambene Tanzania

He is an assistant director for Research, Training and Extension at the Ministry of Livestock and Fisheries.

In October 2016, he was awarded a fellowship under the ABCF program and spent the next seven months at BecA-ILRI Hub studying the genetic diversity of the highly adapted Tanzanian native chicken ecotypes. This would enable him and his team to determine genetic production attributes that can be used to develop well-informed strategies for improved productivity.

Mwambene's findings showed that both fragment and sequencing analyses depicted high allelic and genetic variability across 10 chicken ecotypes. In addition, 2 percent of the genetic diversity observed was due to differences among ecotypes while the rest based on differences among individuals within the ecotypes. These results underscore the importance of establishing appropriate conservation and management strategies to capitalize on observed variability and maintain genetic flexibility across diverse production environments.

"I am truly grateful to BecA ILRI Hub for the fellowship. The training immensely built my capacity in molecular biology, bioinformatics and soft skills including proposal development and communication skills that have been instrumental in my career advancement."

Pius Lazaro Mwambene

Ministry of Livestock and Fisheries,
Tanzania



Helen Nigussie Aychegrew Ethiopia

She is an assistant professor at the University of Addis Ababa's Department of Microbial, Cellular and Molecular Biology. Prior to this, Aychegrew was an assistant professor at Ambo University, Ethiopia.

Nigussie is a two-time beneficiary of the ABCF fellowship. Her first ABCF fellowship experience was in 2013 when she was a PhD student at Haramaya University, Ethiopia. Through the ABCF Program, she undertook studies on phenotypic and genetic characterization of indigenous sheep breeds of eastern Ethiopia.

Aychegrew emphasizes that all the knowledge and hands-on experience she gained from the BecA-ILRI Hub has greatly influenced how she currently teaches her genomics and bioinformatics at the university.

Nigussie is also the executive secretary of the Society of Ethiopian Women in Science and Technology, a forum that seeks to address under representation of women in science. She is an avid writer, publishing her scientific works in various journals.

"My initial experience at BecA-ILRI Hub was unforgettable. It is where I learnt the fundamentals of molecular biology. Believe it or not, I had never used a micro-pipette before in my life. I was elated when I got a second ABCF fellowship in 2018 for the bioinformatics Community of Practice training."

Helen Nigussie Aychegrew

University of Addis Ababa,
Ethiopia





Barberine Silatsa, Cameroon

She is an assistant lecturer and researcher at the University of Dschang. As a young girl, she dreamt of becoming a veterinarian.

At BecA-ILRI Hub, Assongo investigated ticks and tick-borne diseases among the cattle population in Cameroon. Her aim was to evaluate the current epidemiological status of ticks and tick-borne diseases of cattle in Cameroon with a goal of assembling baseline data and evaluating the risk of disease outbreaks.

She established the presence of *Rhipicephalus microplus* (the Asian Blue tick), a major ectoparasite and livestock disease vector globally. It is known to invade and displace endemic species of the same genus, can transmit a broad range of parasites and develop resistance against acaricides.

Since its introduction in West Africa a decade ago, *R. microplus* has been reported in Ivory Coast, Benin, Togo, Mali, Burkina Faso and Nigeria with potentially far-reaching adverse impacts on the livestock sector.

Her research findings have already been published in *Ticks and Tick-borne Diseases* journal.

“The program helped improve my communication skills. I won a prize for the best oral presentation at the International Congress on Tropical Veterinary Medicine in Buenos Aires in 2018. Thanks to BecA’s ABCF seminar series.”

Barberine Silatsa

University of Dschang, Cameroon



Maurice Mogga South Sudan

As the head of the rice breeding program at South Sudan’s Ministry of Agriculture and Forestry, he got the opportunity to carry out his PhD research on genetic improvement of yield and grain quality in upland rice in South Sudan at BecA-ILRI Hub through the ABCF program in 2016.

Mogga is an associate program officer at Alliance for a Green Revolution in Africa (AGRA) based in South Sudan. His responsibilities include developing the government and private sector linkages to upgrade agricultural value chains and expand market opportunities for smallholder farmers and create synergies between AGRA funded programs and other agricultural initiatives. He has been a tutor at the Crop Training Center in Yei, South Sudan where he trained agriculture extension officers in crop pest and disease management.

Mogga has published his findings in PLOS ONE.

“BecA is unique as it offers a great environment to acquire scientific knowledge as well as carry out research. This fellowship enhanced the quality of my PhD research, giving me an opportunity to publish in high impact journals.”

Maurice Mogga

Ministry of Agriculture and Forestry,
South Sudan

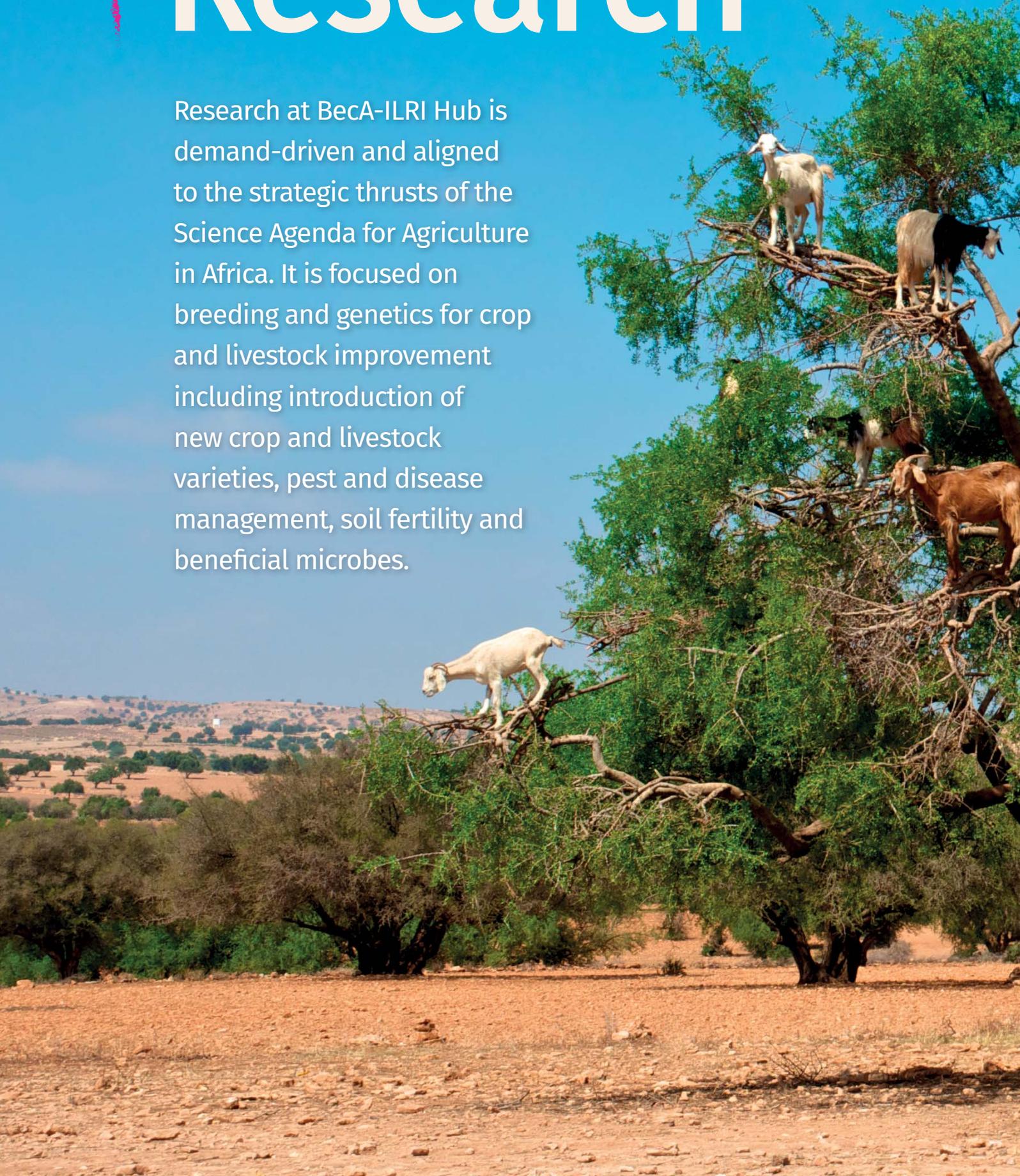




Beca-ILRI Hub provides access to a shared modern, high-end biosciences research facility for African and international scientists to conduct research on African agricultural challenges.

