Bio-Innovate program: Supporting nine regional and multidisciplinary projects in East Africa

Seyoum Leta

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International Livestock Research Institute (ILRI)

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I. Projects from the First Call

Bio-Innovate Supports *five consortia projects* from the First Call for Concept Notes on Adapting to Climate Change in agriculture and the Environment in Eastern Africa. The projects supported from the first cycle are:

Project 1: Delivering New Sorghum and Finger Millet innovations for Food Security and Improving Livelihoods in Eastern Africa

Project summary

This innovation consortium project aims at delivering sorghum and finger millet technologies that minimize the effects of climate change; and raise productivity and income of sorghum and finger millet producing farmers through development-oriented research and action in eastern Africa.

The project proposes an approach that will employ both upstream and downstream technologies to enable development of new tools for a neglected crop, finger millet, but also impact directly on farmers' fields by the introduction and adoption of improved, disease and drought tolerant sorghum varieties. Biotechnology approaches will be used to (i) assess the regional genetic diversity of existing and new collections of finger millet, (ii) map novel stay green QTL identified in Bio-Earn III, (iii) employ and/or develop molecular markers linked to genes, QTL or genomic regions associated with drought tolerance and blast resistance in finger millet. The project will employ diverse research approaches ranging from participatory on-farm and field experiments to exploitation of comparative genomic tools.

Participating countries/Institutions

This project focuses on Ethiopia, Kenya, Tanzania and Uganda and will bring together national, regional and international experts and stakeholders. Capacity building will occur through exchange of students and researchers from local, regional and international institutions involving partners from the four participating countries as well as international collaborators from International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the University of Georgia, the Swedish Agricultural University and the Biosciences eastern and central Africa (BecA) Hub at ILRI.

Project objectives

- Evaluation, promotion and adoption of sorghum and finger millet genotypes for drought and disease tolerance;

- Development of breeding tools and technologies for high-yielding and adapted finger millet in eastern Africa;
- Develop and promote best management strategies for sorghum chaffer pest, anthracnose and finger millet blast disease; and
- Undertake marketing and value chain analyses of sorghum and finger millets in eastern Africa.

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Project 2: ***Enhancing Food Security through Improved Seed Systems of Appropriate Varieties of Cassava, Potato and Sweet potato Resilient to Climate Change in Eastern Africa.***

Project Summary

The purpose of this innovation consortium project is to evaluate and deploy improved varieties of cassava, potato and sweet potato that are adapted to climate change in diverse agro-ecologies, and developing and institutionalizing efficient seed multiplication and delivery system in Eastern Africa. Key intervention areas will include i) screening appropriate cassava, potato and sweet potato varieties for adaptation to diverse agro-ecologies and disease pressure, ii) developing protocols and guidelines for high throughput production of quality planting materials, iii) designing and testing potential models for quality seed multiplication, delivery and initiate their institutionalization, and iv) promoting proven technologies and practices for enhanced semi-intensive and commercial production of cassava, potato and sweet potato in relevant agro-ecologies of Eastern Africa. The key intervention areas will be achieved through screening germplasm under simulated climate and natural field conditions, developing high throughput seed delivery system, and participatory evaluation, packaging and promotion of technologies.

Participating countries/Institutions

The project will be led by Makerere University (MAK) in collaboration with Agricultural Research as well as learning and training institutions from Kenya, Ethiopia, Tanzania and Rwanda. Other cooperating institutions will include the International Potato Centre (CIP). The project implementation will also involve private organizations from the Eastern African region.

Project Objectives

- To screen appropriate cassava, potato and sweet potato varieties for adaptation to diverse agro-ecologies and disease pressure,
- To develop protocols and guidelines for high throughput production of quality planting materials,
- To design and test potential models for quality seed multiplication, delivery and initiate their institutionalization, and
- To promote proven technologies and practices for enhanced semi-intensive and commercial production of cassava, potato and sweet potato in relevant agro-ecologies of Eastern Africa.

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Project 3: ***Value Added Bean Technologies for Enhancing Food Security, Nutrition, Income and Resilience to Cope with Climate Change and Variability Challenges in Eastern Africa.***

Project Summary

The objective of this research project is to contribute to improved food and nutritional security and incomes through increased bean productivity, value addition and marketing, while conserving the environments in drought-prone areas of Burundi, Ethiopia, Kenya, Rwanda and Tanzania. This project in partnership with regional bean networks and the private sector propose to develop and disseminate drought tolerant, micronutrient-rich bean varieties with good canning characteristics and market preferred grain types from available germplasm. The project builds on previous bean research and complements current bean research for development activities in the region.

