Bio-Innovate Africa
Bio-Resources Innovations Network for Eastern Africa Development

Bio-Innovate Voices

ISSUE 01 2015

IN THIS ISSUE

Evans Njuguna, the Operations Manager at Njoro Canning displays some of his company's canning beans products

Message from the Program Manager

Dr. Allan Liavoga, Program Manager Bio-Innovate Africa

Esteemed readers,

It has been a while since the Bio-Innovate Voices was published but I am happy to inform you that we are back on air! As you may be aware, Bio-Innovate Phase I is coming to an end in September 2015 and we would like to take this opportunity to share some of our recent achievements. Bio-Innovate was established in 2010 as a competitive bioscience innovation fund to augment the good work that is being conducted by various bioscience initiatives in the Eastern Africa region.

Kenyan scientists release five new canning bean varieties after sixty-year wait .

Beans is the most important source of protein, iron and zinc for resource poor communities in Eastern Africa. With a growing middle class and steady international market, canning beans has potential to become a major cash crop for farmers in the region.

However production of canning beans is hampered by lack of high quality seeds. Bio-Innovate supported scientists from universities and national research organizations to produce new high yielding, disease and drought tolerant canning bean varieties that have been released in Kenya and Ethiopia and are being tested in Tanzania, Burundi and Rwanda. This initiative was done in collaboration with private sector partners in the canning beans industry that are expected to provide the eventual market to the farmers.

Speaking to the private sector players in the canning bean sector in Kenya one cannot fail to note their excitement over the new canning bean varieties that were released in 2015.

"We are planning to raise our production of canned beans by over 100%, and with the newly released varieties we are confident we shall reach there," Says Mwangi Njiru, the Operations Manager at Trufoods, a company based in Nairobi.

Access to high quality canning bean seeds by farmers in Kenya has been a great challenge. For over sixty years, farmers relied on the Mexican 142 white canning bean variety, which due to over use had become susceptible to drought and diseases such as common mosaic virus and angular leaf spot.

Message from the Program Manager

From previous page

More specifically the Program was designed to catalyze the translation of bioscience research outputs to innovations and take them closer to the end-users. Bio-Innovate has established innovation platforms around specific technologies in an attempt to ensure faster generation and delivery of bioscience innovations to the market place.

The Program is well aware of the inherent limitations public research institutions have in scaling and/or commercializing research outputs for impact. The private sector in Eastern Africa on the other hand is nascent and does not have that capacity to conduct powerful research and development, R&D. However, the private sector is more dynamic, understands the market, and is better capitalized. Consequently, the program has established a mechanism to partner public and private sector partners to jointly develop and deliver bio-innovations.

Bio-Innovate provides product development support that enables the projects to moves their respective technologies and products further along the innovation value chain. Phase I of Bio-Innovate has demonstrated that these partnerships are workable and can be productive if well managed. In this issue we share with you some of the innovations that have been developed, pilot-tested and are ripe for scale-up. These bio-innovations range from agricultural and value addition to environmental management. Managing these kinds of platforms is not without challenges and in the next issue we will share our experiences and some of the opportunities emerging. We hope you will enjoy reading our newsletter and we greatly appreciate your feedback.

Dr. Allan Liavoga

Mr. Davis Karanja (c) of KALRO with researchers Ms. Providence Mujawamariya and Mr. Augustine Musoni from the Rwanda Agricultural Board, at a beans trial site in Rwanda

With zero produce coming from Kenya, the canning bean industry relied on imports from Ethiopia. However that supply line has not been stable.

"Prices fluctuated due to various factors that we did not have direct control over, furthermore we were not getting the quality of beans we preferred and ended up discarding as much as 10% of the produce delivered," Says Evans Njuguna, the Operations Manager at Njoro Canning.

However, after three years of lab research, research station and on farm trials, scientists from the University of Nairobi-Kenya and Kenya Agricultural and Livestock Research Organization (KALRO (formerly KARI) with support from the Bio-Innovate Africa program have developed and released five new canning bean varieties for Kenya. These varieties were developed from germplasm that already existed in the region but for the first time the food processing industry was involved in developing them by testing their industrial quality.

"This is a major development, because it is the first time that a new canning bean variety has been developed locally," Says Prof. Paul Kimani, the lead scientist from the University of Nairobi. "These new varieties are drought and disease tolerant and because demand for them was driven by the private sector players in the canning industry, their sustainability is guaranteed," Adds Mr. Davis Karanja the KALRO national coordinator, grain and legume and the project leader.

