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## **Tanzania - United Republic of**

### **Agricultural Biotechnology Annual**

#### **2018 Tanzania Agricultural Biotechnology Report**

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**Report Highlights:**

Most Tanzanians are not knowledgeable about genetic engineering (GE) and GE products, with the exception of a small population with tertiary-level education. The Tanzanian government allows imports of GE products from the United States and other countries that meet national standards. However, there is no GE food in the Tanzanian market.

#### **SECTION I: EXECUTIVE SUMMARY**

In 2017, the Tanzanian government relaxed the “strict liability” biosafety regime that had de-facto prevented plant scientists from testing GE crops outside the lab. Tanzania recognizes that biotechnology has set of novel and powerful tools with potential to foster sustainable development in various sectors of the economy including agriculture, health, industries, as well as environment. The government’s commitment towards the promotion and application of biotechnology is articulated in the National Biosafety Framework of 2004 and National Biotechnology Policy of 2010.

While the Government has put in place all the necessary policies, legal and institutional frameworks for safe and responsible use of modern biotechnology, progress in research and utilization of GE technologies has been rather slow, mainly due to lack of facilitative biosafety regulations and inadequate knowledge and understanding of biotechnology and biosafety issues by various stakeholders. Currently, there are only two GE research projects in the country: the confined field trial (CFT) at Makutupora Dodoma for testing drought tolerant and stem borer resistant maize under Water Efficient Maize for Africa (WEMA) project; and the contained GE research at Mikocheni Agricultural Research Institute (MARI) for development of cassava resistant to Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD).

In view of the slow pace of adoption of biotechnology in the country and increasing activism, the science and technology stakeholders in Tanzania decided to form an independent association called Biotechnology Society of Tanzania (BST) that assists government of Tanzania to foster socioeconomic development using biotechnology and other scientific advances in Tanzania. The BST is a non-profit, non-government organization registered in Tanzania under the Non-Governmental Organizations Act of 2002 on 13 October 2016. The Society is dedicated to promote advancement and use of biotechnology in the country. The membership of the Society is open to all scientists, academicians, farmers, consumers, manufacturers, policy and decision makers, industry, media, non-government organizations (NGOs) and community based organizations (CBOs) interested or involved in fostering, developing and supporting application of biotechnology tools and information in various sectors of the economy to enhance the living standards of the people of Tanzania.

The Tanzanian government allows importation of GE products from the United States and other countries that meet national standards. However, there is no GE food in the Tanzanian market due to strict liability clause in the Biosafety Regulations of 2009. Regulation 56.-(1) “Any person or his agent who imports, transits, makes contained or confined use of, releases, carries out any activity in relation to GMOs or products thereof or places on the market a GMO shall be strictly liable for any harm, injury or loss caused directly or indirectly by such GMOs or their products or any activity in relation to GMOs.” (2) The harm, injury or loss includes personal injury, damage to property, financial loss and damage to the environment or to biological diversity as well as taking into account socio-economic, cultural and ethical concern.

## SECTION II: PLANT AND ANIMAL BIOTECHNOLOGY

### CHAPTER 1: PLANT BIOTECHNOLOGY

#### PART A: PRODUCTION AND TRADE

##### a) PRODUCT DEVELOPMENT

The endless public debate on the biosafety legal regime in Tanzania has limited research on GE crops. Cassava and maize are the only GE crops under research in Tanzania. See Table 1.

Table 1: GE Crop Research Project in Tanzania:

	<b>Crop</b>	<b>Trait</b>	<b>Institutions Involved</b>	<b>Stage of Development</b>
1	Cassava	Development of varieties tolerant to Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD)	Mikocheni Agricultural Research Institute (MARI) and MALF	Contained research (Genetic transformation in the laboratory)
2	White Maize/Corn	Drought tolerant	COSTECH, DRD-MALF AATF, USAID, CIMMYT and Monsanto Company	Confined Field Trial (CFT)
3	White Maize/Corn	Insect/pests Resistant	COSTECH, DRD-MALF, AATF, USAID, CIMMYT and Monsanto Company	Preparing application for CFT permit

Biotechnology has been also applied in medicine and public health, industry, and the environment. The following are some of the main biotechnology applications in Tanzania.