This multidisciplinary project involving breeders, agronomists, soil scientists, socio-economists, nutritionists, and seed specialists also seeks to contribute to two of the four pillars of Comprehensive African Agricultural Development Program (CAADP) and Forum for Agricultural Research in Africa (FARA) and millennium development goals adopted by governments in this region.

Participating countries/Institutions

This consortium project is led by the Kenya Agricultural Research Institute in collaboration with network partners from Burundi, Ethiopia and Rwanda as well as with Pan African Bean Research Alliance/International Centre for Tropical Agriculture (PBRA-CIAT). The project implementation also involves private sectors and non-governmental organizations from the participating countries in the region such as farmers groups and cooperative unions, community based organizations and NGOs (CARE, Catholic Relief Services-CRS (Kenya, Uganda, Rwanda and Ethiopia), and Concern Burundi (Burundi).

Project Objectives

- Select canning bean varieties that meet the requirement of processing industry,
- Determine the effects of soil fertility, water harvesting technologies and cropping patterns on the levels of Fe and Zn concentration in market preferred bean varieties,
- Disseminate drought tolerant varieties and complementary agronomic management technologies in drought-prone environments, and
- Strengthen capacities and linkages among the actors along the bean value chain.

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Project 4: Sustainable utilization of agro-industrial wastes through integration of bio-energy and mushroom production

Project Summary

The consortium environmental innovation project aims at demonstrating innovative technologies to produce value added products (mushroom and bio-energy from agro-industrial wastes (coffee processing and sisal wastes) while at the same time reducing environmental pollution burden in eastern Africa. The project will establish techno-economic feasibility of the integrated technologies and disseminate to stakeholders. The direct potential benefits anticipated in this project include biogas for electricity production, high energy coffee waste briquettes, edible mushrooms, biofertilizer and public good. The project has a potential to benefit agro processing industries that will

diversify their products through utilization of wastes to produce bioproducts with high economic value thus giving them a competitive advantage.

Participating countries/Institutions

Delivery of the project is feasible because it will be executed by a consortium made up of multidisciplinary development partners from Ethiopia, Kenya, Tanzania, Federal Republic of Germany and Denmark who will complement each other to deliver the expected outputs. The consortium is collaborating with private sector partners as a platform for future product commercialization.

Project Objectives

- To establish technologies for integration of mushroom cultivation with biogas production from coffee and sisal processing and sisal post-harvest waste,
- To evaluate the suitability of coffee solid waste for the production of high energy briquettes utilizing a biogas fired infrared roaster,
- To evaluate techno-economic feasibility of the developed technologies,
- To assess the fertilizer value of the biogas manure, and
- To disseminate the results of the established technologies.

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Project 5: Integrated Process for Sustainable Agro-process Waste Treatment and Climate Change Mitigation in Eastern Africa

Project Summary

This consortium environmental innovation project focuses on integrating agro-wastewater treatment with biogas production and water and nutrient reuse for enhanced agro-processing industrial and agricultural productivity in Eastern Africa. Building on the achievements and lessons from the Bio-EARN Program, this consortium project is aiming at contributing to climate change mitigation, environmental sustainability, and agricultural development by applying strategic waste management innovation systems in Eastern Africa (focusing on Ethiopia, Tanzania and Uganda).

Specifically the project aims to: (1) Strengthen capacity to sustainably manage agro-process wastewater in Eastern Africa; (2) Develop and optimize innovative wastewater treatment processes integrating biogas production and water/nutrient reuse for enhanced industrial and agricultural productivity in Eastern Africa and; (3) Evaluate and disseminate the economic, environmental and social benefits of the integrated wastewater treatment bioprocesses. The project will achieve its objectives by use of appropriate technologies that will be designed, developed and optimized to achieve: (1) better treatment of agro-process wastewaters (slaughterhouse, tannery and Banana wine processing wastewaters) in Uganda, Ethiopia and Tanzania, respectively and; (2) generation of useable by-products such as biogas, bio-fertilizers, and agricultural products (vegetables, flowers, animal feed/pasture grass) from wastewater treatment processes. Through this integrated wastewater treatment approach, we will contribute to environmental, social and economic development of Eastern African countries including reduction in pollution and contamination of water sources receiving agro-processing wastewaters, reduction in incidences of water related diseases such as diarrhoea, reductions in emission of greenhouse gases (GHG); generation of renewable energy source (biogas), slow down the rate of deforestation for firewood and charcoal, reduce indoor air pollution (IAP) and respiratory diseases since Biogas burns smoke free, and improve agricultural productivity by provision bio-fertilizers.

