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Biotech Forum Launched in Uganda

Source: Martin Karimi, AATF



Hon. Eng. Hillary Onek at Launch

A monthly forum to facilitate the flow of information between the scientific community, policy makers and the general public has been launched in Kampala, Uganda. The Open Forum on Agricultural Biotechnology (OFAB), Uganda Chapter, was launched on December 14 at a Kampala hotel.

Speaking while formally inaugurating the Forum, Hon Eng Hillary Onek, the Minister of Agriculture, Animal Industry and Fisheries said that biotechnology provides practical answers to some of the greatest challenges mankind faces at the dawn of a new millennium, such as hunger and malnutrition. He observed that biotechnology is an accessible and exciting new development that is already improving the way people live.

Hon Eng Onek called upon Uganda to embrace and apply modern science and technology in farming, saying that countries that have embraced modern agricultural technologies, have improved economic performance, reduced poverty and ensured greater food security for their people.

Hon Dr Kibirige Sebunya, Minister of State, Agriculture, Animal Industry and Fisheries underscored the need for a Ministry of Science and Technology saying that OFAB's host, the Uganda National Council for Science and Technology (UNCST), cannot operate optimally under the Ministry of Finance, Planning and Economic Development.

The UNCST has developed a Biotechnology and Biosafety Policy that is due for presentation to the cabinet. According to the Executive Secretary, Dr Peter Ndemere, the policy will provide an overall framework for regulation of Modern Biotechnology products in Uganda. A draft bill that will expand UNCST's mandate on biotech beyond research regulation to include commercialisation of GMOs is in preliminary stages.

The guest speaker, Mr Mark Cantley, former Science Adviser for the European Commission, urged African nations to define their own needs and priorities rather than following an agenda dictated by other parties. Mr Cantley observed that a coordinated national strategy is desirable for advancing a country's interests in the use of modern biotechnology, a state hampered by a lack of political will.

Giving his remarks, Dr Mpoko Bokanga, the Executive Director, African Agricultural Technology Foundation (AATF) challenged Africans to overcome the unfounded fears of genetically modified foods. He said that decisions regarding the adoption of new technologies must be guided by informed choices based upon knowledge of local priorities, opportunities offered by such technologies, expected benefits and ability to manage risks.



Dr. Bokanga at Launch

In reference to OFAB, Dr Bokanga reiterated AATF's commitment to provide a platform where the critical mass of knowledge in different African countries can be accessed by policy and law makers, journalists and the general public.

The event was also addressed by Dr Charles Mugoya, Program Manager, Agrobiodiversity and Biotechnology, Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) who decried the lengthy policy formulation processes saying this was the greatest impediment to the use of biotechnology in Africa.

The Forum brought together parliamentarians, scientists, journalists, the civil society, and policy makers. The Director General National Agricultural Research Organization (NARO), Dr Dennis Kyetere, moderated the discussions.

OFAB is an initiative of the African Agricultural Technology Foundation (AATF). In Uganda, the initiative is implemented in collaboration with UNCST and the Program for Biosafety Systems (PBS) in partnership with NARO and ASARECA.

The initiative is a response to the need for better understanding of a range of products, benefits and concerns associated with biotechnology. The Forum provides an opportunity for exchange of information and encourages factual discussions on the issue of agricultural biotechnology.

A similar forum was inaugurated in Nairobi, Kenya in September 2006.

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Cassava, Uganda's Food Security Crop

By Robert Kawuki, NaCRRI



Source: http://www.africancrops.net

Cassava, a tropical root crop is the third most important source of calories in the tropics, after rice and corn. According to FAO, more than 600 million people depend on the cassava in Africa, Asia and Latin America. For Uganda, cassava provides around 13 percent to the daily caloric intake. According to Dr. Robert Mwanga of NaCRRI, cassava is an assured way to attains some of The Millennium Development Goals (MDG's) in particular, the eradication of extreme poverty and hunger. This is because its roots provided food, the leaves a vegetable delicacy and the stem is a planter that can be turned into wood for cooking, thus the Baganda saying that 'wamalako nga Muwogo' (you complete as Cassava). Cassava has also increasingly demonstrated its role as a key raw material in the industrial sector owing to the various uses to which its starch can be put to. Certainly, to sustain cassava's duo roles for food and non-food uses, it's critically necessary that its key production constraints be addressed in order to attain optimal productivity. The colonial government in Uganda made the first attempt in 1941, through variety selection, to increase cassava productivity. During this period (1941-1958), introductions from Amani, Tanzania and a few local varieties were screened at Serere and Bukalasa, and promising clones multiplied and released to farmers. Further interventions to sustain cassava productivity in Uganda were done in the 1990's with collaboration with the International Institute of Tropical Agriculture (IITA). Together, these colonial and post-colonial cassava selection schemes resulted into the release of cassava varieties that significantly increased cassava productivity at farm level.

