



Sciences for Prosperity

UGANDA NATIONAL ACADEMY OF SCIENCES

**ENHANCING AWARENESS OF THE BENEFITS OF
BIOTECHNOLOGY AND GMO FOR NATIONAL DEVELOPMENT.**



DECEMBER
2013

National framework for GMO and bio-safety.

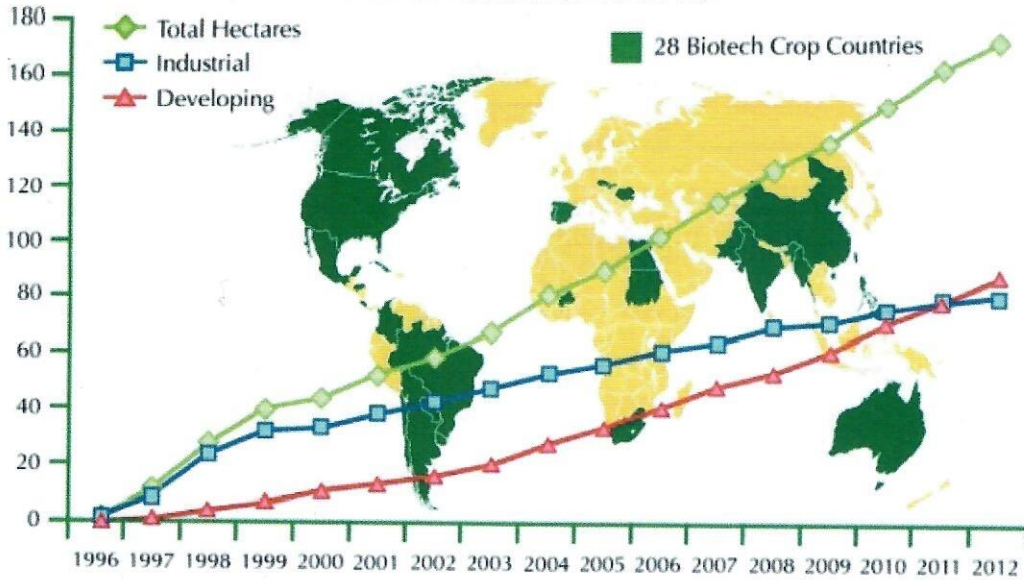
Background

Biotechnology has become controversial because of the perceived risks it presents to the environment and humans. Proponents assert that it is beneficial and carries no risk. Opponents assert that its risks outweigh benefits and should be highly regulated.

There is increasing volume of evidence to document benefits of GM crops. GM technology itself has no greater adverse impact than any other technology used in plant breeding. There is probably more research into GM technology than almost any other area of food research; there is no evidence to suggest that the GM technology *per se* poses any unique risk compared to any other plant breeding technology. Although GMOs is not a silver bullet, the issue is; can we meet the demand for food to feed 9 billion citizens by 2050 without using every tool in the tool box? Is it ethical to reject technology without evidence but on the grounds of preference when 1 billion global citizens every single day are starving? "Our obligation as citizens is to look at the evidence presented and have the courage to reposition our views as that evidence accumulates."

Countries are increasingly adopting the technology as can be seen in the area under GMO crops. Countries formulate bio-safety laws based on their own national interests and four bio-safety policies have emerged categorized as follows: **promotive** (e.g. USA, Canada, Argentina, and South Africa), **permissive** (Japan, Kenya), **precautionary** (Zambia, Ethiopia) and **preventive** (Benin). There is no international bio-safety regulatory protocol to completely prevent perceived risks of genetically modified organisms. However, the general understanding is that legislations and guidelines should not impose unnecessary technical barriers or compromise International trade for the sake of prevention of risks unless it is supported by scientific evidence. Countries which have signed and ratified the Cartagena protocol must have a law on bio-safety. Uganda has a biotechnology policy but has yet to enact a bio-safety law which is holding the commercialization of the available GMOs.

GLOBAL AREA OF BIOTECH CROPS
Million Hectares (1996-2012)



IN 2012, 28 COUNTRIES WERE GROWING BIOTECH CROPS
OTHERS ARE SIGNIFICANT IMPORTERS.