Research

Research at BecA-ILRI Hub is demand-driven and aligned to the strategic thrusts of the Science Agenda for Agriculture in Africa. It is focused on breeding and genetics for crop and livestock improvement including introduction of new crop and livestock varieties, pest and disease management, soil fertility and beneficial microbes.





Climate-smart Brac

Initiated in 2013, the climate-smart *Brachiaria* grass project aims to improve livestock productivity and income for smallholder farmers by increasing the availability of drought resilient and high-quality forage in SSA. The project is supported by the Swedish International Development Cooperation Agency.

The project implements the following four major activities:

- i. Provision of technical support to African NARS, development partners and the private sector on *Brachiaria* grass and other tropical forages production;
- ii. Disease management;
- iii. Research on the use of the beneficial microbes to enhance host fitness; and

- iv. Exploration of *Brachiaria* seed production potential in SSA.

Studies carried out in Kenya and Rwanda since 2013 have identified five improved *Brachiaria* cultivars well suited for East African farming systems. A subset of these varieties (*Brachiaria brizantha* cv. Piata, *B. brizantha* cv. Xaraes, and *B. decumbens* cv. Basilisk) were successfully integrated in existing farming systems, improved forage availability, increased milk production (between 15 to 40 percent) and recorded over 50 percent increase in livestock weight gain.

In 2018 and 2019, NARS from 12 countries and two non-governmental organizations in Ghana and Uganda received technical support on *Brachiaria* grass. The NARS, from the Democratic Republic of the Congo,

South Africa, Eswatini, Cameroon, Ethiopia, Mozambique, Somalia, Sudan, South Sudan, Tanzania, Uganda and Zimbabwe received technical support on *Brachiaria* grass.

The support included: provision of seeds of improved *Brachiaria* cultivars; information on **Brachiaria** farming; evaluation methods for *Brachiaria* grass for adaptation, biomass production and livestock productivity; and training NARS scientists on *Brachiaria* biosciences. The project also undertook exploration studies of *Brachiaria* seed production potential in Africa. All these countries, except Somalia, initiated the evaluation of the three improved *Brachiaria* grass cultivars (*Basilisk*, *Piata* and *Xaraes*).

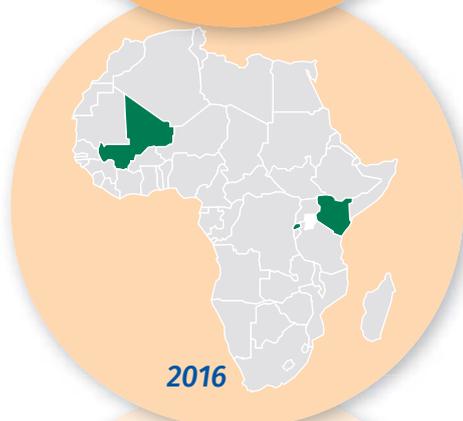
The first-year nation-wide survey of diseases afflicting *Brachiaria* grass in Rwanda was completed in November

Adowso Broni, a *Brachiaria* farmer, harvests *Brachiaria* grass from Semanhyia Farms in Bono region, Ghana.



Brachiaria project

Cattle grazing *Brachiaria* grass fields at the ILRI campus, Nairobi.



African countries benefitting from the Climate-smart *Brachiaria* program, 2013-2019.

2018 revealing leaf blight, leaf spots and leaf rust as major diseases afflicting the grass. Endophytes and plant-associated microbes were isolated from the native *Brachiaria* grass that had been subjected to the prolonged dry season that lasted between late 2017 and early 2018. A total of 577 fungi and 404 bacteria were isolated in 2018, and identification of microbes and their screening for plant beneficial properties were initiated.

In 2019, the second-year surveillances of *Brachiaria* diseases was completed confirming leaf blight, leaf spot and rust as major diseases of *Brachiaria* grass in Rwanda. The causal agent of leaf spot and rust diseases were provisionally determined. Field experiment on management of rust disease is ongoing. Thirty bacteria and five fungi were selected for greenhouse

and field evaluations for phosphate solubilization, drought tolerance, pest management and plant growth promotion of *Brachiaria* grass.

Studies to identify a *Brachiaria* seed production niche in Cameroon showed quality variations among the seed production sites. Studies to improve *Brachiaria* seed production technology were conducted at the Institute of Agricultural Research for Development (IRAD) Wakwa and Garoua regional centers in Cameroon.

In 2019, *Brachiaria* grass ecotypes collections were established in DR Congo, Sudan and Tanzania. Six NARS scientists were recruited as ABCF Fellows on forage biosciences while two completed their fellowship in 2019.

So far, 18 countries in SSA have benefitted from the climate-smart *Brachiaria* program.

Combating African

Pigs are increasingly contributing to improved nutrition and household incomes in Africa where pork consumption and pig keeping are culturally acceptable. However, pig farming is severely constrained by the African swine fever (ASF), an acute, highly contagious and fatal disease in domestic pigs. The transboundary disease characterised by fever and haemorrhagic lesions is caused by the African swine fever virus (ASFV).

There are currently no vaccines available for ASF. The disease has

raged through eastern Europe since 2007 and was reported in Belgium and through much of south east Asia in 2018. Controlling the disease relies on surveillance, restriction of pigs and pork products movement, and rapid diagnosis and culling of ASFV infected animals. However, the implementation of these measures is difficult for smallholder pig farmers in African with limited capacity. Information about the prevalence and diversity of ASFV isolates in circulation in Africa is scant.

BecA-ILRI Hub initiated the African swine fever virus (ASFV) genome sequencing studies in 2017 to better understand ASF and ASFV prevalence, virus evolution and transmission dynamics as well as its potential for

BecA-ILRI Hub initiated the African swine fever virus (ASFV) genome sequencing studies in 2017 to better understand ASF and ASFV prevalence, virus evolution and transmission dynamics as well as its potential for local and global spread and risks.

Studies in South-Kivu province of DR Congo, show that exposure to ASFV was higher in adult pigs (over one year old) than in younger (less than one year old) pigs.



swine fever



local and global spread and risks. The main objectives of the studies carried out in DR Congo, Kenya and Tanzania were two-fold: identification and characterization of ASFV in the three countries; and isolation and complete genome sequencing of ASFV.

Results from Tanzania revealed that ASFV genotype XV circulates between the natural reservoirs of the virus (warthogs and soft ticks) in Saadani National Park, Tanzania, independent of domestic pigs.

Using antibody-ELISA, the studies in South-Kivu Province of DR Congo, show that 37% of apparently healthy local pigs were exposed to ASFV. The exposure was higher in adult pigs (over 1 year old) (44.7%) than in younger (less than 1 year old) pigs (33.5%). The studies also used molecular techniques to confirm the presence of ASFV genotype IX in 22.8% of these asymptomatic domestic pigs.

In an effort to further characterize the viruses involved in ASF outbreaks in DR Congo, Kenya and Tanzania, scientists carried out whole genome sequencing of the virus.