Participating countries/Institutions

This project focuses on Eastern Africa Region and will bring together national, regional and international experts and stakeholders. The consortium will comprise of scientists from Constructed Wetland Research and Development Group, University of Dar es Salaam (UDSM-Tanzania). Collaboration will be drawn from Department of Biochemistry, Makerere University (MAK-Uganda); Environmental Science Program, College of Natural Sciences, Addis Ababa University (Ethiopia) and Faculty of Science, National University of Rwanda (NUR-Rwanda).

The project will also involve the participation of an international organization, AKUT Burkard and partner, Germany; as well as the private sectors from Uganda, Tanzania and Ethiopia.

Project specific objectives:

- Strengthen capacity to sustainably manage agro-process wastewater in Eastern Africa by 2013,
- Develop and optimize innovative wastewater treatment processes integrating biogas production and water/nutrient reuse for enhanced industrial and agricultural productivity in Eastern Africa by 2013, and
- Evaluate and disseminate the economic, environmental and social benefits of the integrated wastewater treatment bioprocesses by end of 2013.

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II. Projects from the Second Call

Bio-Innovate Program is Supporting *Four Innovation and Policy Projects* from the Second Call for Concept Notes on *Innovation Incubation and Promotion of Targeted Value Chains; and Bioresources Innovation Policy and Sustainability Analysis in Eastern Africa.*

The projects supported from the second cycle are:

Project 6: ***Use of Biosciences for Value Addition and Diversification to Enhance Commercialization of Sorghum and Millet Products in eastern Africa***

Project Summary

This project strives to improve utilization of sorghum and finger millet through product value addition, diversification, commercialization, and industrialization. Optimized malting and extrusion technologies will lead to diversification of products such as quality malt, clear-malt drink and malted extruded snacks. Previous investigations have produced prototypes based on sorghums and millets that have potential to increase demand for these crops, create new opportunities for enterprise development and improve livelihoods of key players. The use of quality malt, clear malt beverage and malted extruded snacks will be promoted to increase sorghum and millet utilization and income generation. Marketing research, business technology incubation centers and public-private partnership approaches will be used as main pathways to diffuse the technology and products to the marketplace.

The project outcomes include creation of new enterprises and employment, improved competitiveness of sorghum and millet products, increased incomes to smallholder farmers and consequently, improved livelihoods of the rural poor. This is in line with millennium development goals (MDGs), especially MDG1 which aims to eradicate extreme hunger and poverty.

Participating countries/Institutions

This project will be led by Sokoine University of Agricultural Sciences and collaborates with Makerere University (MAK-Uganda) and the Institute of Nutrition Food Science and Technology; Hawassa University (Ethiopia). The Implementation of the project will also be supported by private sectors from Ethiopia, Tanzania and Uganda

Project Objectives

- Up-scale technologies for commercial production of high quality sorghum malt flour (HQMF), clear malt drink (CMD), malted extruded instant flour (MEIF), sorghum flakes (SF) and sorghum snacks (SS),
- Promote best practices along the sorghum and finger millet value chain for production of high quality and safer products,
- Enhance capacity of SMEs in supply of quality sorghum and millet grain, malting processes, extrusion technology, waste management, and entrepreneurship, and
- Dissemination of technology for commercial production of high quality sorghum malt flour (HQMF), clear malt rink (CMD), malted extruded instant flour (MEIF), and sorghum flakes (SF) and sorghum snacks (SS).

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Project 7: Bio-enhanced Seeds and Seedlings for Eastern Africa

Project Summary

The purpose of this project is to develop bio-enhanced seeds and seedlings within a regional, commercial setting to reduce the impact of biotic and abiotic production constraints in crops, for the ultimate benefit of resource-poor farmers. It primarily aims to realize the potential of vegetables and cereals for farmers in Eastern Africa, by enhancing them with bio-pesticides in a harmonized regional policy environment, so that these seeds and seedlings are adapted to the conditions encountered in farmers' fields in the region. The project will build on bio-enhancement of banana tissue culture, previously funded through the BIO-EARN and conducted by the same principal partners.