● Growing Biotech ● Granting Import Approvals ● Approving Research Field Trials



International Instruments for GMO Regulation

- **Cartagena Protocol on Biosafety (CBD):** proposed to lay down a common and coordinated approach among countries to address perceived or potential risks of LMOs (GMOs) on biological diversity and human health. This is the Key driving force in establishment National *Biosafety Framework* including the necessary policy, legislation, administrative systems etc, for compliance & public engagement to ensure adequate level of safety.
- **Other International Instruments:** WTO Agreements which include Sanitary & Phytosanitary (SPS) measures, Technical Barriers of Trade (TBT) and Trade Related Aspects of Intellectual Property Rights (TRIPs).

Two opposing approaches for GMO regulation:

There has been two major opposing views as to whether GM technology is inherently safe or unsafe.

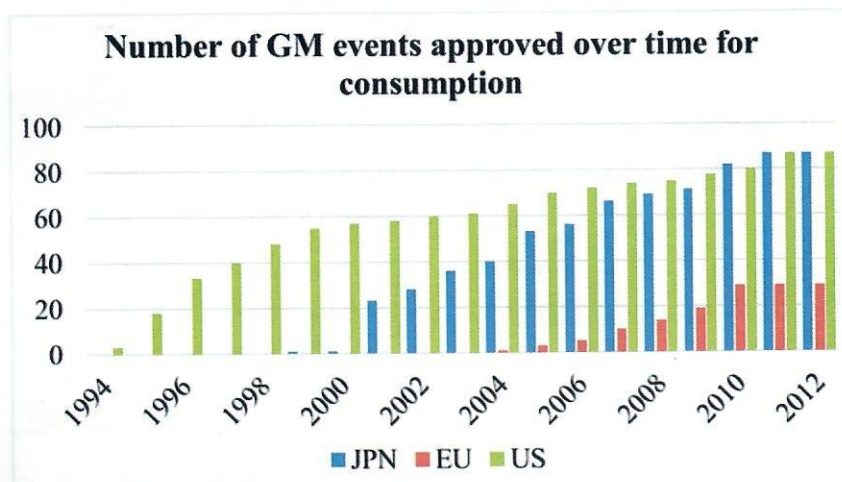
1. **Precautionary Principle (Europeans)** GM crops are potentially dangerous and pose new risks and thus their use should be avoided until they are proven safe

2. **Substantial Equivalence Principle (USA)** : GMOs are no different from conventional crops, if the products so derived are “substantially equivalent” in composition, nutritive value or safety after thorough comparative testing

Criticisms on Precautionary Principle: Focuses exclusively on risks disregarding benefits, difficult to prove absence of risk, too many interpretations, ambiguous, not good decision tool, discourages innovation & adoption of useful technologies by exagulating potential risks.

Criticisms on Substantial Equivalence Principle: Similarity in composition is not a guarantee that GM food and its conventional counterpart has the same nutritional value as unexpected substances may appear, does not allow rigorous tests & hence unintended changes in organisms may go undetected and still cause harm, stimulates GM innovation & adoption & favour businesses, can be used as risk assessment tool but not decision tool.

Effect of Regulatory approaches on GMO approval in three developed economies



Main differences in European (Precautionary) & US (Substantial Equivalence) approaches of regulation

Issues raised	European approach	USA approach
GMO & risk perception	present new risk potentially dangerous	No new risks, beneficial once passed safety tests
GMO Safety	Unsafe unless proven safe	Safe unless proven unsafe
Regulatory focus	Risk avoidance, absolute safety	Favor safe GM innovation & adoption
Basis of regulation	Process (technology)	Product (trait)
Legislation	New laws & regulations	Existing laws adequate
Labeling	Mandatory labeling	Not required, voluntary
Internationally endorsed by	Cartagena Protocol, CBD	OECD, FAO/WHO, Codex

The major factors driving the difference in European & US approaches of GMO regulations

Factors	Europe	USA
Public Opinion	Anti-GMO, distrust of regulators, natural food, Past food scandals such as mad cow disease	Trust regulators, no past scandals, less aware & concerned
Dominant Interest groups	Anti-GMO NGOs, Green lobists, farmers who fear competition, consumers, misinformed media	Pro-GMO businesses, groups, farmers & consumers
Economic interest	No much gain expected for businesses, farmers or consumers since they already over produce food	Export trade, so Favorable condition for GMO use
Regulatory decisions	Consider scientific evidence & public opinion	Independent, stronger focus on scientific evidence
Political influence	Green parties and organic farmers have significant power	No such parties & minimal influence

Status of genetic engineering research and applications in Uganda:

Uganda should put in place a proper bio-safety system in order to properly implement the modern technology. To use the technology in long term, national capacity should continue to be built. Appropriate institutions created by the law should also take the responsibility of creating public awareness about the benefits and perceived risks of the technology.