Unfortunately, throughout the crop's growth to harvesting, it experiences a continuous assault from a plethora of pests and diseases that cause substantial yield losses. For example in 2007 the country reported an outbreak of the cassava mosaic virus and cassava brown streak disease which threatens to undermine prospects. Worse still, are the increasing challenges from recurring droughts, persistent low-input cultivation, and market limitations in form of reduced shelf life, poor quality standards and lack of an effective and national cassava industrialization strategy. The heterozygous nature of the crop, low fruit set and susceptibility to inbreeding depression further undermine breeding initiatives aimed at improving its genetic potential. In response to some of these challenges, the National Cassava Programme has since then implemented activities to address some of these challenges, principle of which is the integration of end-user participatory approaches, appropriate biotechnology tools and traditional breeding methods to make cassava a highly competitive starchy crop for both food and non-food applications. This is being done in partnership with local, national and international collaborators. The National Cassava Research Programme is optimistic that this initiative will both increase the competitiveness of cassava in the industrial sector and reduce food security problems in Uganda.

Cassava Biotech Research in Uganda



Dr Yona Baguma is the Molecular Biologist at National Crops Resources Research Institute (NaCRRI). JOSEPH OLANYO talked to him and other scientists about the Cassava Biotechnology Research in Uganda.

What is cassava biotechnology research all about?
It's basically the application of biotechnology tools in solving challenges or constraints to cassava production. It also involves the generation of new cassava and cassava based products e.g., genetically modified cassava

What are these challenges?
We have a quite a number. Cassava Mosaic Virus disease (CMVD), deficit root qualilities e.g., starch, Iron, Zinc and beta-carotene which is the precursor for Vitamin A. These limitations are only constraints in Uganda but beyond. In the face of this, research is being done on similar challenges in other institutions in the World.

Do we have the capacity to handle these challenges?
We have reasonable capacity. To start with the human component, we have my self with expertise in molecular biology, gene discovery and metabolic pathway analysis. Then there is Dr Titus Alicai, with expertise in molecular virology and tissue culture. Then we have Dr Valentine Aritua, he is a molecular virologist. Mr Robert Kawuki, he is a breeder and a molecular genetics. He has some rare expertise in single nucleotide polymorphism (SNP's). Mr Emma Ogwok, he is training for his Masters in molecular virology. Specifically he is developing genetic

transformation systems to transform cassava for resistance to Cassava Brown Streak Disease (CBSD). Both RNA interference (RNAi) that involves the inhibition of gene expression by way of degrading specific RNA molecules or blockage of transcription of specific genes, and coat protein mediated silencing strategies are being used. Ms Beatrice Apio, she is optimising tissue culture and transformation protocols for the Ugandan cassava land races. Mr John Odipio, he is a tissue culture expert and responsible for Confined Field Trial activities. Mr Anthony Pariyo, a breeder and molecular geneticist; knowledgeable in molecular makers for CMVD. Teddy Amuge, currently training for her masters at Makerere University searching for polymorphic molecular markers for CBSD. Then we have Dr Elizabeth Kizito, she is a post doc looking for molecular markers for root quality traits. Ephraim Nuwamanya, he is studying the biochemistry of cassava starch. Finally we have the technical staff including Mr. Francis Osingada, he is the incharge of the laboratory on routine basis; Ms Rose Makumbi-Tissue Culture expert and Mr. Jimmy Akono with schedules similar to Osingada. Taken together, this demonstrates the human resource directly involved on cassava biotechnology work.

We have some expertise outside this institute including but not limited to Dr Richard Edema, Dr Patrick Okori, Dr Ssenttumba Mukasa and Prof Patrick Rubaihayo who contribute by way of supervising students. We have so many other external collaborating institutions like BECA Nairobi, Danforth Plant Science Centre USA, MED-BIOTECH, and the Swedish Agricultural University.