Cross-sectional studies in South-Kivu Province were carried out on domestic pigs with clinical signs of African swine fever during the 2018-2019 outbreaks. The studies revealed the virus causing

the outbreaks was ASFV of genotype X and serotype VII. This was the first ASFV genotype X described in the DR Congo and the second serotype VII ever described (after the first one reported in Uganda).

In an effort to further characterize the viruses involved in ASF outbreaks in DR Congo, Kenya and Tanzania, scientists carried out whole genome sequencing of the virus. In DR Congo, a complete genome sequence of ASFV genotype X was generated, confirming previous findings. In Kenya, the studies generated a complete genome sequence of ASFV genotype IX. In Tanzania, the studies generated four complete genome sequences of ASFV genotype II and a complete genome sequence of ASFV genotype IX. These sequences will contribute to tracing the evolution of ASFV during its spread and provide valuable information for diagnosis improvement and vaccine development.

Technology



platforms

BecA-ILRI Hub hosts 12 technology platforms, that provide opportunities for researchers from the CGIAR, NARS and the private sector to access advanced technologies. The platforms support the scientists by strengthening their capabilities to solve agricultural challenges through training, development and validation of new tools for adoption. Below are highlights of work done on the technology platforms in 2018 and 2019.

Using technology to genetically engineer bananas resistant to diseases and pests

The International Institute of Tropical Agriculture's (IITA) genetic transformation and genome-editing platform is hosted at the BecA-ILRI Hub. The platform enables the development of improved plant varieties that are resistant to diseases and pests. These varieties are vital for increased productivity and income security for farmers. Through the platform, IITA developed genetic engineered bananas that are resistant to bacterial *Xanthomonas* wilt disease, a major production constraint of the crop in eastern Africa.

The disease has posed serious challenges in breeding program and germplasm distributions for bananas and plantains as it cannot be eliminated by traditional techniques.

The Plant Biotechnology team, led by Leena Tripathi, deputy director of Eastern Africa Hub of IITA and country representative in Kenya hopes to replicate the technology on Ensete, a staple food crop in Ethiopia also affected by the disease.

The platform enables the development of improved plant varieties that are resistant to diseases and pests.

Developing banana streak virus resistant plantains using CRISPR/Cas9 technology

In 2018, Leena Tripathi's team, achieved a breakthrough in their efforts to develop a genome-edited banana streak virus resistant plantain. They successfully used CRISPR/Cas9 technology, a powerful technology for genome editing, to knock out endogenous banana streak virus integrated in the B genome of *Musa* spp.

This work was published in *Communications Biology* (Nature Research Journal) in 2019 and was the first report on generation of genome-edited crop in Africa. It was additionally the first global report on the application of genome editing of banana for control of diseases. This study paved way for improving banana and plantain varieties for other deadly diseases such as banana bacterial wilt and *Fusarium* wilt (Panama disease) which are affecting banana production. The genome-edited products with no integration of foreign DNA are not regulated in several countries. Therefore, the technology can be applied to produce and release new varieties in a shorter period with less resources.

In 2019, the team worked closely with regulators in Kenya to develop guidelines for commercialization of genome-edited products.

Genomic solutions for African breeders

Genomic research has become critical in identifying animal and crop diseases and ways of treating them. Genomic projects in Africa are investing in infrastructure for genomic research and training local researchers.

The Integrated Genotyping Service Support (IGSS) platform, at the BecA-ILRI Hub in Kenya has contributed to building a critical mass of African breeders technically competent in the use of DNA markers for crop improvement. The platform has increased accessibility and utilization of genotypic data to drive accelerated genetic gains and to deliver high yielding crop varieties preferred by farmers.

Cathrine Ziyomo is the lead molecular breeder and head of IGSS platform. She delves into how the platform is advancing genomic research in Africa.

The Integrated Genotyping Service Support (IGSS), which began in 2014 provides rapid, high quality and affordable genome profiling services to a diverse cadre of breeders.

What services does IGSS offer to breeders?

The Integrated Genotyping Service Support (IGSS), which began in 2014 provides rapid, high quality and affordable genome profiling services to a diverse cadre of breeders. It offers a comprehensive package on genome-sequencing based genetic profiling, bioinformatics, data management and storage, sample handling, phenotype and genotype data analysis, breeding and decision support services for initiating and implementing molecular breeding – through training workshops and outreach activities.

Why do we need IGSS at BecA-ILRI Hub and in Africa?

This is a unique approach that integrates service provision with decision support. In the past, breeders would send their samples to developed countries like the United States of America, making their involvement and follow-up support a logistical nightmare.

The IGSS team visits the breeders at their centres to help them with analysis and selection decisions and with designing breeding schemes. So far, the IGSS team is the only one of its kind in Africa.

Cathrine Ziyomo is the lead molecular breeder and head of IGSS platform.

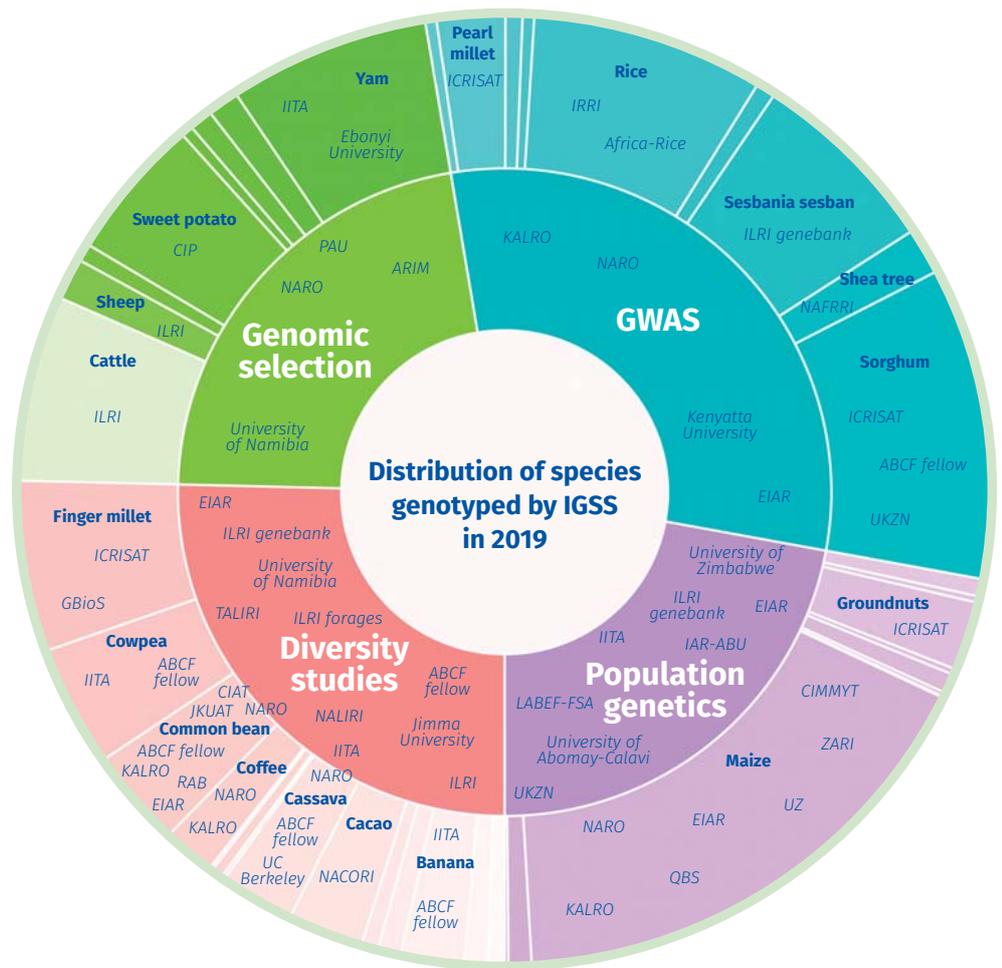


What are the activities of IGSS at Beca-ILRI Hub?

