

Progress with agricultural biotechnology research and development in Uganda

Beatrice A. Atim (MP)¹

The Challenges

Uganda's economy is heavily reliant on agriculture as nearly two thirds of the population are directly involved in farming as a source of livelihood. While there has been some growth in other sectors of the economy such as industry and services, agriculture is still the principal sector for food and income among the country's rural population. In recent years, there has been a steady decline in productivity of the sector largely exacerbated by climate change. Pests, diseases, drought, floods, and low soil fertility are only some of the challenges faced by farmers in Uganda. Drought alone has frequently caused food insecurity in many areas of the country in recent years. Diseases, such as cassava brown streak disease, banana bacterial wilt disease, and coffee wilt disease have caused untold suffering to farmers as no immediate long-term solutions were available. There is a dire need of modern appropriate technologies to mitigate many of these production challenges. Farmers should have access to improved seeds, fertilizers, agricultural implements, and relevant pesticides.

Biotechnology capacity in Uganda

The government of Uganda has steadily built infrastructural and human resource capacity for the country in the past ten years. There are now more than fifteen biotechnology laboratories in the country using various biotechnological tools such as tissue culture, genetic engineering, vaccine production, artificial insemination, disease diagnostics, and gene discovery among others. Most of the research facilities are government run but at least three private facilities exist that mostly focus on micropropagation of key crops such as banana and coffee.

On the human resource front, Uganda now has more than 140 biotechnology scientists conducting agri-biotech in the various research facilities. These include highly trained personnel at PhD, MSc, and BSc level qualifications.

Biotech research and development in Uganda

In Uganda biotechnology is widely used in different sectors such as health, industry, environment management, mining, and agriculture. In the agricultural sector, the government of Uganda, through the National Agricultural Research Organization (NARO), working with national scientists, is currently using modern biotechnology to address several concerns facing farmers and society at large. This is in addition to the wide use of tools such as tissue culture, artificial insemination, and disease diagnostics. Modern biotechnology is only being used in areas where it provides the most viable or sometimes the only solution to an existing problem such as pests, diseases, or drought. Banana bacterial wilt disease and cassava brown streak disease for example are areas where modern biotechnology is being used to improve crops and sustain food security in Uganda. Improvements are also being made to other national

¹ Parliament of Uganda

priority crops such as maize, rice, millet, groundnuts and sweet potato using biotechnology (Table 1), but also using conventional crop improvement approaches.

Table 1: Summary of biotech crop research in Uganda

Crop	Trait under testing
Banana	Increased pro-vitamin A content Increased Fe Bacterial wilt resistance Weevil / nematode resistance Fusarium wilt resistance Banana fruit quality enhancement
Cassava	Resistance to cassava mosaic disease Resistance to cassava brown streak disease
Groundnuts	Groundnut rosette resistance
Maize	Drought tolerance Stem borer resistance
Millet	Increased pro vitamin A
<i>Solanum</i>	Potato Bacterial wilt resistance
Rice	Nitrogen use efficiency, drought and salt tolerance
Sorghum	Improved starch
Sweet potato	Weevil resistance



Figure 1: Disease resistant cassava under research in NaCRRI, Namulonge

Scientists at NARO have made breakthroughs in addressing many of the challenges to these crops. At the National Crops Resources Research Institute for instance, scientist have successfully tested biotech-derived varieties that are resistant to the devastating cassava brown streak disease (Figure 1). In Kawanda, scientists have also been able to develop banana with resistance to bacterial wilt disease, in addition to the vitamin A enhanced banana that will help address malnutrition in mothers and children.

Biotechnology can therefore contribute to addressing some of challenges in food production by reducing pest / diseases attacks on crops and animals, in improving nutrition among vulnerable groups, in protecting crops from the effects of climate change, and in reducing farmer drudgery in agricultural production. Biotechnology tools will however be only an extra defense against these challenges and will not substitute all other technological options such as use of improved seed and fertilizers. Many farmers in Uganda need technologies to improve their production and it is imperative that we harness all appropriate technologies to benefit our society.

Challenges and opportunities

While biotechnology offers great promises to addressing some of our farmers problems, it also important to note that technologies such as genetic engineering are regulated worldwide to avoid misuse and ensure that only quality and desirable products are generated for farmers and society. There is lack of a clear and comprehensive regulatory framework for modern biotechnology in the country. Uganda needs to immediately pass the Biotechnology and Biosafety Bill into law so that the science of biotechnology is adequately regulated for the benefit of our country. Currently, the Bill to regulate this science is before the Parliament of Uganda. Members of Parliament need to be equipped with adequate knowledge on the relevance of regulating this science. There is also a need to improve public and stakeholder understanding of biotechnology and biosafety so that decision makers can make informed decisions given the high amount of misinformation surrounding the use of biotechnology in Uganda. Public perception towards biotechnology is still negative due to this misinformation.

In the long-term, there is need to mainstream biotechnology and biosafety education in the school curriculum and secondary and tertiary levels to improve understanding and appreciation of the role of biotechnology and the need for biosafety in the country's future development.

At the regional level, many countries in the East Africa region already have laws governing the use of modern biotechnology and are at advanced stages of testing certain genetically engineered products. It is important that Uganda establishes clear regulatory mechanisms for such products to ensure that any cross border movement of materials is conducted in an appropriate manner.