##### 1. Tissue Culture and Micro propagation:

The application of tissue culture techniques to address constraints of disease-free planting materials and rapid improvement in crop production is now routinely applied in several institutions in Tanzania. Institutes conducting tissue culture in Tanzania are: Mikocheni Agricultural Research Institute (MARI) in Dar es Salaam; Agricultural Research Institute (ARI) Mlingano in Tanga; ARI Uyole, Mbeya; Horticulture Research Institute-Tengeru (Arusha); Kizimbani Agriculture Research Station (Zanzibar); Tropical Pesticides Research Institute (TPRI), Arusha; Sokoine University of Agriculture (SUA); and Tanzania Coffee Research Institute (TACRI) through Crop Bioscience Solutions Ltd (CBS). CBS is the commercial crop biotech company dedicated to modern agricultural technologies. Through innovative biotechnology, they deliver quality-planting materials that are affordable at a competitive price.

##### 2. DNA Markers and Marker Assisted Technologies:

MARI, the SUA Faculty of Veterinary Medicine, Central Veterinary Laboratory (CVL), Molecular Biology and Biotechnology Department (DMBB), University of Dar es Salaam (UDSM) and Ifakara Health Research Development Centre use DNA marker technology that simplifies the genetic improvement and disease diagnostics.

### 3. Developing Genomics and Bioinformatics capacity in Tanzania:

SUA has established a Genome Science Center, which supports research and postgraduate training in the area of functional genomics and bioinformatics. The center has facilities for complementary DNA (cDNA) works, printing microarrays using a high-throughput GENETIX microarray and 4-colour scanning of arrays.

### 4. Genetic Engineering:

ARI, Mikocheni is conducting the first GE research on cassava in a contained environment. Meanwhile, Makutopora in Dodoma is conducting Confined Field Trial (CFT) on Water Efficient Maize for Africa (WEMA).

#### b) COMMERCIAL PRODUCTION

There is no commercial production of GE crops or GE seeds in Tanzania.

#### c) EXPORTS

Tanzania does not export GE crops. There is no legal authorization for GE commercial production.

#### d) IMPORTS

The Tanzanian government has never banned the importation of GE food or products. A GE food importer must follow food importation laws and sections in the Environment Act. The Biosafety Regulations of 2009. Regulation 56 (1) “Any person or his agent who imports, transits, makes contained or confined use of, releases, carries out any activity in relation to GMOs or products thereof or places on the market a GMO shall be strictly liable for any harm, injury or loss caused directly or indirectly by such GMOs or their products or any activity in relation to GMOs.” (2) The harm, injury or loss includes personal injury, damage to property, financial loss and damage to the environment or to biological diversity as well as taking into account socio-economic, cultural and ethical concern.

e) **FOOD AID**

Tanzania receives food aid for school feeding programs and monetization. Movement of GE food aid products is permitted under the environmental regulations governing handling of GE products in transit.

f) **TRADE BARRIERS**

Not applicable.

**PART B: POLICY**

a) **REGULATORY FRAMEWORK**

Tanzania developed its National Biosafety Framework (NBF) in February 2007. The Environment Division under the Vice President's Office is the National Biosafety Focal Point and the National Competent Authority (NCA); it provides the BCH required data for the Cartagena Protocol. The NBF includes national policies related to biosafety and the regulatory regime; administrative, decision-making and monitoring; and mechanisms for public awareness, education, and participation. In 2010, the Ministry of Education Science and Technology established the National Biotechnology Policy (NBP) under authority presented by the Environment Management Act of 2004: This policy ensures that Tanzania has the capacity to capture the proven benefits arising from health, agriculture, industry, and environmental applications of biotechnology while protecting and sustaining the safety of the community and the environment.

Other components of the biosafety legal framework include the Plant Biosafety regulations, 2009, Biosafety Guidelines and Standard Operating Procedures: The institutional framework consists of the:

- National Biosafety Focal Point (NBFP),
- National Biosafety Committee (NBC),
- National Biotechnology Advisory Committee (NBAC),
- Ministerial Competent Authorities,
- ABSAC, Plant Biosafety CoE, TPRI and the
- Institutional Biosafety Committees (IBC).

See Figures 1 and 2 below.