IGSS integrates the three Beca-ILRI Hub pillars—research, capacity building, and technology platforms. IGSS has reached out to NARS, CGIAR centers and academic research institutions that have brought in samples for genotyping for a variety of crop and animal species.

Contributing to capacity building of African NARS and researchers, IGSS focuses on strategies to modernize strong breeding programs through workshops and outreach activities within countries. In 2018 and 2019, nine workshops covering the application of molecular breeding techniques and data management to improve the efficiency and effectiveness of breeding programs were conducted. In addition, the IGSS team successfully organized outreach activities that provided sample collection, data analysis and breeding decision support in eight African countries.

The sustainability of the IGSS platform relies on the aggregation of samples to reduce the cost, the provision of good quality services and support to the breeders within a good turn-around time. In this regard, the focus of activities in the past years has been on several areas including creating awareness amongst NARS breeders, CGIAR centers and Excellence in Breeding Platform on the potential of genomic selection to increase efficiencies in plant breeding and facilitating the supply of samples delivered to the platform for genotyping. It has also focused on other projects funded by the Gates Foundation and academic research institutions.



Distribution of species genotyped by IGSS in 2019

In 2018 and 2019, nine workshops covering the application of molecular breeding techniques and data management to improve the efficiency and effectiveness of breeding programs were conducted.

By close of 2019, the platform had reached out to more than 200 breeders through workshops and outreach activities.

What mechanisms have you put in place to ensure sustainability of IGSS?

In 2018, Beca ILRI Hub and a private company DART began the process to explore a joint venture model that encompasses the principles and operational simplicity that will sustain the delivery of genotyping services to breeders and seed companies beyond December 2019 when the project funding ends. Subsequently, a business plan was developed in 2019 that will see IGSS transition from a project to a not-for-profit entity with a new governance structure and management model. Plans to register and set up the entity under the guidance of the ILRI legal team in Kenya were initiated in 2018 and should be completed in 2020.

BecA-ILRI Hub's diagnostics platform offers training opportunity for early-career African scientists

The Community Network for African Vector-Borne Plant Viruses (CONNECTED) formed a partnership with BecA-ILRI Hub in 2018 that led to a five-day training course for early career plant molecular biologists from Africa. The course titled: 'An introduction to virus and vector diagnostics' took place during 11-15 March and was hosted by BecA-ILRI Hub in Nairobi, Kenya. CONNECTED is building a sustainable network of international scientists and researchers to tackle vector-borne plant diseases that devastate lives in SSA.

The course trained 20 participants from 10 countries: Benin, Burundi, Democratic Republic of Congo, Ghana,

Kenya, Nigeria, South Africa, Tanzania, Uganda and Zambia. The trainers were Prof. Neil Boonham from Newcastle University and Prof. Gonçalo Silva from the Natural Resources Institute, University of Greenwich, UK. The key objective of the training was to impact the participants with practical skills that they can easily use to diagnose cassava and yam diseases in the fieldwork.

The training included DNA extraction and PCR amplification, gel electrophoresis, product purification, DNA prep for sequencing, LAMP and RPA amplification, Database searching and DNA clustering.

Here is what some of the participants said of the training:

'I have learnt techniques such as bar-coding that will help me distinguish species of insects like the whitefly. This is very important for the work that I do. I thank CONNECTED and BecA for this opportunity.'

Helen Apio, National Crops Resources Research Institute (NaCRRI), Uganda.

The training included DNA extraction and PCR amplification, gel electrophoresis, product purification, DNA prep for sequencing, LAMP and RPA amplification, Database searching and DNA clustering.





'I am a trained entomologist with no prior experience on some of these techniques such as PCR and DNA extraction. These are very important to me and my project work, which is on aphids. I am grateful to CONNECTED because I can now integrate entomology and microbiology to reach greater heights in my career.'

Honest Machekano, Botswana
International University of Science and Technology (BIUST), Botswana.

'The training has strengthened my diagnostic skills. I now know how to diagnose viruses and identify insect pests for plants. I will now be to identify what lies in resistant virus lines.'

Fred Masika, ABCF alumni, Uganda.

CONNECTED is building a sustainable network of international scientists and researchers to tackle vector-borne plant diseases that devastate lives in SSA.

The course, conducted at ILRI, Nairobi, trained 20 participants from 10 countries across Africa



Advisory panel

Members of the BecA-ILRI Hub advisory panel in 2019



Eugene Terry, (Chair)
Senior technical adviser,
New Markets Lab, USA



Theresa Sengooba
Senior advisor, Project for
Biosafety Systems, IFPRI



Sir Ed Southern
Founder,
Kirkhouse Trust, UK



Abdou Tenkouano
Executive director,
CORAF, Senegal



Aggrey Ambali
Advisor and head of NEPAD Science,
Technology and Innovation Hub



Yemi Akinbamijo
Executive director of Forum
for Agricultural Research in Africa



Ed Rege
CEO and founder, Emerge Centre for
Innovations-Africa (ECI-Africa)



Margaret Munene
General manager,
Palmhouse Dairies Ltd, Kenya



Andy Watt
Managing director,
QualiBasic Seed Company, Kenya



Judith Francis
Senior programme coordinator,
S&T Policy, CTA



Rhoda Peace Tumusiime
Former African Union commissioner
for Rural Economy and Agriculture
and chairperson of HOPE



Dieter Schillinger
Assistant director general,
ILRI, Kenya



Jacob Mignouna
Director,
BecA-ILRI Hub, Kenya

Transition

Prof. Diran Makinde

a biosciences icon who lived
his dream of a food secure Africa



Beca-ILRI Hub was dealt a major blow with the untimely death of Prof. Diran Makinde in August 2019 in Johannesburg. He was a great supporter and friend of Beca-ILRI Hub. His service on our advisory panel was invaluable.

His contribution towards food and nutrition security in Africa through biosciences was evidenced during his term as a Senior Adviser at NEPAD's Science, Technology and Innovation Hub and as the director of the African Biosafety Network of Expertise (ABNE). In both positions, he spearheaded projects related to capacity building and biotechnology regulation. He strove to promote expertise and capacity in biosafety. He participated in many initiatives in Africa on biotechnology, health and veterinary sciences.

'Diran was one of the most enthusiastic participants in Beca-ILRI Hub's Advisory Panel deliberations. It was evident that he truly subscribed to the original concept of the Beca-ILRI Hub and I could always count on him to provide convincing arguments for continued financial and advocacy in support for the Hub. The Panel will miss his often-passionate arguments for the strengthening of the ILRI-AU-NEPAD co-ownership relationship of the Hub as a valuable instrument for African bioscience capacity building,'

Eugene Terry, Chair, Beca-ILRI Hub Advisory Panel.

New staff appointments 2018-9

Beca-ILRI Hub continues to deliver its mandate by ensuring that it has subject matter experts on its portfolio who can lead its core operational components. This way, it can support the region in building capacity and adopting new technologies applicable to research.



Edwina Bochere is a research assistant in the Defense Threat Reduction Agency (DTRA)-funded ASF project. She joined Beca-ILRI Hub in 2018. Her role in the project is to conduct regional diagnostics of ASF in Kenya, Uganda, Tanzania and DRC, genotyping and whole genome sequencing of ASFV strains. Prior to this role she worked with ILRI livestock vaccine initiative.



