

Uganda develops capacity for agricultural biotechnology at Kawanda.

By Andrew Kiggundu

Agriculture is the main stay of the people of Uganda, on which we depend for food and income. Most farming activities are basically subsistence, meaning that people practice agriculture for their basic survival. Such subsistence production is characterized by limited inputs to control production constraints meaning farmers are faced with multitudes of crop pests and diseases that not only reduce yields in the field but also produce in storage undergoes tremendous insect damage. In some places the combination of these and other physical constraints like poor soils and drought have left many communities without food. The cultivation of locally selected varieties referred to as landraces that are usually highly susceptible aggravates the situation.

Over centuries of crop production, breeding has been continuously practiced to improve crops by generating new varieties with resistance to pests and diseases as well as various physical constraints like drought. This conventional breeding developed high yielding varieties that partly contributed to the green revolution of the 60s that led to an exponential increase in yields of cereal crops like maize and rice. Some crops such as banana are extremely difficult to breed conventionally because they are sterile, and take a long time to mature. Limited conventional breeding of banana has relied on the use of wild relatives of cultivated banana and obtaining useful hybrids with good characteristics. Many unwanted characteristics from the wild banana are usually still present in the new hybrids. In the meantime, increased understanding of genetics has led to the development of modern biotechnology which can be used to precisely identify, isolate, and transfer specific genes that control individual traits in an organism. Therefore genes with specific agronomic benefits like disease and pest resistance, drought tolerance, early maturity etc can be precisely inserted into a desired variety. This ability to modify the genetic endowment of crops and animals continues the practice of crossing and selection farmers and breeders have been doing for centuries, only it's more precise therefore a term 'precision breeding' has been coined.

Five years ago, Uganda embraced the use of biotechnology in agricultural research for development and a new biotechnology facility with capacity for tissue culture, molecular biology and plant transformation was opened at Kawanda Agricultural Research Institute. Presently the facility referred to as the National Agricultural Biotechnology Centre is using biotechnology to address various agronomic problems in bananas, beans and coffee. The goal was to ensure that the people of Uganda benefit from the revolution in biotechnology that is transforming agricultural research and development around the world. In this endeavour the National Agricultural Research Organisation (NARO) and the International Network for the Improvement of Banana and Plantain (INIBAP) started a joint project that was characterized by capacity building in terms of personnel and infrastructure as well as effective transfer of banana biotechnologies- to ensure that the country achieves ownership of the technology and products. The project brought in players from a number of regional and international institutions, including CIRAD-France, Katholique University of Leuven, Belgium, the John Innes Centre and University of Leeds in UK, the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria and the University of Pretoria, South Africa.



Three areas of agricultural biotechnology are currently being employed at NABC. These include plant tissue culture used for mass generation of pest- and disease-free planting material of improved crop varieties for banana and coffee. Plant genetic transformation used to transfer useful genes from one organism to another, for instance to confer resistance to key pests and diseases, molecular diagnostics and characterisation used to diagnose crop diseases and to understand the genomes of key crops, leading to more effective conventional breeding and gene identification. The team at NARO biotech seems to be on their way to achieved very significant scientific and technological progress in banana (matooke) the past several months.

achieving international leadership in the genetic transformation of East African highland banana (EAHB), the recently developed protocols are being considered for patent application.

The National Agricultural Biotechnology Centre performs research and development in biotechnologies not only for sustainable agriculture but nutrition improvement. We are sourcing and using genes to improve our national staple crop banana to resist pests and diseases that are currently affecting productivity. Banana is an important staple crop with a national consumption reaching 259kg per person per year. In central Uganda the work matooke is synonymous with food. Many families therefore use it as the single basis of food even for children. Matooke does not provide the whole range of required nutrients in a balanced diet.

At the NABC one of the projects we are undertaking is to use biotechnology to develop banana with increased nutrients like Vitamin E, zinc and Iron, which are very important in human health especially for growing children and pregnant mothers. Common diseases like malaria have aggregated iron deficiency causing anaemia in children and women.

There are transgenic approaches that we are developing to improve matooke through the process of bio-fortification. There are other productivity factors in matooke that are being targeted for improvement through biotechnology; these include maturity period, shorter plants and delayed ripping.

Biosafety is of major concern to the general public. The centre, with support from USAID, has funded the acquisition of infrastructure and personnel training in the requirements of biosafety in biotechnology. A new Biosafety containment greenhouse with internationally recognized biosafety level 2 is currently under construction as part of the centre. Through collaboration with programmes like the Program for Biosafety Systems (PBS) and with guidance from the Uganda National Council for Science and Technology (UNCST), staff at the centre have undergone various training programs for biosafety to ensure compliance with both international and national requirement for handling and working with genetically modified organisms.