Despite existing policies, legislation and enthusiasm for GE crops among some Tanzanians, the debate is not over. A section of the public is still pressing the government to stop research on all agricultural GE production activities in the country. Thus, it is important to ask what Tanzanians think about GE crops and to promote understanding of science and the practice of science-based decision-making

Figure 1: The institutional structure as per NBF:

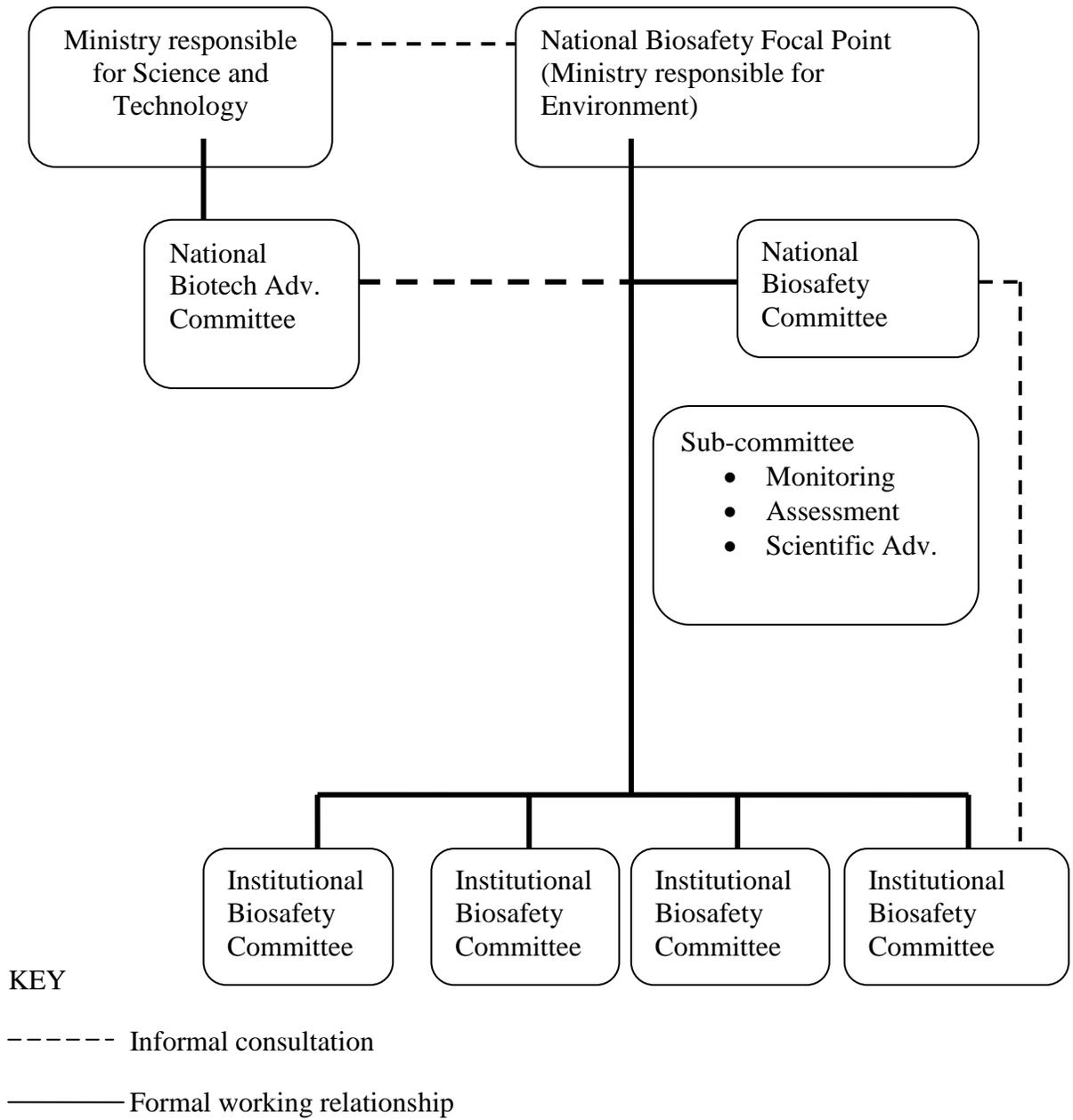
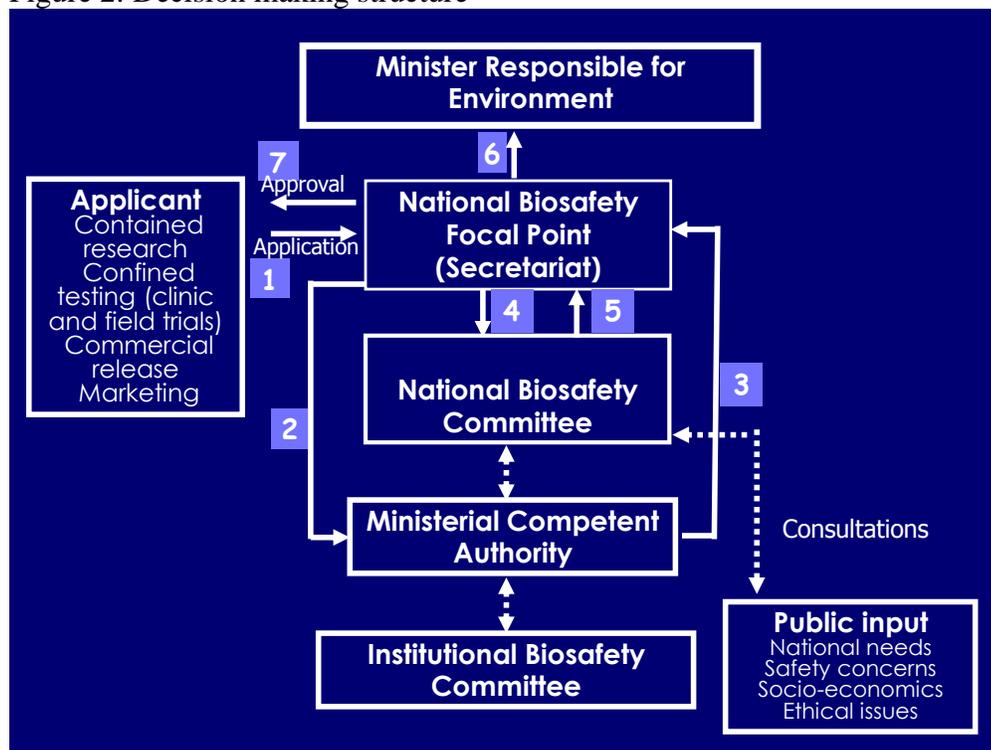