Participating countries/Institutions

This project focuses on East Africa Region (Kenya, Tanzania and Uganda) and will bring together national, regional and international experts and stakeholders. The consortium Project is led by Jomo Kenyatta University of Agricultural Technology (JKUAT) and will comprise of scientists from the International Institute of Tropical Agriculture (IITA) and actively will work with two private sectors from the region i.e RealIPM Company (Kenya) and Alpha Seed Company (Tanzania). Other sub-Saharan networks, such as COMESA, also have a scope beyond the original target countries. Through IITA, the project will link with the BeCA hub; with regional networks such as ASARECA; and with regional trading blocks such as COMESA.

Project objectives

- To develop bio-enhanced vegetable seeds and seedlings,
- To develop bio-enhanced maize seeds, and
- to facilitate regional harmonization of bio-pesticides registration and promote bio-enhancement of seeds and seedlings

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Project 8: Industrial Enzymes for Sustainable Bio Economy: Large Scale Production and Application in the Industry, Environment and Agriculture in Eastern Africa

Project Summary

This project focuses on scale-up production of three target enzymes such as proteases, amylases and xylanases for use in leather processing, textile, pulp and paper, animal feed processing, starch and detergent industries in the region. Given the importance of these enzymes in serving as processing aids in different industries in the region and their role in significantly reducing environmental pollution, scaling up of production processes and use of the enzymes at industrial scale is the prime purpose goal of the project.

The main activities of this project include scale up production, optimize enzyme stabilization and formulation, and test the enzymes under application conditions. Production of industrial enzymes locally is expected to create employment opportunities, industrial competitiveness, and lead to significant reduction in environmental pollution. Over all, availability of industrial enzymes locally with sufficient quantity and reasonably cheap prices will have significant economic and environmental benefit to the region.

Participating countries/Institutions

In this project, researchers from four countries in Eastern Africa (Ethiopia, Kenya, Rwanda, and Tanzania) will be involved. The researchers are drawn from public universities and private firms. Private firms from Ethiopia, Kenya and Tanzania will take part in the project. In the course of the study other private firms will also join the team. In addition to the researchers from the region, two highly experienced and renowned scientists from Sweden and India will take part in the scale-up and optimization study of the project.

Project objectives

- Scale up production of different industrial enzymes discovered so far using solid state fermentation and submerged fermentation,
- Scale up downstream processing and optimize methods for enzyme stabilization,
- Collaborate with local industries in the region to evaluate different enzymes under actual industrial application condition.

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Project 9: Biosciences Innovation Policy Consortium for Eastern Africa (BIPCEA)

Project summary

The goal of this project is to provide policy support services which are necessary to move research ideas and products to the market, and ultimately lead to a vibrant bio-economy in Eastern Africa. It is expected that through this project Bio-Innovate partner organizations will increasingly be able to develop and commercialize their bioscience innovations; and that policies, strategies and plans to promote bioscience innovations generally will be more prominent in the policy and development agenda in Eastern Africa. With increasing expectations from the biosciences, there are also growing demands on public research organizations to create and catalyze the development of pro-poor, demand-driven innovations. However, public organizations in Eastern Africa are often ill-equipped to move innovations beyond the initial research stages and meaningfully partner with the private sector in product development and dissemination.

Participating countries/Institutions

The project is to be implemented by Councils, Commissions and Ministries for Science and Technology in the region, closely working with regional science, technology and innovation(STI) policy organizations. The activities of the project range from strategic policy studies to rendering practical policy support to Bio-Innovate and other related projects in the region

The project will work as a fully functional regional mechanism, spearheaded by a team with broad bio-policy and innovation expertise, and actively involving institutions from the Bio-Innovate partner countries as well as regional and international S&T policy organizations in addition to the Project's implementing partners; the African Technology Policy Studies Network (ATPS), the International Service for the Acquisition of Agri-biotech Applications (ISAAA), International Livestock Research Institute (ILRI) Legal and

Intellectual Property Office and the Stockholm Environment Institute (SEI). The Consortium may also draw on expertise from the Economic and Social Research Foundation in Tanzania and the Pan African Competitiveness Forum, and any other relevant innovation policy actors in the region.

Project objectives

- To identify and evaluate policy support needs of Bio-Innovate projects in Eastern Africa,
- To establish a platform/forum for interaction and exchange of ideas on bioscience innovations and policies in Eastern Africa, and
- To provide policy support tools for biosciences innovations and related activities in the region.

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