The research involved farmers from across various ecological zones in Kenya and within research stations. Mzee James Mwaura, a bean farmer from Bahati Location in Nakuru-Kenya, has been a bean farmer for four years. He has a nine-acre bean farm and was one of those selected for on-farm trials. "I grew this new variety (Kenya Cheupe) and as an experienced bean farmer I can tell you that this is the kind of bean I have been looking for," Says Mzee Mwaura. Whereas we didn't get much rain, I still got a good harvest and I believe with this I can get three times what I used to get. From an acre I got nine bags where I used to get three," He adds.

The canning bean varieties released are KAT-SW 12 (Kenya Mali), KAT-SW 13 (Tamutamu), MN-6 (Kenya Cheupe),

KCB 13-12 (Kenya Mamboleo), KCB 13-09 (Kenya Salama) and KCB 13-11 (KenStar).

Kenya has a developed caning bean industry that has been operating below capacity due to irregular supply of beans. The new bean varieties, some of which show up to 60% increase in yield, could be a steady source of income for the farmers that will be contracted to produce the extra 400,000 tonnes and 200,000 tonnes required annually by Trufoods and Njoro Canning respectively. Trufoods and Njoro Canning are important private sector players in the canning bean industry in the region and with their involvement, over 50,000 canning bean farmers will directly benefit from ready market for their produce.

Apart from Kenya, the other regional countries also developing new canning bean varieties are Ethiopia, Rwanda, Tanzania and Burundi. In Ethiopia, where beans is the most important export commodity, one variety has been released. Awash 2 was released in 2013 while Rwanda is in the process of releasing three other varieties. ■

What the beans farmers say

Mzee James Mwaura, a bean farmer from Bahati, Nakuru-Kenya. Mwaura was one of the farmers in the canning beans trials

James Mwaura from Bahati location, Thayo sub location has been a beans farmer for four years now. He has nine acres under beans where he previously used to get 1-2 tones per acre depending on the variety he planted and the rain distribution for that season.

Over the years, his farm production has slumped due to twin challenges of diseases and rainfall distribution and bean seeds that were not of the correct quality. We visited James on mid January 2015 and on this day, the 65 year old was harvesting beans from a portion of his farm. This time, his farm was not just a farm, but also a trial site where several bean varieties were being evaluated by the University of Nairobi.

For years, James has been producing the local bean varieties and selling to the local market for an average of USD 0.5 per kilogram. However for the next few seasons, he will be producing seed beans at a guaranteed price of 1.0 USD for University of Nairobi. And whereas that arrangement may not continue forever, James is already thinking beyond that. Even when this trial ends, I will continue with these new varieties," Says James. "What I have seen so far is that with these new beans my production is going to increase almost three-fold. In addition, I have seen far less diseases this season, the beans are tastier and people in my family who used to complain of flatulence (gas) are experiencing very little of that." ■

Delivering clean high yielding sweet potato vines to farmers in Uganda

Sweet potato is the second most important tuber crop in Uganda and has potential to provide food security to many resource poor rural homesteads and in particular regions that traditionally have poor soils and whose weather pattern has become erratic ostensibly due to climate change.

Unlike other subsistence crops, sweet potatoes can stay in the ground for three to five months after maturity, thereby providing food for families for much longer. Its production is however hampered by lack of high yielding vines, disease build up, climate change and poor delivery system of clean vines for planting. Typically farmers recycle some of the harvested crop as seed. As a result, they are presently losing up to 80% of their produce due to low quality vines and disease.

"Most farmers don't use clean sweet potato vines because they are not readily available when they are needed," Explains Dr. Settumba Mukasa, a genetics and biotechnology expert from Makerere University, Uganda. Dr. Settumba manages the University's tissue culture lab at Kabanyolo in Wakiso, District. He adds, "Often, sweet potatoes are planted after dry spells when vines are not readily available and this means that farmers use whatever they can get. These often are vines that have been used multiple times and have lost their vigour. The vines are bulky, making their transportation from one part of the country to another a big challenge and furthermore, diseases affecting them are not visible to the naked eye and so farmers cannot know that they are using infected vines."

The Bio-Innovate Africa program is working with universities, research organizations, the private sector and farmers across Eastern Africa to develop and deliver new cultivars that are drought and disease tolerant and that are adapted to various ecological zones. It has also designed and pilot-tested potential models for multiplication and delivery of quality vines. In Uganda, the program is supporting scientists at Makerere University to conduct trials, diagnose sweet potato viruses and undertake tissue culture for the rapid multiplication of farmers-

Dr. Allan Liavoga, Program Manager, Bio-Innovate Africa and Dr. Settumba Mukasa of Makerere University inside the University's tissue culture lab at Kabanyolo, Uganda.