Figure 2: Decision making structure



b) APPROVALS

No GE plants are registered for cultivation, import or export in Tanzania.

c) STACKED EVENT APPROVALS

No GE stacked products are awaiting approvals in Tanzania

d) FIELD TESTING

Tanzania has allowed confined field trials (CFTs) for GE corn. The trial is on a two-hectare plot at Makutupora research station, Dodoma Tanzania. No GE crop trial is done in farmers’ fields. Since 2016, the GOT through Commission for Science and Technology (COSTEC) have conducted five trials for white maize. There will be three trials of the drought tolerance trait and two trials testing the stacked insect resistance and drought tolerance traits.

Table 2: Controlled Field Trials in Tanzania

GE Plant	Trait	Developer	Stage	Number of trials
White maize/corn	Drought tolerant	Monsanto	CFT	3
White maize/corn	Stack (Drought tolerant and insect resistant)	Monsanto	CFT	2



Figure 3 and 4 showing double stacked maize (drought tolerant and insect resistant) trial at Makutopora CFT. The drought and stem borer resistance is 100%.

#### e) INNOVATIVE BIOTECHNOLOGIES

The application of biotechnology in Tanzania considered within the context of the country's need for food security, nutrition, and survival of its people. The application of tissue culture techniques to address constraints of disease free planting materials and rapid improvement in crop production is now routinely applied in several institutions in Tanzania. Institutes conducting tissue culture are:

1. Mikocheni Agricultural Research Institute (MARI) in Dar es Salaam,
2. Tanzania Agricultural Research Institute (TARI) Mlingano in Tanga,
3. Tanzania Agricultural Research Institute (TARI) Uyole, Mbeya
4. Horticultural Research Institute-Tengeru (Arusha)
5. Kizimbani Agriculture Research Station(KARS) (Zanzibar),
6. Tropical Pesticides Research Institute(TPRI), Arusha
7. Sokoine University of Agriculture (SUA)
8. Tanzania Coffee Research Institute (TACRI)

The use of DNA marker technology used to identify genetic linkages to qualitative and quantitative traits, which simplifies the genetic improvement and disease diagnostics. These are carried out at:

1. Mikocheni Agricultural Research Institute
2. Sokoine University of Agriculture the College of Veterinary Medicine
3. Central Veterinary Laboratory (CVL)
4. Molecular Biology and Biotechnology Department (DMBB), University of Dar es Salaam
5. Ifakara Health Research Development Centre

#### f) LABELING

Any "GMO" or product thereof should be clearly labelled and packaged in accordance with national biosafety guidelines for Tanzania annex V part C and shall comply with such further requirements, if any, imposed by the NBFP and competent authority, to indicate that it is, or has been derived from, a "GMO", and, where applicable, whether it may cause allergies or pose other risks.

g) MONITORING AND TESTING

NBFP is responsible for approving GE import products, while the Tanzania Food and Drugs Authority (TFDA) and Tanzania Bureau of Standards (TBS) monitor and test agricultural commodity and food product imports at ports of entry. However, the Tanzanian government has limited personnel and testing facilities for evaluating agricultural products for GE content.

h) LOW LEVEL PRESENCE POLICY

Tanzania has no policy on low-level presence.

i) ADDITIONAL REGULATORY REQUIREMENTS

Not Applicable.

j) INTELLECTUAL PROPERTY RIGHTS

Tanzania is a member of the Trade Related Intellectual Property (TRIPS) Agreement. Tanzania does not have a National Intellectual Policy (NIP). However, there are number of institutions dealing with and promoting IP issues. They include:

- Business Registrations and Licensing Agency (BRELA)
- Commission for Science and Technology (COSTECH): <http://www.costech.or.tz/>
- Copyright Society of Tanzania (COSOTA)
- Fair Competition Commission (FCC): <http://www.competition.or.tz/>
- Fair Competition Tribunal (FCT): <http://www.fct.or.tz>
- Ministry of Agriculture (Plant Breeders Rights - PBR) Tanzania Bureau of Standards (TBS)
- Tanzania Food and Drugs Authority (TFDA): Tanzania Revenue Authority – Customs (TRA): <http://www.tra.go.tz/>
- Commercial Court (High court of Tanzania): <http://www.comcourt.go.tz/comcourt/>
- University of Dar es Salaam (UDSM): [https://udsm.ac.tz/sites/default/files/UDSM\\_IntellectualPropertyPolicy2008\\_Prelims.pdf](https://udsm.ac.tz/sites/default/files/UDSM_IntellectualPropertyPolicy2008_Prelims.pdf)
- Sokoine University of Agriculture, (SUA): <http://www.suanet.ac.tz/>
- Nelson Mandela African Institution of Science and Technology (NM-AIST): <http://www.nm-aist.ac.tz/>
- National Institute of Medical Research(NIMR)  
Tropical Pests Research Institute (TPRI)

#### k) CARTAGENA PROTOCOL RATIFICATION

Tanzania acceded to the Cartagena Protocol on Biosafety (CBP) on March 16, 2003. It was adopted on January 29, 2000 as a supplementary agreement to the Convention on Biological Diversity and entered into force on September 1, 2003. NBFP is Tanzania's focal point of the CBP and shares data with the Biosafety Clearing house, a mechanism set by CPB to facilitate information exchange on GE product development and to assist member countries in complying with their obligations under the protocol.

#### l) INTERNATIONAL TREATIES/FORA

Tanzania is a member of several international organizations that deal with plant protection and plant health, including the International Plant Protection Convention (IPPC), International Treaty on Plant Genetic Resources for Food and Agriculture, Codex Alimentarius, World Trade Organization (WTO), WIPO, and ARIPO and has ratified the International Convention on Biological Diversity (CBD), Plant genetic Resources for Food and Agriculture (IT-PGRFA) and the aforementioned CPB.