Uganda has a vision of building an economy which has a modern and productive agricultural sector with enhanced technology, an industrial sector that plays a leading role in the economy

and reach middle income by 2017. To achieve this, science, technology and innovation which are major drivers of national development need to be incorporated in different sectors. Biotechnology which has applications in agriculture, industry, healthcare and environment can play a significant role to attain the goals set in each sector. Fortunately there are no complaints about the use of biotechnology in other sectors other than Agriculture.

With present Uganda's capacity and an accepting environment, the country can manage any risks associated with processes and products of biotechnology and sensitizing policy makers and general public about the technology.

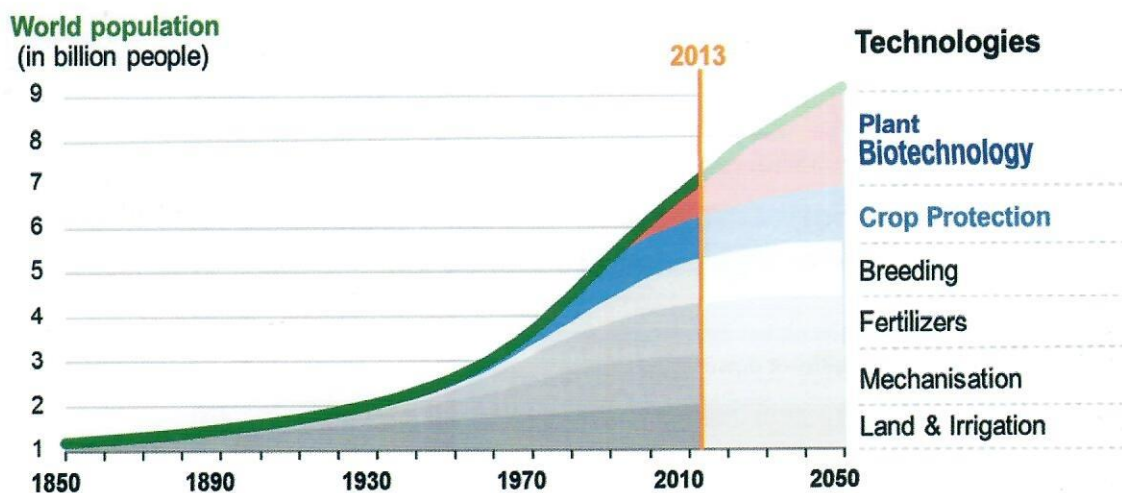
How is the future looking?

A look at the projected cereal yield in 2025 reveals that there is going to be a global shortfall as shown in table below

Cereals Regional Shortfall in 2025.

Region	Shortfall (million tons)
Sub-Saharan Africa	-88.7
East & Southeast Asia	-126.9
Middle East	-132.7

Yield increase is driven by innovation



Technological innovations are needed to fill the gap between demand and supply.

Direct benefits of GMOs

The University of Pretoria has established that small holder maize farmers in SA spend ca. 275 hours/hectare weeding with the traditional crop of maize but with GM herbicide resistant maize the number of hours needed are down to 152 hours. The study found that women who are mainly the ones involved in weeding were happy as this released time for them to care for their children and do house jobs.

The opponents of GM argue that GMOs will lead to weed and insect resistance but this is what breeders deal with all the time with traditional breeding. Our obligations as citizens is to look at the evidence presented and have the courage to reposition our views as that evidence accumulates.

A study of 160 cotton farmers in Burkina Faso (2011) showed that Bt cotton increased yields by 18% and had no difference in production costs (increase in seeds but decrease in insecticides) which shifted farm income from -ve to +ve

ENVIRONMENTAL SAFETY ISSUES:

Opponents of GMO argue that herbicide resistance genes will be transferred to weedy relatives to create super weeds but our crops: maize, banana, soybeans, tomatoes etc are not indigenous and therefore do not have relatives. In any case this transfer of genes happens all the time but we never get the weeds becoming crops and vice -versa.

