

**Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub Submission to JOINT STANDING COMMITTEE ON FOREIGN AFFAIRS, DEFENCE AND TRADE FOREIGN AFFAIRS AND AID SUB-COMMITTEE inquiry on “The role of current and potential development partnerships in the food and agriculture sector with a range of stakeholders”**

**TOR #2: The particular roles of agricultural innovation in supporting agricultural development and inclusive economic growth**

The Australian Government, through the Department of Foreign Affairs and Trade (DFAT), supported a major agricultural research for development (R4D) investment in east and central Africa. This was done through a partnership between the Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub, an African research and capacity building biosciences centre for excellence based in Nairobi, Kenya and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia’s national science agency, referred to as the BecA-CSIRO Partnership.

The Partnership successfully delivered a portfolio of six projects with seven participating countries including Kenya and Tanzania, plus five other African countries outside of the Indo-Pacific region (Burundi, Cameroon, the Democratic Republic of Congo, the Republic of Sudan and Uganda). The following are examples of bioscience innovations from the Partnership contributing directly to development results:

- Through the *Aflatoxin Project*, a multi-disciplinary, integrated approach to understanding and addressing aflatoxin contamination in maize was undertaken. The team has identified consistently low susceptibility inbred maize lines through field trials led by the Kenya Agricultural and Livestock Research Institute in Kenya. These lines are now being included in the Kenyan national maize breeding program, for the first time introducing aflatoxin resistance as a targeted trait and also supporting this work with the Institute’s own resources.
- To help build capacity for a broader set of BecA-ILRI Hub community members to drive their research, a high end mycotoxin/nutritional analysis platform was established in 2011 which now has almost 100 users. This technology, a first in the region, is providing a better evidence base to under-researched areas of food and nutritional security including food safety.
- The *Amaranth Project* identified and addressed gaps in knowledge and technologies across the amaranth value chain in Kenya and Tanzania, such as the need for more appropriate varieties. It tested, selected and distributed six optimal varieties along with advice on better cultivation techniques and the nutritional value of the crop. The project also worked with the private sector to develop better food processing and new amaranth-based products and to assess the feasibility of consumer uptake.
- A thermo-stable vaccine developed through the Partnership’s *Peste des Petits Ruminants (PPR) Project* (implemented in Sudan and Uganda) has been incorporated as a key tool in the regional strategy for the progressive control of PPR by the African Union Inter-African Bureau for Animal Resources (AU-IBAR).
- The *African swine fever (ASF) Project* determined a better understanding of the target region’s pig value chain and ASF disease epidemiology – critical factors in developing control programs. ASF surveillance measures and farm-level biosecurity guidelines were applied using the knowledge and tools derived from the project, and validation of rapid real time Polymerase Chain Reaction (PCR)

platforms in the field allowed a more rapid confirmation of ASF outbreaks. Staff members from the Departments of Veterinary Services in Kenya and Uganda are currently implementing ASF surveillance activities using knowledge, skills and tools derived from the project. Research activities facilitated much-needed collaboration between the two countries for trans-boundary surveillance of diseases, which is now underpinned by a signed Memorandum of Understanding to increase cross-border efforts to control ASF.

- The Africa Biosciences Challenge Fund (ABCF) is an innovative model for strengthening the capacity of African scientists and was developed by this Partnership. Through the ABCF, a total of 182 scientists have benefited from formal training, high quality mentoring and access to cutting-edge technologies while working on their own research projects at the BecA-ILRI Hub. Some of these short term fellowships were a catalyst for new projects; for example, research undertaken to develop striga-resistant sorghum through the ABCF program has led to new varieties which have successfully undergone national performance trials in Sudan and have now been released in Sudan, available royalty-free to farmers.

Australia has played a key role in supporting these efforts to build enduring changes in the research and development system in east and central Africa. In addition to CSIRO, the Queensland Department of Agriculture, Forestry and Fisheries, the University of Queensland and the Queensland Alliance for Agriculture and Food Innovation (QAAFI) were major participants – 25 Australians, from a wide range of disciplines, engaged directly with the BecA-ILRI Hub and/or project teams. This diversity was a major strength of the Partnership and provides some important links for the BecA-ILRI Hub to pursue other Australian partnerships into the future.

### **TOR #3: Actions and approaches to agricultural development in the region that would promote gender equity, women's economic empowerment and health**

The Partnership sought to achieve gender balance across its three components: in management, within the various research projects, and in the ABCF capacity building program. The Partnership took the deliberate approach of incorporating delivery of benefits to African women as a design component of the project portfolio. The food nutrition arm of the Partnership focused on improving nutritional quality, availability or safety, an issue of considerable importance to women and children; good nutrition for pregnant women, nursing mothers, infants and children aged 5 and under is critical to the child's physical and cognitive development. Further, the *Amaranth*, *Mushrooms* and *Cavies Projects* all focused on "commodities" that are more likely to be under the "control" of (i.e. owned, grown, raised, used or sold by) women in African society, and provided the opportunity for women to benefit directly from project outcomes. Similarly, the *ASF Project* implicitly focused on the role of women in the pig farming system, since they are predominantly responsible for pig management.