#### m) RELATED ISSUES

The Tanzanian government has not banned importation of GE food. Any person who wishes to import, transit, or place on the market a "GMO" intended for direct use as food or feed, or for processing, shall submit an application in writing with a reference to the information on the item found in the BCP, to the NBFP for approval: Tanzania adopted the Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress to the CBP. It gives Tanzania flexibility to implement legislative, administrative, or judicial rules and procedures relevant to liability and redress.

### **PART C: MARKETING**

#### a) PUBLIC/PRIVATE OPINIONS

The debate on biotech crops and bioengineered foods is contentious and political in Tanzania. There is public debate on the reported positives and negatives of the technology. Some non-governmental organizations (NGOs) have targeted Tanzanian consumers with negative messaging, while Commission for Science and Technology (COSTECH), VPO, and other NGOs continue to provide balanced messaging. For example, the Open Forum for Agricultural Biotechnology has been promoting the use of GE plants and production.

#### b) MARKET ACCEPTANCE/STUDIES

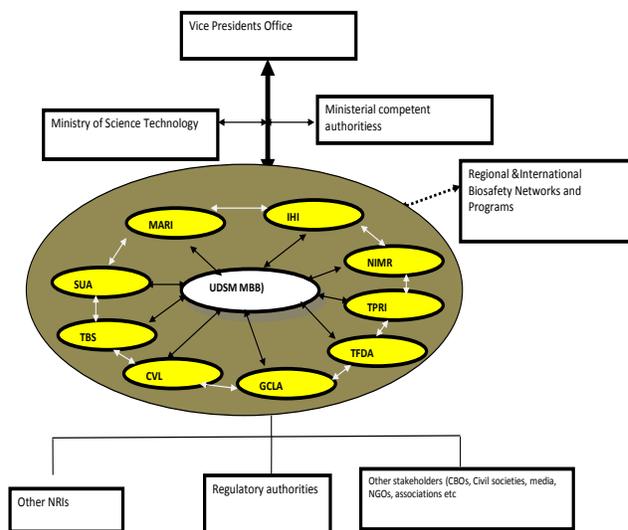
Recent studies reveal that among Tanzanians (except for a small population of elites with tertiary-level education) there is limited understanding of and familiarity with genetic engineering and products derived therefrom. According to the study conducted recently by local scientist on "Perception of agricultural biotechnology among farmers, journalists and scientists in Tanzania". The study found that Tanzania has infrastructure, researchers (inadequate but the number is growing), policies, legislations and guidelines for developing and deploying GM crops. The results further show that overall 70.5 percent of the sampled farmers, journalists and scientists had positive perception of GM crops whereas 23.8 percent had a neutral perception and 5.7 percent had a negative perception. Individual perceptions of GM crops in Tanzania is influenced by a combination of multiple factors, namely age, gender, educational level, marital status, religion, occupation and basic knowledge in science and technology. It is recommended that agricultural stakeholders should strive to have in place policies and legislations, which are supported by scientific evidence and which in turn support science advancement.

## Biosafety Center of Excellency

Tanzania, like many African countries, has very limited capacity in biosafety. Very few institutions have all the capacity to successfully carry out all agreed tasks under the Cartagena Protocol on Biosafety (CPB) and the Environmental Management (Biosafety) Regulations, 2009. Given the limited capacity and the high level of skills needed, ranging from the safety and regulatory aspects to technical and scientific issues, the Tanzanian government established in 2009 the National Center of Excellence (CoE). The center would help strengthen cooperation in biosafety and provide the necessary backstopping to institutions involved in biotechnology and biosafety.

Institutions that make up the CoE are; University of Dar es Salaam (UDSM), Tropical Pest Research Institute (TPRI), Mikocheni Agricultural Research Institute (MARI), Tanzania Food and Drug Authority (TFDA), Sokoine University of Agriculture (SUA), National Institute of Medical research (NIMR), Government Chemist Laboratory Agency (GCLA), Tanzania Bureau of Standards (TBS), Central Veterinary laboratory (CVL) and Kizimbani Agricultural Research Institute. See Figure 5 below.