FAO has categorically stated that studies of environmental effects of GM crops have shown to give similar results as those in conventional crops. The US National Research Council (2011) reported that "GM crops have had fewer adverse effects on the environment than non-GM crops."

The environmental impact has been reduced under GM crops due to: conservation tillage, reduction in insecticide use and more environmentally benign herbicides.

EU has Double Standards:

EU is main importer of GMO crop produce equivalent to 35M tonnes of soybeans and more in GMO maize per year for animal feed. Since mad cow disease outbreak, the animal products for feed have not been used. This has necessitated importing GM maize and soybeans from USA and Brazil. USA, Argentina and Brazil export to Europe over 90% of all soybeans and soybean products requirements of Europe.

Africa countries pulled in opposite direction & divided:

Countries with favorable GMO climate i.e.GM adopters: These countries include; South Africa, Ghana, Burkina Faso, Kenya, Uganda, Egypt. They have better capacity for GM R&D which is fairly well funded from local & donor sources. They are working comfortably with private technology providers and some have commercialized or have active active research programmes.

2. Countries with stringent regulations: These countries follow the European model. Such countries include Ethiopia, Zambia, Tanzania & Malawi. They have stringent interpretation of Precautionary Principle and use broad socioeconomic issues in the agenda as they focus GM monitoring & risk assessment capacity, not R&D and have no favorable climate for research adoption or PPP

Health concerns:

Human diseases associated with mycotoxins in food: Acute toxic hepatitis caused by Aflatoxin, Liver cancer caused by Aflatoxin, Oesophageal cancer caused by Fumonisin and Neural tube defects caused by Fumonisin. The issue of safety of food for humans and livestock or new allergens, toxins can not be tied to GMOs only. In a 90-day standard toxicological animal trials at high doses, experimental animals have shown no symptoms of ill effect. The UN Food and Agricultural Organization has stated that “no deleterious effects from consumption of foods derived from GM crops discovered anywhere in the world” and this has been supported by UK Royal Society, American National Academy of Sciences, and French Academies of Science and Medicine.

Socio-economic concerns:

The loss of export market is myth as the world over the GM products are accepted and are being used. The issue of lack of access to patented technologies will be solved by countries developing their own capacity to generate their own technologies and this will also minimize corporate dominance of seed sector which the opponents of the technology use as a hindrance. There is the argument of the loss of land races & traditional knowledge. The breeders are constantly replacing these varieties and will continue to be replaced with or without GM technology.

THE SERALINI SAGA

The 90-day toxicological rat trials at high doses is the standard assessment method but Seralini tried experiment for 2 years arguing that it was better. Six EU states including France and other countries such as Canada, Australia, New Zealand, Brazil have flawed the study due to: Strain of rats that got the tumours after 2 years, 40% of the treatments had no controls, lack use of accepted international protocols (50 rats compared with 10 rats used in this experiment) and flawed statistical analyses. Seralini saga has since apologized for misleading the world and the publishers have withdrawn the article.

Which regulatory approach is better?

The best regulatory approach is the one which allows new technologies to be used while preventing new risks to human health or the environment. Using this standard, US approach has done a better job than the EU. A number of countries have adopted a “mixed approach” to suit their situations.

DECLARATION OF AMASA-9

The 9th Annual Meeting of African Science Academies (AMASA-9) held in Addis Ababa, Ethiopia, 10-12 November 2013.

We, the undersigned African Science Academies, having deliberated on the relevance of bio-technology for development in Africa, during the 9th Annual Meeting of the African Science Academies (AMASA-9) held in Addis Ababa, Ethiopia, 10-12 November 2013 held by collectively issue the following Declaration of AMASA-9 on Africa. "Biotechnology for Development in Africa. Directed to Africa's policy makers, academicians, legislators and relevant ministries such as Science and Technology, Agriculture, Health, and Environment.

PREAMBLE.