Examples of the project-level gender highlights include: in the *Aflatoxin Project*, a high proportion of women farmers attending the sensitisation workshops in Kenya (62% of 460 farmers). In the *Amaranth Project*, women are heavily involved in amaranth growing and selling (~ 50%) and even processing in Kenya, but their involvement in these roles is less in Tanzania. Women were strongly represented (87%) in the participatory selection of preferred amaranth varieties for commercialisation and scale out, based on field performance, palatability/taste evaluation and consumption of amaranth.

In the ABCF program between 2010 and 2013, 33% of fellows and 44% of annual training workshop participants were women (against about 30% of applicants), reflecting the BecA-ILRI Hub's objective to attain gender balance amongst capacity building participants. However, although the participation of women exceeded the minimum target of 30%, it still fell short of the 50% target in the overall ILRI gender mainstreaming strategy. Although this is undoubtedly partly due to the fact that only one in four agricultural researchers in Africa is female<sup>1</sup>, to increase the number of women participants in the ABCF program in future there will be a need to consider and address the circumstances that may be preventing them from applying. The increased involvement of women scientists is especially important given that the majority of those who produce, process, and market Africa's food are women.

Australia- and Africa-based women held major leadership and research roles in the project portfolio. Within Africa, the Mushrooms Project was led by a female scientist from the University of Dar es Salaam and included another woman as one of the lead researchers. From an Australian research perspective, several female senior scientists and technicians played key roles in the Partnership including oversight of the Food and Nutrition research, leading much of the Australian input into the Aflatoxin Project and leading the socio-economic component of the ASF Project.

Women were also strongly represented in capacity building within most of the projects and comprised about a third of participants formally trained through project funding. Yet again, the *ASF Project* delivered very strongly in this area, with 11/15 (73%) of participants trained through PhDs, Masters Degrees, laboratory and field training in Kenya and Uganda being women. In the *Amaranth Project*, 11/23 (48%) of those formally trained as technicians, postgraduate and undergraduate students in Kenya and Tanzania were women.

#### **TOR #4: The current and potential role of the private sector, including small developing-country entrepreneurs and larger Australian and international businesses, in driving inclusive and sustainable development in Indo-Pacific agriculture and food value chains**

Outcomes from the Partnership's *Aflatoxin Project* implemented in Kenya and Tanzania have influenced the Kenya Cereal Millers Association (CMA) - the largest group of commercial millers in Kenya - to invest in new infrastructure at their mills that will support aflatoxin testing. This policy decision by CMA represents an outstanding impact as well as the value of the research outputs. Furthermore, the project has catalyzed a new project based at the BecA-ILRI Hub which brings together Texas A&M University, the CMA and the International Food Policy Research Institute (IFPRI).

The *Amaranth Project* worked with the private sector to develop better food processing and new amaranth-based products (e.g. noodles). Improved methods of drying amaranth leaf for better retention of nutritional quality were developed and the importance of using well controlled drying conditions was proven. The Project experimented with development of six amaranth based products - composite flour, dried leaves, leaf powder cookies, puffed amaranth, extruded amaranth and noodles - and assessed the feasibility of consumer uptake.

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<sup>1</sup> AWARD/ASTI (2009), Women's participation in Agricultural research and higher education: Key trends in sub-Saharan Africa.

An important Small-to-Medium Enterprise (SME) Project partner was Annico Ltd, a small enterprise involved in milling and blending amaranth-based flours. With support from the Project Leader, Dr Daniel Sila, at the Jomo Kenyatta University of Agricultural Technology (JKUAT), the Global Alliance for Improved Nutrition (GAIN) has agreed to support expansion of Annico's operations with an award of up to US\$ 200,000. This will increase the range of amaranth-based products in the market. Further, JKUAT-Nissin (A partnership between JKUAT and Nissin Foods Holding (Japan)) has commenced production of amaranth-based noodles using local materials for the local and export markets. Pilot plant trials fortifying sorghum flour with amaranth have also commenced. These developments are a direct result of the Project's research and connections. In Tanzania, the Project helped increase commercialisation of amaranth, especially in the north of the country. As a result of this expansion, more SMEs are operating in the market and three companies (Winnie Pure Health, Capwell Industries and Same (Tanzania)) are fortifying maize with amaranth flour. This aligns with the Kenyan and Tanzanian governments' national food fortification programs.