Mwihaki Mundia joined the Beca-ILRI Hub as a communications officer in 2018. She works to progress communications strategies and implement annual action plans targeting key audiences of the Hub including the use of media programs, digital and social media channels and one-on-one engagements. She also manages Beca-ILRI Hub's presence and visibility at major external events. Before joining Beca-ILRI Hub, Mwihaki worked for Creatives Garage as a communications officer and World Agroforestry Centre as a communications assistant.



Cathrine Ziyomo joined Beca-ILRI Hub as a senior scientist/molecular breeder in 2018. She leads the Beca-ILRI Hub's Integrated Genomic Service and Support (IGSS) platform that aims to facilitate molecular breeding in Africa by offering high-quality, high density SNP genotyping services and the allied breeding and statistical support needed to allow breeders to use this technology in crop or livestock improvement programs. Prior to joining Beca-ILRI Hub, Cathrine was a maize molecular breeder at Dupont Pioneer based in Zimbabwe.



Joyce Musyoka joined Beca-ILRI Hub in 2019 as a research associate, Nutrition and mycotoxin platform. Her role is to provide technical and implementation support to ABCF fellows and researchers on the platform through training and supervision as well as to carry out tasks such as mycotoxins and nutrition analysis. Prior to this position, she served as a graduate intern at the International Potato Centre (CIP).



Reuben Mwangi joined Beca-ILRI Hub in 2018 as a research associate in the diagnostic platform. His roles include performance and evaluation of a range of plant and animal diagnostic tests, and training NARS and other partners scientists in conducting disease diagnostics. He is also an internal auditor in the nutrition and mycotoxin Platform for ISO 17025:2015 standards. Before joining Beca-ILRI Hub, Reuben worked as a laboratory technologist at the KEPHIS Plant Quarantine and Biosecurity Station.



Judy Imbanga is Beca-ILRI Hub's project manager. Her main role is to manage and oversee Beca-ILRI Hub's ongoing projects. She is responsible for the management and coordination of Beca-ILRI Hub's partners as well as communication, liaison and reporting in close consultation with respective lead scientists at Beca-ILRI Hub. Prior to this position, she was the regional manager for Options Consultancy and the regional project manager for Plan International.



John Juma joined Beca-ILRI Hub as a research associate—bioinformatics in 2018. He provides data analysis support to research fellows, students and scientists. Prior to this appointment, John was a bioinformatician and Linux systems administrator at ICRISAT.

Staff in 2018-9

SCIENTISTS

Jacob Mignouna, Director
Cathrine Ziyomo, Lead molecular breeder
Josephine Birungi, Technology manager
Jean-Baka Domelevo Entfellner, Bioinformatics
Nasser Yao, Plant molecular breeder
Roger Pelle, Molecular parasitologist
Sita Ghimire, Plant pathologist

POSTDOCTORAL SCIENTISTS

Christian Tiambo, Livestock geneticist**
Josiah Mutuku, Plant pathologist **
Peter Emmrich, Metabolic biologist

VISITING SCIENTISTS

Adriana van der Does, Plant pathologist*
Oluwasheyi Shorinola, Plant geneticist
Samuel Mutiga, Plant pathologist
Tilly Eldridge, Plant geneticist**

RESEARCH ASSOCIATES

Collins Mutai, Brachiaria project
Dedan Githae, Bioinformatics*
Edwina Bochere, Africa Swine Fever
Eunice Machuka, Capacity building
Frederick Ng'ang'a,
 Mycotoxin and nutritional analysis platform
Jackline Chepkoech, IGSS platform
John Juma, Bioinformatics**
Joyce Musyoka, Mycotoxin and nutrition platform
Leah Kago, Brachiaria project
Leonard Kiche, IGSS platform
Lucy Muthui, SegoliP

Martin Kanyeki, IGSS platform
Martina Kyalo, Capacity building
Mercy Chepng'etich, IGSS platform
Moses Nderitu, IGSS platform
Phillis Ochieng', Mycotoxin and nutritional analysis platform*
Reuben Mwangi, Diagnostic platform
Samuel Nganga, IGSS platform

TECHNICAL SUPPORT

Agnes Mburu, Technical management assistant
Dalmas Ngere, Laboratory assistant
Edwin Onyiego, Greenhouse assistant
Everlyn Onyango, Technical assistant
Francis Gatehi, Laboratory assistant
Julius Osaso, Diagnostic platform manager
Linnet Agiza, Laboratory assistant
Manasses Mwaura, Technical assistant
Mary Odiyo, Laboratory assistant
Mary Wambugu, Technical support coordinator
Michael Ominde, Laboratory assistant

PROGRAM SUPPORT

David Barasa, Assistant to project manager
Elijah Mwaura, Program accountant
Judy Imbanga, Project manager
Mwihaki Mundia, Communications officer
Rachael Mwangi, Project manager**
Valerian Aloo, Capacity building officer

*Left BecA-ILRI Hub in 2018

**Left BecA-ILRI Hub in 2019

IGSS: Integrated Genotyping Service and Support
 SegoliP: Sequencing, Genotyping, Oligo Synthesis and Proteomics unit

Staff retreat 2018

BecA-ILRI Hub staff and research fellows held a one day team building exercise at the Thayu Farm Hotel.







ABCf fellows

BURUNDI

Gelase Nkurunziza, Researcher, Burundi Agricultural Sciences Institute (ISABU). *Project: Marker-assisted selection for multiple disease resistance in tropical maize.*

Astere Bararyenya, ISABU. *Project: Discovery and analysis of quantitative trait loci associated with continuous storage root formation and bulking traits in sweet potato (*Ipomoea batatas*).*

CAMEROON

Clémence Njehoya Aggy èpse Ngue, Researcher, Institute of Agricultural Research for Development (IRAD). *Project: Identification of the *Brachiaria* grass seed production niche in Africa.*

Yves Hernandez Tchiechoua, Graduate Student, Pan African University Institute for Basic Sciences, Technology and Innovation (PAUSTI). *Project: Community of Arbuscular mycorrhizal fungi associated with *Prunus africana* and application as inoculum on leafy stem cuttings of *P. africana* in nursery.*

Armel Ngnintedem Tangomo, Graduate Student, PAUSTI. *Project: Phylogenetic effects of *Dacryodes edulis* leaves, stem barks and seeds powder on the gut microbiome diversity of the local Chicken.*

Paul Marie Désiré Ko Awono, Researcher, Institute of Agricultural Research for Development (IRAD). *Project: Development of *Brachiaria* Seed Production Technology in Cameroon.*

DEMOCRATIC REPUBLIC OF CONGO

Patrick Baenyi, Researcher, Evangelical University in Africa. *Project: Genetic diversity of indigenous goat populations in DR Congo.*

Dorine Kabange, Researcher, University of Lubumbashi. *Project: Genetic diversity of indigenous goat populations in DRC*

Giscard Wilfried Koyaweda, Graduate Student, PAUSTI. *Project: Identification of drug resistance and in silico binding affinities of selected antivirals in hepatitis B virus from patients attending Institute Pasteur of Bangui.*

Patrick Ntangereka Bisimwa, Lecturer, Evangelique University of East Africa. *Project: Genetic analysis of African swine fever virus and immunogenetic markers for tolerance in pigs from South-Kivu, eastern DRC.*

ETHIOPIA

Fetta N. Gerura, Researcher, Wolkite University. *Project: Screening and molecular characterization of resistance potential landraces of Enset—*Ensete ventricosum* (welw).*

Getachew Tadesse, Addis Ababa University. *Project: Molecular characterization of *Salmonella* isolates in Ethiopia.*

Selamawit Ketema Ashinie, Ethiopian Institute of Agricultural Research. *Project: Metagenomic analysis of the Virome of chickens with respiratory disease.*

NIGERIA

Aissatou Diddi, Researcher, National Veterinary Laboratories (LANAVET). *Project: Epidemiology of PPR in northern part of Cameroon.*