Dorine Anyango, Production Manager, Bio-Crop Uganda inside the Bio-Crop sweet potato screen house

preferred new high yielding varieties. The scientists tested over a hundred lines, but by 2014 had narrowed down to eight, four white fleshed and four orange-fleshed cultivars, that yield above 10 tonnes per acre and these are presently under consideration for official release. The white and yellow fleshed are popular due to their grain matter and vitamin A respectively.

In the model seed delivery system, Makerere University is providing a sizable quantity of clean vines to private labs like Bio-Crop Ltd Uganda who multiply them and sell to village based satellite vines multipliers to multiply them further. One such satellite is in Kikoota village, Mpigi district, some 60 kilometres southwest of Kampala. It is owned by Vincent Lwanyaga, a 50 year old sweet potato grower and entrepreneur.

Vincent was one of the farmers involved in the field-testing that scientists from Makerere University conducted. He has built a screen house, which he set up to multiply the vines in a controlled environment with help of a community-based organization, CHAIN Uganda. "When people saw the high yields I was getting, it convinced them that planting clean sweet potato vines as opposed to recycling was beneficial and as a result, they come for samples," Says Vincent. "Since then, they buy vines for planting from me," He explains. Through this set-up, people from his village of about 500 people have access to high yielding clean sweet potato vines for planting. Vincent is therefore an important cog in this seed delivery system that starts with tissue culture work at Makerere University. From his sale of vines, Vincent's life has been transformed and he has not only been able to put his children through school, but also built himself a brick house from the proceeds of this venture.

"Apart from accessibility, the other challenge is acceptability," Explains Apollo Kasharu, the executive director for CHAIN Uganda. "These vines are not given for free whereas previously rural farmers would get the vines from their neighborhoods for free. From our assessment, this is changing and the presence of private vine sellers like Vincent indicates that there is a growing acceptance of and market for the vines," He adds.

With laboratories and vines multiplication centres, clean vines can be prepared during dry seasons and made ready for the onset of rain. The starting point is to find out promising and high yielding varieties the farmers and the market demands. Makerere University identifies the intervention required to get the varieties in a clean form. If the challenge is disease, they use tissue culture process to clean up the vines ready for multiplication. Private multiplication labs acquire these from the university, multiply them further from where village-based multipliers buy and sell to other farmers. ■

Lwanyaga Vincent's new house built from proceeds from sale of sweet potato vines

What the sweet potato farmers say

Mawesse Ronald, a sweet potato farmer from Kikoota Village, Mpigi District, Uganda: "Since I started using clean and improved sweet potato vines from a local vines multiplier, my production has increased from three tonnes per acre to eight tonnes. Sweet potato is very important in this region and people using clean vines are doing very well. I started sweet potato farming in 2009 and with money from it I have built myself a house, gotten married and am now able to support my wife and child.

Pilot test on growing mushrooms and generating biogas from sisal waste

Kenya and Tanzania are the world's second and third largest producers of sisal, Agave sisalana, with a number of large plantation estates and processing factories. From the sisal plant biomass, only 2% is utilized in the sisal production process while 98% of it is considered waste and thus the sector is considered one of the highest waste producers.

The sisal sector generates 20 million tonnes of wastewater, 5 million tonnes of solid decertification waste and 4-8 million tonnes of post harvest sisal boles across Eastern Africa. These wastes are mostly underutilized, untreated and in most cases disposed by burning or dumping, emitting green house gases (GHC) that contribute to climate change.

Liquid waste from sisal production can also introduce excess nutrients to water sources, which create unsuitable conditions for water life.

Despite being a menace to the environment, sisal wastes represent a potential bio-resource for production of value added products such as food in the form of mushrooms, livestock feed, bio-energy, bio-fertilizers and other bio-based products. In Kenya and Tanzania, the Bio-Innovate Africa program is supporting scientists from the University of Dar es Salaam and Pwani University in Kilifi, Kenya to demonstrate mushroom growing and biogas generation using sisal boles (post harvest dry portion) and sisal decertification waste generated after fibre is removed from the leaf. The pilot project in Tanzania is being done at the Alavi sisal estate, in the Pwani region, some 60 kilometres from the capital Dar es Salaam.

Ibrahim Investment Limited owns the Alavi sisal estate, and is one of the industrial partners in the sisal waste

Prof. Anthony Mshandete, University of Dar es Salaam, inside one of the mushroom growing rooms

Inside the Alavi sisal factory, Prof. Anthony Mshandete and Prof. Amelia Kivaisi of the University of Dar es Salaam

project. The scientists have successfully demonstrated production of one tonne of mushroom per season (of three months) from four tonnes of sisal boles.