For the laboratory infrastructure, we have a biosciences laboratory, Biosafety Level II Screenhouse, Tissue culture laboratory and a Confined Field Trial (CFT) site. Those are the facilities we have right here and we can do a lot of research with them.

For how long has Cassava biotechnology research been going in Uganda?

I recall it started around 1994. That is when Dr George William Otim Nape studied the causal agent for cassava mosaic disease where he found that the disease was caused by a recombinant virus. Anything else followed on from there.

Do you have any policy on Cassava Biotechnology research?.

No. There is no deliberate policy on cassava biotech research. We don't have it. But, there are other policies that guard research and within them we can conduct some elements of biotechnology research and it's against that we are able to do what we are doing. But there is very urgent need for the biotech policy for us to be able to move research from where it is to the level of the end-users. For example at Kawanda, they are conducting a confined field trial research for bananas; recently a confined field trial has also been approved for cotton. Even us here we are going to apply a confined filed trial, probably in 2008 year. However, we can not move beyond that filed without a policy. The policy ideally would be very important in insuring that the benefits of the biotechnology in this country improve the livelihoods of the people.

Under the guidance of the UNCST, which is directly responsible for driving that process? Once it's approved, then any research for any commodity can be provided for, then any other research within the provision of the policy can follow.

If the policy comes into place, what will it do?

The country should be able to move very fast. We need it. It will stimulate further research, cooperation, partnership, access and transfer of biotechnologies to the end users.

What are your achievements so far?

We have built capacity in diagnostics of bacterial and viral diseases on cassava, we have also been able to build capacity in molecular marker systems for cassava mosaic disease and root quality traits, and we have contributed to scientific knowledge by way of gene discovery. Notably, starch branching enzyme II (SBEII) and the coat protein region of CBSV. We have also optimised tissue culture systems for some of the Ugandan local land races. This is important because it is the gateway to transformation. Finally, we have comprehensively profiled the root quality traits of cassava and genotyped some of our breeding populations.

What is the current Status of the cassava biotech?.

We really have adequate capacity to move biotechnology research in this country. But that does not mean that we don't need more. You may have noted that we are tackling various components of biotechnology research with a sole idea of ensuring that we don't stop at the lab. Ultimately, we want to use this knowledge to provide solutions to our main clients the farmers and other end users.

We further feel that within this region (EA) we are actually leading existing National Cassava Programs and we can offer technical support because we recognise one fact and that is if we move with other members in the region then we can move very far and certainly we also need synergies.

Any future prospects?

We intend to continue strengthening capacity for biotechnology research and to integrate biotechnology application with traditional methods for accelerated developments of solutions desired by end-users.

Level of Research in the country



On the level of research, **Robert Kawuki, a PhD student specialising on molecular genetics** contends that:-

If I compare with the current level of research in other institutions, we are taking the right path but still limited. To a large extent, our research is subsistence oriented with limited applications of tools to enhance the research process. For instance other parts of the world will combine conventional selection methods and modern biotechnology tools. A case in point is the effective combinations of the disciplines of biochemistry, physiology, socio-economic, genomics and genetics in the research process.

In our case, we haven't fully exploited this. We are just beginning on transformation work here. We are yet to automate most laboratory procedures. The throughput level is low as compared to other parts of the world involved in cassava research. The problem is not lack of capacity, there are many Ugandans that are trained in advanced laboratories, but upon returning home, the infrastructure is a big challenge to them to implement the expertise they could have gained. Some decide even to go back to search for jobs else where. You come, you want to work for your country, but you are frustrated by lack of infrastructure to match with your level of expertise.

Asked what could be done, Mr Kawuki says If there is no deliberate effort to realise that science and technology can not contribute significantly to the economic development, then infrastructure for research would receive less priority. If the policy makers appreciate and realise that it can contribute, then they can always advocate for infrastructural, investment.

Researchers engineer drought-resistant plants

Author: Heidi Ledford, Publication: Nature.com,
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Researchers have created drought-resistant tobacco plants, which can withstand prolonged dry periods and thrive on 70% less water than ordinary tobacco plants. The finding could be important for creating other drought - resistant crops, says Jeffrey Leung, a plant biologist at France's National Centre for Scientific Research in Gif-sur-Yvette, who was not affiliated with the study.