Opeyemi Adetola Oladejo, Lecturer/Graduate Student, Obafemi Awolowo University. *Project: Genetic diversity of Nigerian locally-adapted chickens using major-histocompatibility complex-linked microsatellite and single-nucleotide-polymorphism markers.*

Daniel Babasola Adewale, Scientist, Federal University of Oye-Ekiti. *Project: Profile assessment of seed coat and anti-nutritional factors in African yam bean (*Sphenostylis stenocarpa*) seed: providing a platform for its meal quality improvement.*

KENYA

Benard Oloo, Assistant lecturer, Egerton University. *Project: Molecular Characterization of the Microbial communities isolated along Indigenous chicken value chain in Kenya.*

Phyllis Muturi, Lecturer, University of Embu. *Project: Genetic diversity of elite Bambara groundnut in Kenya using single nucleotide polymorphism markers.*

Carolyn Muthike, Tutorial fellow, University of Nairobi. *Project: Chemo prevention properties of African black nightshade leafy vegetables against cancer.*

Edith K. Avedi, Kenya Plant Health Inspectorate Services (KEPHIS). *Project: Use of next generation sequencing in the identification of tomato yellow leaf curl virus complex found in tomato growing fields in Kenya.*

George N. Wabere, Lab Manager, KEPHIS. *Project: Molecular characterization of Ralstonia solanacearum, Dickeya spp., and Pectobacterium spp. strains from Kenya.*

Felix M. Kibegwa, University of Nairobi. *Project: Linking rumen metagenomics and metabolomics to enteric methane emissions in Boran steers reared on three types of grasses.*

James M. Akoko, Graduate student, Maseno University/Afrique One ASPIRE. *Project: Brucella host pathogen associations and transmission dynamics in sub-Saharan Africa.*

Naomi N. Mumo, Lecturer, Jomo Kenyatta University of Science and Technology (JKUAT). *Project: Characterization and identification of papaya ringspot virus affecting Carica papaya L. in Kenya.*

Charles K. Mwangi, Graduate Student, JKUAT. *Project: An immunoinformatic approach for vaccine design against East Coast Fever.*

Collins Muli, Graduate Student, Kenyatta University. *Project: Targeting virus transmission in a vital crop for African food security.*

RWANDA

Bellancile Uzayisenga, Graduate student, Rwanda RAB/ University of Nairobi. *Project: Surveillance, Identification and Management of Diseases of Brachiaria Grass in Rwanda.*

Theoneste Hagenimana, Researcher, University of Rwanda. *Project: Quantification of Acrylamide formation in processed French fries and potato crisps of Rwandan potato cultivars.*

Jules Mutabazi, Scientist, RAB. *Project: Transcriptomic responses of Brachiaria grass cultivars in acidic soils.*

Vestine Musanayire, Researcher, RAB. *Project: ToT Molecular biology/diagnostics.*

Angelique Ingabire, Researcher, RAB. *Project: ToT Molecular biology/diagnostics.*

Lydia Murerwa, Researcher, RAB. *Project: ToT Molecular biology/diagnostics.*

SUDAN

Iman Ibrahim Ahmed Al Awad, Junior scientist, Central Veterinary Research Laboratory. *Project: Seroprevalence of tick-borne diseases among cattle in Northern State, Sudan.*

Abdelrahim Abubakr Mohammed Ahmed, Researcher, University of Bahri. *Project: Collection of local Brachiaria ecotypes from Sudan and their morphological and genetic characterizations.*

TANZANIA

John Mlay, Researcher, Tanzania Livestock Research Institute (TALIRI). *Project: Fungal endophytes of Buffel grass (Cenchrus ciliaris) seeds in Tanzania.*

Elifuraha Mngumi, Researcher, Sokoine University of Agriculture (SUA). *Project: Metagenomic analysis of the Virome of chickens with respiratory disease.*

Athumani S. Nguluma, Research Officer, TALIRI. *Project: Genetic Diversity of Small East African Goats in Tanzania (I).*

Rose Loina, Researcher, TALIRI. *Project: Genetic Diversity of Small East African Goats in Tanzania (II).*

Emma P. Njau, Researcher, SUA. *Project: Screening, characterization and complete genome sequencing of sylvatic outbreak African swine fever virus in Tanzania.*

Patrick S. Rukiko, Research Officer, TALIRI. *Project: Collection of local Brachiaria ecotypes from Tanzania and their morphological and genetic characterizations (I).*

Walter E. Mangesho, Research Officer, TALIRI. *Project: Collection of local Brachiaria ecotypes from Tanzania and their morphological and genetic characterizations (II).*

TOGO

Kodzo Atchou, Graduate student, Pan African University of Science and Technology. *Project: Transcriptome profiling of Theileria parva piroplasm parasite stage using next generation sequencing.*

UGANDA

John Charles Aru, Senior Research Technician, National Semi-Arid Resources Research Institute. *Project: Characterization of the finger millet blast pathogen population in eastern Africa through screening a panel of 10 finger millet and 5 rice differentials with diverse monoconidial isolates.*

ZIMBABWE

Edmore Gasura, Senior Lecturer, University of Zimbabwe. *Project: Selection of Maize Parents for Striga asiatica resistance breeding based on genetic diversity of tropical maize inbred lines.*

CoP Bioinformatics fellows

DEMOCRATIC REPUBLIC OF CONGO

Ahadi Bwingangane Birindwa, lecturer, Université Évangélique en Afrique.

ETHIOPIA

Ermias Assefa Emam, researcher, Ethiopian Biotechnology Institute.

Helen Nigussie Aychegrew, researcher/lecturer, Addis Ababa University.

KENYA

Isaac Njaci, researcher, Kenyatta University.

Davies Kiambi Kaimenyi, research fellow, Pwani University.

Mary Gathoni Maranga, tutorial fellow, Jomo Kenyatta University of Agriculture and Technology.

Edwin Kimathi Murungi, lecturer, Egerton University.

Bernice Ngina Waweru, junior scientist, Kenya Agriculture and Livestock Research Organization.

Mukani Moyo Okoba, researcher/lecturer, Kenyatta University.

NIGERIA

Henry Osaiyuwu Osamede, researcher, University of Ibadan.

SUDAN

Hassan Zacharia Ali, scientist, University of Nyala.

TANZANIA

Beatus Modesty Lyimo, researcher, Nelson Mandela African Institution of Science and Technology (NM-AIST).

UGANDA

Abubaker Muwonge, researcher, National Crops Resources Research Institute (NaCRRI), National Agricultural Research Organization.

Pius Kavuma Basajjabaka Mugagga, researcher, Makerere University, Uganda.

Publi



cations

2018

Amzati, G.S., Pelle, R., Muhigwa, J.B.B., Kanduma, E.G., Djikeng, A. et al.

2018. Mitochondrial phylogeography and population structure of the cattle tick *Rhipicephalus appendiculatus* in the African Great Lakes region. *Parasites & Vectors*, 11(1), p.329.

Aye, R., Weldearegay, Y.B., Lutta, H.O., Chuma, F., Pich, A. et al.

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2018. Distribution and asymptotic behavior of the phylogenetic transfer distance. *bioRxiv*, p.368993.

Fisseha, Z., Kyallo, M., Tesfaye, K., Harvey, J., Dagne, K. et al.

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2018. Genetic diversity of *Aspergillus flavus* and occurrence of aflatoxin contamination in stored maize across three agro-ecological zones in Kenya. *Agriculture & Food Security*, 7(1), p.52.

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Habimana, V., Bett, R.C., Amimo, J.O., Kibegwa, F.M., Githae, D. and Jung'a, J.O.