#### **TOR #5: Innovative modalities and practices that would enhance the contribution of all relevant stakeholders in supporting agricultural development, better nutrition and inclusive economic growth in the Indo-Pacific region (Kenya and Tanzania)**

The Australian Government funded BeCA-CSIRO Partnership has played a critical role in enhancing the capacity of Africans to achieve longer-term food security. The institutional support, mentoring and learning exchange of the leadership team and researchers, research initiatives, and the establishment of a strong capacity strengthening model have led to the emergence of numerous opportunities for further support that are in perfect alignment with key national, regional and continental priorities (including the Science Agenda for African Agriculture, S3A):

- **Capacity building program:** The ABCF is an innovative model for strengthening the capacity of African scientists which was developed by this Partnership. Emerging impact stories that support the remarkable success of the ABCF program have led to strategic consultations with key national and regional agricultural research programs for the design of a longer term strategy to support key capacity gaps (including in areas such as molecular breeding and modernization of national crops breeding programs, food safety, bioinformatics and genomics) and strengthen collaborations for research, development and utilization. Comprehensive plans for engagements are now in place with the National Agricultural Research Systems (NARS) in Kenya, Ethiopia, Rwanda, Sudan, Tanzania and Uganda to guide joint efforts and investments that now include emerging commitments of resources (albeit limited) from national governments. We have also developed a similar plan with key partnering institutions in West Africa: **WACCI** (West African Center for Crop Improvement; Ghana), **CERAAS** (Centre d'Etude Régional pour l'Amélioration de l'Adaptation à la Sécheresse; Senegal), and **ITA** (Institut de Technologie Alimentaire; Senegal).
- **The systems approach to aflatoxin control:** Findings from the Partnership's *Aflatoxin Project* have helped to redefine research by national programs and international collaborators as well as frame the engagement with major grain millers in the region. First and foremost, it now seems likely that the aflatoxin challenge can best be addressed using a systems approach. Modelling for aflatoxin will be able to forecast likely risk years and regions so that new diagnostics and sorting/decontamination can be applied in a more targeted and rigorous way to grain emanating from those regions. With this multi-faceted approach in mind, the International Maize and Wheat

Improvement Centre (CIMMYT), the provider of ~ 90% of germplasm for breeding programs in Africa including those of Kenya and Tanzania, is considering the use of the the diagnostics platform at the BecA-ILRI Hub to screen their germplasm. CIMMYT is also interested in adopting the on-farm modelling developed by the project to understand the interactions between genetics, environment, and on-farm inputs. Columbia University (USA) has put together a PhD program on nutrition (including aflatoxin) with Project Leader Dr Jagger Harvey on the Steering Committee and the BecA-ILRI Hub as the lead laboratory for research and capacity building for Africa, along with development of a supported lab in Burundi, in the first three years; this is incorporated within a proposal to the African Development Bank which recognises that the BecA-ILRI Hub platform is the only such facility that can undertake a broad set of nutritional analyses in eastern Africa.

- **Alternative livestock for smallholder farmer resilience:** Using an integrated agricultural research for development (IAR4D) approach, the domestic cavies research program focused on harnessing the potential of alternative livestock to contribute to improved family nutrition and income generation targeting the most vulnerable section of the population: women and children. Through dynamic innovation platforms, the project stimulated better organization of cavy farmer groups and traders who support each other in production and marketing in Cameroon and DRC and it is now estimated that 12,000 individuals are benefiting from the project directly at the household level across the two countries. Intensification of cavy culture is anticipated to improve the livelihoods of more than 200,000 households in North and South Kivu provinces of DRC with the pilot sites set up in collaboration with local partners serving as a prime source of training and information on a range of cavy production and marketing issues.
- **Improved livestock disease prevention and management:** The *ASF Project* sought to understand the pig keeping system and epidemiology of the ASF disease in eastern Africa. Both of these aspects are critical in developing control programs. The socio-economic component of the Project brought together key actors in the departments of veterinary services in both Uganda and Kenya to implement ASF surveillance measures using the knowledge and tools derived from the Project, and in defining the role and value of pigs being kept by smallholders on the western border of Kenya with Uganda. A major finding of the Project was that the virus cannot always be detected through blood sampling, and that pigs can have the virus in their tissues but not in their blood. This is critical in disease surveillance and monitoring since it means that slaughterhouses need to be key actors in sampling and detection, and that blood sampling alone is not a sufficient surveillance mechanism. The finding also has implications for quarantine and transfer of the disease outside the region, since sale and shipment of pork could be instrumental in disease spread even to regions outside Africa. The Project has identified social networks and network intersections for trade, breeding and slaughter that are critical in the transmission of ASF virus and cause of outbreaks. Given that the virus is stable in the environment and is highly infectious, with its spread depending on movement of people, pigs and pig products, future control programs will use information generated by the Project through social networks analysis. The findings of this research are contributing to the updating of control strategies by the Food and Agriculture Organisation of the United Nations (FAO) and AU-IBAR, and the German Federal Ministry for Economic Cooperation and Development (BMZ) is funding a vaccine development project based on viruses isolated from this Project. Further, FAO and others are developing a Global Platform for ASF with input from the Project team, and partly in response to this investment.

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