Thus far, the researchers — led by plant biologist Eduardo Blumwald of the University of California, Davis — have focused on tobacco, which is easy to genetically manipulate. They are now trying the same approach in tomatoes, rice and wheat. Drought is the major culprit behind crop losses worldwide, and water shortages are expected to become still more important as climate change alters rainfall patterns and increases the proportion of arid land in some key agricultural regions (see Return of the dust bowl?). In many parts of the world, water is already as expensive as fertilizer, says Blumwald. As absent-minded gardeners know all too well, water-starved plants often cope with the stress by wilting and shedding their leaves. That's believed to be a key part of their survival strategy: they sacrifice older leaves to stay alive just long enough to make seeds. That approach may boost long-term survival in the wild, but it can be devastating to crop yields, says Blumwald. "Crops adopt the same strategy that those plants in the wild use," he says. "If things go wrong, they put out some seeds and die. But we do not grow crops for that."

A tale of two hormones

In looking at the issue, Blumwald suspected that the drought-induced leaf shedding was genetically programmed, and reasoned that one way to circumvent that programming would be to boost a plant hormone called cytokinin. Cytokinins promote cell division and are found in actively growing plant tissues. Dying tissues, on the other hand, do not make the hormone. So Blumwald and his colleagues created transgenic tobacco plants that produce a protein that makes cytokinin in stressed tissues. Although ordinary tobacco plants shed their leaves and died if not watered for two weeks, the transgenic plants kept their foliage and revived when watering resumed. The transgenic plants also suffered only a 12% reduction in yield when watered with 70% less water than normally used. These findings were published in Proceedings of the National Academy of Sciences of the USA 1. The results are surprising, says Leung, because researchers previously focused on another plant hormone, called abscisic acid, as the key to manipulating drought tolerance. "Genetic screens have turned up hundred of mutants that are altered in drought tolerance," says Leung, "and if there is a link of the mutation to a hormone, it has almost always been abscisic acid." The new approach may hold advantages, he says, because previous attempts to manipulate abscisic acid yielded plants that were abnormal even under normal growth conditions.

Arie Altman, a plant biologist at the Hebrew University of Jerusalem in Israel, agrees that the work is a significant contribution towards improving drought tolerance in crops. An important next step, he notes, is to test whether the plants are also resistant to salt stress.

"Drought is in most cases connected with salinity," he says. "It is the combination of drought and salinity that is the most crucial problem."

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Pioneer modifies sorghum to boost nutrition in Africa

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Researchers at Pioneer Hi-Bred International Inc. are helping develop transgenic sorghum that will be more nutritious for the 300 million Africans who seat the grain as a staple in their diets. Genetic modification of crops is controversial in Africa, where some say the technology is unsuited for developing countries and potentially dangerous. But the payoff, project sponsors say, will be better nutrition and improved health for many poor, subsistent African farmers and their families who grow sorghum in small food plots. Pioneer is building better sorghum as part of the Africa Biofortified Sorghum Project, a nine-member consortium that won a five-year, $18.6 million grant, one of four funded by the Gates Foundation. The project has developed its second generation of transgenic sorghum seeds, known as "ABS#2." The second-generation transgenic sorghum plants have more essential amino acids that are easily digestible, especially lysine, and more of vitamins A and E, along with more available iron and zinc.

Pioneer also is training African scientists from South Africa's Council for Scientific and Industrial Research and the Kenya Agricultural Institute to work on the project in Johnston and back home in Africa. Two of the African scientists - Kenneth Mburu of Kenya and Getu Beyene, an Ethiopia native working in South Africa - are now working on the project at Pioneer's laboratories in Johnston. Three African scientists preceded them. Paul Anderson, research director for grain end-use improvement at Pioneer and the project's principal investigator, said the breakthrough in the second-generation sorghum was made possible by biotechnology, which uses technologies such as gene splicing to transfer traits from one plant to another. "There is no way this could be done by (conventional) plant breeding alone," said Anderson.

Using Pioneer's biotechnology techniques, genes that boosted protein quality and digestibility and mineral availability were transferred to sorghum, Anderson said. "They all seem to work as expected," he said. "This is a great success within a very short period of time." Because the project involves a genetically modified plant, it is controversial in Africa. "It would be a shame if unproven and undocumented biosafety risks block the (biofortified sorghum) project," said Robert Paarlberg, a professor of political science at Wellesley College.

The genetically modified sorghum faces other hurdles, even if it is approved for production in Africa, Paarlberg said.

"There is no guarantee farmers would grow the biofortified seed," he said. "You need a distribution system to get the seeds in the hands of low-resource farmers."

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