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Kidanemariam, D.B., Macharia, M., Harvey, J., Holton, T., Sukal, A. et

al. 2018. First report of Dasheen mosaic virus infecting taro (*Colocasia esculenta* L.) from Ethiopia. *Plant Disease*, (ja).

Kidanemariam, D.B., Sukal, A.C., Abraham, A.D., Stomeo, F., Dale, J.L. et

al. 2018. Identification and molecular characterization of Taro bacilliform virus and Taro bacilliform CH virus from East Africa. *Plant Pathology*, 67(9), pp.1977-1986.

Kuwi, S.O., Kyalo, M., Mutai, C.K., Mwilawa, A., Hanson, J. et al.

2018. Genetic diversity and population structure of *Urochloa* grass accessions from Tanzania using simple sequence repeat (SSR) markers. *Brazilian Journal of Botany*, pp.1-11.

Lutta, H.O., Mather, A., Maina, T.W., Odongo, D., Ndiwa, J. et al.

2018. Preliminary findings of Lipoprotein B in detecting cattle chronically infected with contagious Bovine Pleuropneumonia. *Journal of Veterinary Science & Medical Diagnosis*, 2018.

Manyazewal, A., Francesca, S., Pal, M., Gezahegn, M., Tesfaye, M. et

al. 2018. Prevalence, risk factors and molecular characterization of *Cryptosporidium* infection in cattle in Addis Ababa and its environs, Ethiopia. *Veterinary Parasitology: Regional Studies and Reports*, 13, pp.79-84.

Mbeyagala, E.K., Tukamuhabwa, P., Bisikwa, J., Holton, T. and Mukasa,

S.B. 2018. Next-generation sequencing reveals the first complete genome sequence of cowpea aphid-borne mosaic virus from Uganda. *Genome Announcements*, 6(3), pp.e01491-17.

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Mutiga, S.K., Chepkwony, N., Owens A. Hoekenga, O.A., Sherry, A. 2018.

The role of ear environment in post-harvest susceptibility of maize to toxigenic *Aspergillus flavus*. *Plant Breeding*. 138. 38-50. 10.1111/pbr.12672.

Mutinda, S.M., Masanga, J., Mutuku, J.M., Runo, S. and Alakonya, A.

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- Mutisya, D.L., Ghimire, S.R., Njarui, D.M.G., Kago, L., Githae, D. and Mutai, C. 2018.** Abundance and identity of red spider mite species on Brachiaria grass in Kenya and its worldwide comparative phylogeny. *Can J Biotech* 2(1): 100-107 <https://doi.org/10.24870/cjb.2018-000118>.
- Mutuku J.M., Wamonje, F.O., Mukeshimana, G., Njuguna, J., Wamalwa, M. et al. 2018.** Metagenomic analysis of plant virus occurrence in common bean (*Phaseolus vulgaris*) in central Kenya. *Frontiers in microbiology*. 2018;9.
- Mwaikono, K.S., Maina, S. and Gwakisa, P. 2018.** Fecal microbiota of free-range pigs (*Sus scrofa domestica*) scavenging on a municipal dumpsite is a potential reservoir of pathogens. *Journal of Applied & Environmental Microbiology*, 6(2), pp.42-50.
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Statement



of accounts

The tables and figures below provide consolidated statements of audited accounts of BecA-ILRI Hub's incomes and expenditures for 2018 and 2019.

Expenditure by activity 2018

	USD '000	Percentage (%)
Capacity building	3,297	37
Research projects	2,833	32
Laboratory management and service units	2,060	23
Program management	669	8
Total expenditure	8,859	100

Expenditure by activity 2019

	USD '000	Percentage (%)
Capacity building	2,048	27
Research projects	3,120	42
Laboratory management and service units	1,403	19
Program management	928	12
Total expenditure	7,499	100

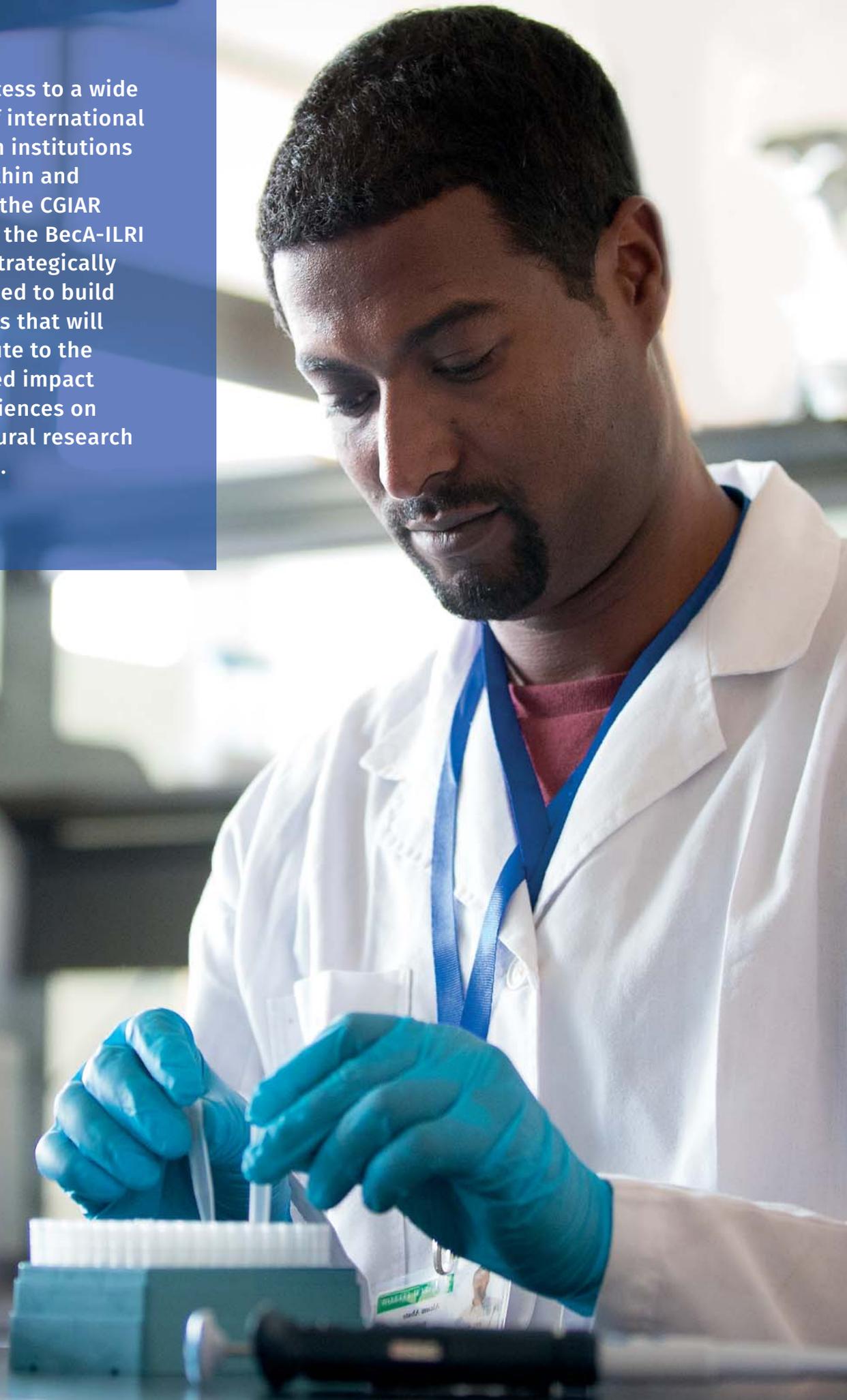
Income analysis 2018

	USD '000	Percentage (%)
Donors	6,786	77
Service units	2,060	23
Total Income	8,846	100

Income analysis 2019

	USD '000	Percentage (%)
Donors	6,096	81
Service units	1,403	19
Total Income	7,499	100

With access to a wide range of international research institutions both within and outside the CGIAR centres, the BecA-ILRI Hub is strategically positioned to build networks that will contribute to the increased impact of biosciences on agricultural research in Africa.