Figure 5: Organizational structure of the CoE



#### a) NEXT STEPS

Top Tanzanian government leaders, cereal millers, traders, and research scientists widely acknowledge that biotechnology is an important tool for improving agricultural production in Tanzania and have continued to publicly support biotechnology. However, some government staff from the Vice President's Office (VPO) demonstrate a negative perception; and some leaders of the Tanzania Agricultural Research Institute (TARI) and non-governmental organizations oppose the technology, arguing that more scientific data is needed on safety to humans, animals, and the environment before embracing the technology.

Tanzania has advanced in agricultural biotechnology governance, as evidenced by the Environment Management Act of 2004, which established a National Biotechnology Policy (NBP). To maximize on these gains, Tanzania needs encouragement to:

- Continue public awareness on modern biotechnology and biosafety; and
- Continue capacity building on biotechnology to manage and strengthen research, development, and trade.

The delay in adopting the technology could be attributed to the lack of political and public will, lack of supportive policies, legislation and regulations for the development and deployment of GE crops. It took seven years for stakeholders to reach consensus, which paved the way for the 2015 amendment of the Environment Management (Biosafety) Regulations of 2009, and subsequent first confined field GE trial in October 2016.

#### Contained Research

In early 2011, the government of Tanzania established the Biosafety level II laboratory at Mikocheni Agricultural Research institute (Figure 6) and GE activities began Tanzania.

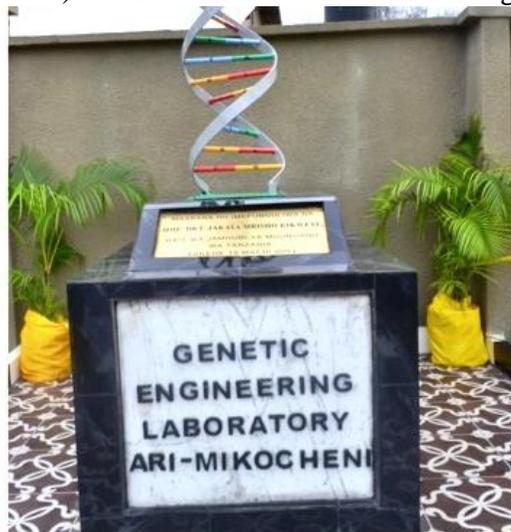




Figure 7: Contained facility at Mikocheni Agricultural Research Institute (MARI)

MARI's research activities include development of cassava varieties tolerant to Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD). Cassava is a staple and cash crop for many Tanzanian farmers and high population growth rates are driving an increase in demand. CMD and CBSD (Figure 3) pose a serious threat to farmers in Tanzania, because crop yields can be cut to 60-100%, which is equivalent to a loss of Tshs112 billion in revenue annually. The MARI research program is expected to deliver CMD and CBSD tolerant cassava plants ready for testing in confined environments sometime in insert year to year.