The waste that results after growing the mushroom, also referred to as spent substrate, is mixed with other locally available bio-materials to generate 10,000 litres of high quality biogas per day with a methane content of 68% that is capable of starting the biogas generator and lighting up the facility for nine hours. If done to full scale, it has potential to produce enough energy to power the heavy machines at the factory. The mushrooms are sold to Uyoga Limited (TZ) where they are dried or sold fresh, processed into mushroom cookies, mushroom spaghetti and mushroom soup. The local price for mushrooms in the nearby city of Dar es Salaam is 4 USD per kilogram. Mushrooms from the project site in Kenya has been certified by the Kenya Bureau of Standards, KEBS - permit No. SM#20218 of 2014, while that of Tanzania did not require certification from Tanzania Food and Drug Authority.

"These piloted innovations are demonstrations to the rest of the industry on ways they can manage their sisal waste, reduce wastage of bio-resources, save on power costs and provide additional revenue streams that would make waste management efficient and profitable," Says Prof. Amelia Kivaisi the project lead for the biogas and mushroom component. In addition to mushrooms and biogas, the trial sites are producing liquid bio-fertilizer generated during biogas production. At the site the scientists have demonstration plots where they are testing the quality of the bio-fertilizer on vegetables. "From our tests here, this liquid bio-fertilizer has high fertilizer value and produces remarkable yields," Says Prof. Anthony Manoni Mshandete, of the University of Dar es Salaam. "Moreover, this liquid fertilizer can be applied once to serve two consecutive seasons, unlike commercial fertilizers," He adds. ■

Turning noxious tannery waste into biogas and reusable water

Treated water from the tannery is safe and can be released into the environment

Presently it is estimated that less than 10% of industries in Eastern Africa treat their industrial and agro processing waste to any degree. This poses serious health and environmental challenges to the growing population of the region. Bio-Innovate supported scientists across Eastern Africa to develop innovative solutions to treat and convert such wastewater into energy and treated water that can be re-used.

Policy makers may be in a dilemma in deciding what is more important, the products and jobs created by the industries or mitigating the health risk posed by the industrial waste generated. However there is an opportunity for a win-win situation where this waste is converted to valuable by-products. At the banks of Modjo river in Central Ethiopia, scientists from Addis Ababa University, supported by Bio-Innovate Africa have installed a pilot facility at Modjo Tannery Ltd that is treating the wastewater generated from the factory and is converting most of the organic elements into biogas and removing a range of toxic metal used during the tanning process. This Modjo site is one of the wastewater treatment technologies being incubated to demonstrate how the public and private sector can partner to address a technological challenge that has a huge impact on the society. The anticipated outcome of this project is that the technology developed can be adopted by similar industries across the region.

Tanning is a major industry in Ethiopia with most of the 30 tanneries situated along river banks. If this waste is not treated, it poses a serious danger to communities and their livestock living downstream that depend on the river for their livelihood and the fish in the river. Some of these negative effects are already visible and need to be arrested.The wastewater treatment system is based on a biological system that is environmentally friendlier and anticipated to be less expensive. The system is composed of two-stage bio-digestion that produces biogas coupled with a constructed wetland that removes residual nutrients and other organic matter as well as trapping heavy metals resulting to treated water that meets national effluent discharge standards.

The project has demonstrated the technical feasibility and social and environmental benefits of the technology and is currently analyzing the cost-effectiveness of the technology with a view to building a business case that will guide the roll-out of the innovation to other small and medium scale industries facing similar challenges in the country and region. The innovative solution is the outcome of more than ten years of research and innovation activities involving collaborating partners from national, regional and international organizations including the Royal Institute of Technology (Sweden), Addis Ababa university (Ethiopia), University of Dar es Salam (Tanzania), Makerere University (Uganda) and GETP Systems Limited (India). Tests done on the site and downstream confirm that the treated water can be reused by the factory for cleaning, an activity that consumes a lot of water, and by the nearby communities for irrigation. The release of treated effluent into the receiving Modjo river will also greatly reduce the pollution burden on the river which is used by downstream communities for cultivating vegetables, livestock consumption, recreational and other domestic purposes.

The pilot-system is currently generating about 60m3per day of biogas that is used to offset the energy costs of the factory. The annual energy expenditure by the tannery is estimated at 28, 500 USD. If installed full-scale, the pilot plant can result in energy costs savings of up to 52,000 USD per year. ■

Bio-Innovate Africa
Bio-Resources Innovations Network for Eastern Africa Development

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR

SWEDEN

The Bio-Innovate Voices is a publication of the Bio-Innovate Program Management Office, International Livestock Research Institute, ILRI P.O. Box 30709 Nairobi, Kenya
Email: Bioinnovate@cgiar.org | Tel: +254 (0) 20 422 0000 | Fax: +254 (0) 20 422 3001
Website: **www.bioinnovate-africa.org**

Production team: Dr. Allan Liavoga, Polycarp Otieno, Abel Anyolo, Nancy Munyeki