Acronyms

AAU	Addis Ababa University
ABCF	Africa Biosciences Challenge Fund
AfDB	African Development Bank's
AGRA	Alliance for a Green Revolution in Africa
ASF	African swine fever
ASFV	African swine fever virus
AGRA	Alliance for a Green Revolution in Africa
AUC	African Union Commission
AWARD	African Women in Research and Development
BIUST	Botswana International University of Science and Technology
BSV	Banana streak virus
CAADP	Comprehensive Africa Agriculture Development Programme
CGIAR	Consultative Group on International Agricultural Research
CONNECTED	The Community Network for African Vector-borne Plant Viruses
CoP	Community of Practise
CORAF	West and Central African Council for Agricultural Research and Development
CTA	Technical Centre for Agricultural and Rural Cooperation
ECI-Africa	Emerge Centre for Innovations–Africa, formally PICO Eastern Africa
HOPE	Household Opportunity for Poverty Eradication
IFPRI	International Food Research Institute
IGSS	Integrated Genotyping Service and Support
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IRAD	Institute of Agricultural Research for Development
KALRO	Kenya Agriculture and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Services
KMFRI	Kenya Marine and Fisheries Research Institute
LAMP	Loop Mediated Iso-Thermal Amplification
NaCRRI	National Crops Resources Research Institute
NARS	National Agricultural Research Systems
NEPAD	New Partnership for Africa's Development
PCR	Polymerase Chain Reaction
RAB	Rwanda Agricultural Board
RPA	Recombinase Polymerase Amplification
SSA	Sub Saharan Africa
TALIRI	Tanzania Livestock Research Institute

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Citation

BecA-ILRI Hub. 2020. *BecA-ILRI hub 2018-2019 Biennial Report*. Nairobi, Kenya: Biosciences eastern and central Africa-International Livestock Research Institute Hub (BecA-ILRI) Hub.

ISBN: 92-9146-615-8

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Writer/editor: Mwihaki Mundia.

Editors: Tsion Issayas, Mwihaki Mundia and Wandera Ojanji.

Contributors—BecA-ILRI Hub: Valerian Aloo, Roger Pelle, Sita Ghimire, Cathrine Ziyomo and Elijah Mwaura.

Contributors—Partners: Partners: Helen Nigussie Aychegrew (University of Addis Ababa), Nina Wambiji (KMFRI), Pius Lazaro Mwambene (Ministry of Livestock and Fisheries, Tanzania), Barberine Silatsa Assongo (University of Dschang), Maurice Mogga (Ministry of Agriculture and Forestry, South Sudan), and Hako B.A Touko (Catholic University of Buea).

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Page 28-9: Premier Gateway Corporate Team Building Facilitators.

Patron: Professor Peter C Doherty, AC, FAA, FRS

Animal scientist, Nobel Prize Laureate for Physiology or Medicine-1996

Box 30709, Nairobi 00100, Kenya

Phone: +254 20 422 3000/3903

Fax: +254 20 422 3001

ILRI-Kenya@cgiar.org

BecAdirector@cgiar.org

hub.africabiosciences.org

ilri.org

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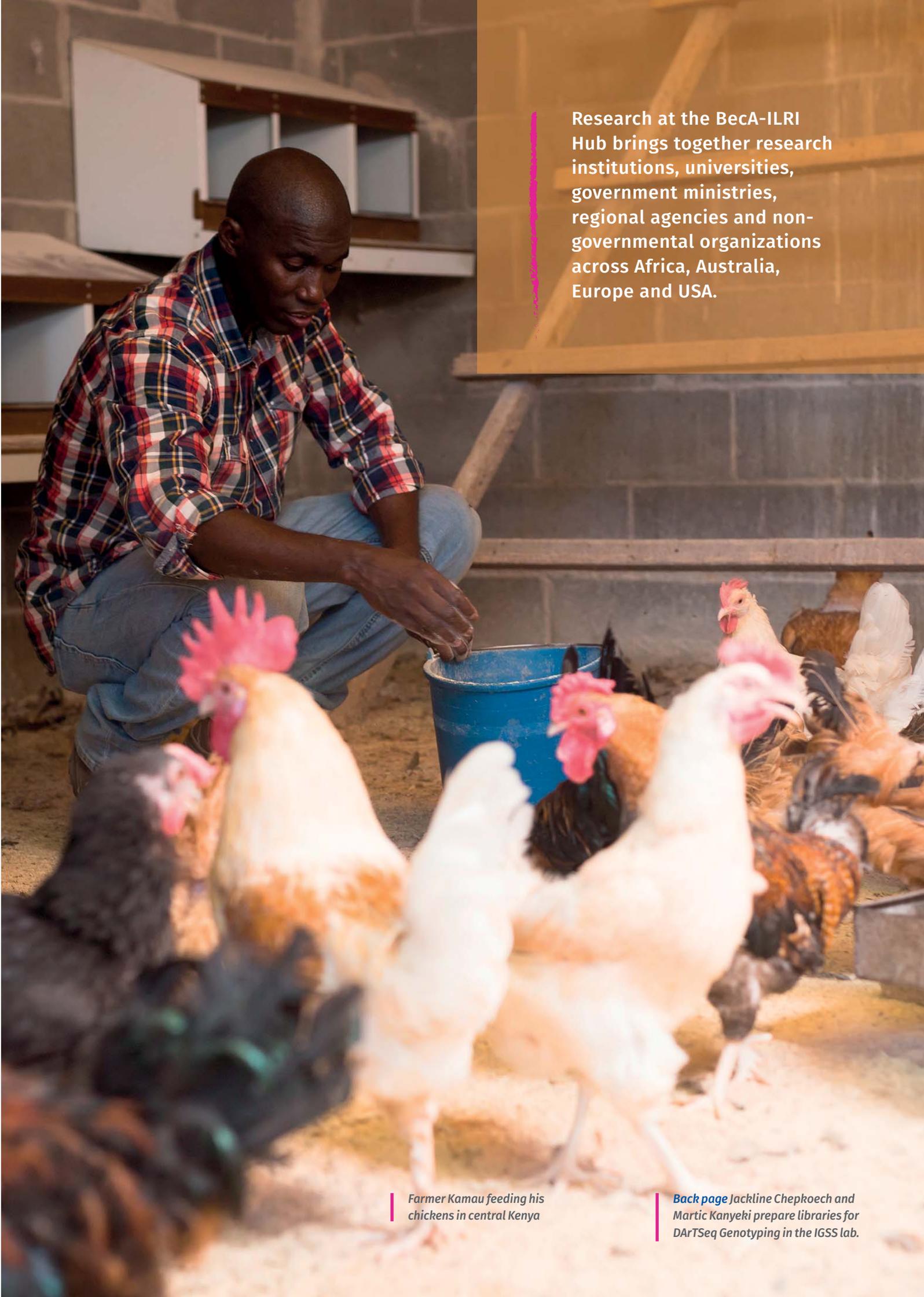
ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia

Phone: + 251 11 617 2000

Fax: + 251 11 667 6923

Email: ILRI-Ethiopia@cgiar.org



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Farmer Kamau feeding his chickens in central Kenya

Back page Jackline Chepkoech and Martic Kanyeki prepare libraries for DARTSeq Genotyping in the IGSS lab.



Biosciences eastern and central Africa-International Livestock Research Institute (BeCA-ILRI) Hub
 PO Box 30709 Nairobi 00100 Kenya | Tel: +254 20 422 3805
 BeCA-Hub@cgiar.org | hub.africabiosciences.org

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