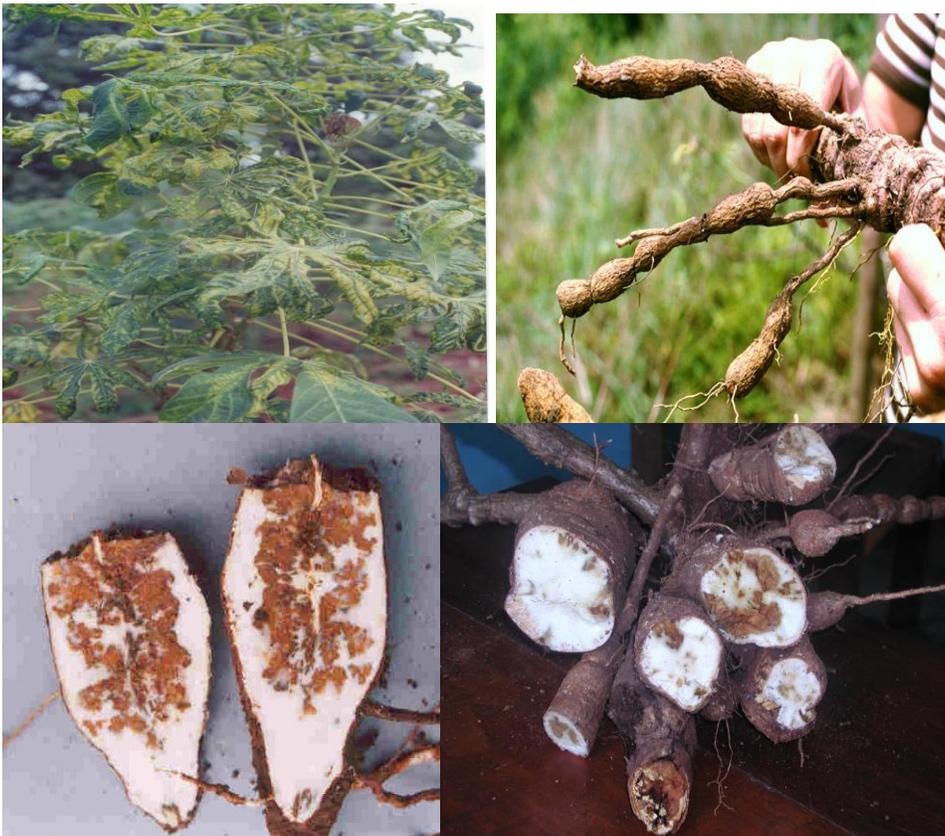


Figure 8: Devastating effects of CMD (top) and CBSD (bottom)

## Confined Research

In 2009, a collaborative project entitled “Water Efficient Maize for Africa (WEMA)” established a Confined Field Trial (CFT) at Makutopora Dodoma (Figure 9) for GE research. The CFT site will be used for evaluating water use efficiency of drought tolerant GE maize varieties in Tanzania.



Figure 9: Confined field trial site, Makutopora Dodoma



Figure 10: Double stacked maize (drought tolerant and insect resistant) at Makutopora CFT. The main objective is to test the efficiency of Bt gene in resistance to Stem Borer (*Busseola fusca*) which up to now is almost 100%. However, they have noticed that crops are also resisting Fall Army Worm infestation and the performance is almost 80%.

Nevertheless, testing FAW resistance was not part of their objective as they conducted trials on resistance to stem borer. (FAW and stem borer are coming from the same family, the Noctuidae.) But, now FAW control is a GOT priority and scientists are struggling to show value for FAW control. **Should Tanzania adopt and apply GE technology, it could help feed its more than 70 million people in the next decade and reduce the rates of chronic malnutrition.** Therefore, the country must review policies and legislation to cope with science advancement.

## **CHAPTER 2: ANIMAL BIOTECHNOLOGY**

### **PART D: PRODUCTION AND TRADE**

#### **a) PRODUCT DEVELOPMENT**

The endless public debate on the biosafety legal regime in Tanzania has limited research on GE animal. No any GE animal under research in Tanzania.

#### **b) COMMERCIAL PRODUCTION**

There is no commercial production of GE animal in Tanzania.

#### **c) EXPORTS**

Tanzania does not export GE animal. There is no legal authorization for GE commercial production.

#### **d) IMPORTS**

The Tanzanian government has never banned the importation of GE animal products. A GE food importer must follow food importation laws and sections in the Environment Act, which governs the importation of GE Food:

#### **e) TRADE BARRIERS**

There is no trade barriers related to biotechnology in Tanzania.

### **PART E: POLICY**

#### **a) REGULATORY FRAMEWORK**

The National Biosafety Act covers both plants and livestock (See Figures 1 and 2), but no regulations have been developed specifically for animal biotechnology.

#### **b) INNOVATIVE BIOTECHNOLOGIES**

Not applicable at this time.

#### **c) LABELING AND TRACEABILITY**

Not applicable at this time.

#### **d) INTELLECTUAL PROPERTY RIGHTS**

Not applicable at this time.

#### **e) INTERNATIONAL TREATIES/FORA**

Not applicable at this time.

#### **f) RELATED ISSUES**

None at this time.

## **PART F: MARKETING**

### **a) PUBLIC/PRIVATE OPINIONS**

The debate on biotech animals and bioengineered foods is contentious and political. Some non-governmental organizations (NGOs) have targeted Tanzanian consumers with negative messaging, while Commission for Science and Technology (COSTECH), VPO, and other NGOs continue to provide balanced messaging. For example, Open Forum for Agricultural Biotechnology has been promoting the use of GE plants and production.

### **b) MARKET ACCEPTANCE/ STUDIES**

Not Applicable