- Whereas biotechnology is any technological application, traditional or modern, that exploits living organisms or substances from thereof to make or modify products or processes for specific end use, improve plants or animals, or develop microorganisms for specific purpose for applications;
- Whereas the African continent keeps missing opportunities to grasp technological evolutions for development as exemplified by the green revolution training by passing Africa;
- Whereas biotechnology can be a powerful developmental tool to tackle food, health and environmental problems of the African continent;
- Whereas conventional crop and livestock improvement strategies can significantly be augmented and made more efficient through the use of biotechnological methods;
- Whereas Africa is in urgent and dire need to break the seemingly perpetual cycle of hunger, malnutrition, and underdevelopment;
- Whereas the prudent and informed use of transgenic technology for Africa's agricultural development can pay robust dividends to the continent;
- Whereas focusing on improving Africa's biotechnology capacity development in human resources, equipment, and infrastructure is essential and best accomplished through a pool system organised by the continent's main regions;
- Whereas as functional modalities of collaborations in biotechnological training, cost sharing, and operational agreements at the national, regional and continental levels are essential;
- Whereas African governments have to take aggressive actions to embrace modern and traditional biotechnology as necessary tools and practical options for Africa's development;

- Whereas the applications of molecular and genomics tools in the characterisation and documentation of Africa's indigenous plant and animal genetic resources can be a powerful tool to prevent biopiracy of Africa's genetic wealth;
- Whereas restrictive policy environments discourage the responsible use of biotechnology-mediated products in Africa;and
- Whereas ensuring African ownership of the biotechnology agenda and products,with African governments embracing this technology as a timely and functional tool for the continent's overall development,is essential.

HEREBY DECLARE AS FOLLOWS

1. Highlight the positive aspects of biotechnology without losing sight of the associated potential risks and challenges including its perceived threat of biodiversity and bio-safety concerns
2. Uphold that biotechnology-enhanced tools and products can play a significant and positive role in meeting Africa's dire need and persistent challenges to break the seemingly perpetual cycle of hunger,malnutrition,and underdevelopment.
3. Observe that the overwhelmingly global scientific evidence shows that plant products which are Genetically Modified Organisms(GMOs),are as safe as their non-GMO counterparts;hence African Countries shall encourage research on and utilisation of GMOs as long as norms articulated in the existing international protocol and conventions such as the biodiversity Convention,Cartagena,and Nagoya Protocols are adhered to.
4. Recognise and endorse the fact that three African countries(South Africa,Burkina Faso,and Egypt)are on the global list of the 30th Biotech Crops Producers and this shall encourage other African countries to follow in the footsteps of these success stories
5. Call on African countries to invest heavily on biotechnolgy and to accelerate Africa-wide capacity building both in human and infrastructure development,focusing on biotechnology education,overall capacity building and infrastructure development,and argue African governments to invest generously in biotechnology training in their own universities both at the undergraduate and post-graduate levels.
6. Strongly recommend that African countries shall loosen the policy environment by enacting user friendly and country-specific legal frameworks with the proviso that Africa's biotechnolgy agenda should not be donor-driven,but rather national need-driven.
7. Urge African countries to develop and impliment comprehensive national biotechnology policies and biosafety laws appropriate to their own specific conditions but harmonised with Africa -wide and national norms

8. Recommend that African governments and organisations shall engage African Science Academies(ASA) to conduct thorough analysis of specific biotechnology-related issues in Africa to provide the foundation for evidence based policy advise to educate key stakeholders with a view to creating and sustaining demand for constructive policies and investment in biotechnology.To this end,ASA should come up with a checklist of elements that should be considered for inclusion in a comprehensive biotechnology policy for African countries,out of which a model policy could be designed to promote investment and innovation in biotechnology in Africa.
9. Propose that Africa shall establish and support functionally strong regional biotechnology networks and forge inter-country collaborations for capacity buiding in human resources,infrastructure,and facilities to meet the continent's various challenges in biotechnology
10. Recommend that Africa shall continue supporting and strengthening existing regional bioscience hubs such as Biosciences Eastern and Central Africa (BECA). North African Biosciences Network(NABNET),Southern Africa Network for Biosciences(SANBIO),West African Biosciences Network (WABNET),so that they shall serve as Centers of Excellence for the various aspects of biotechnology.
11. Recommend that African countries shall establish and/or endorse collaboratively Strategic Centers of Excellence of biotechnology in different regions of the continent with adequate equipment,operational facilities,and infrastructure to conduct state of the art of biotechnology research and train top-notch African scientists .Such centers shall have the required features where the merits of hands-on specialised training on specific methods and tools can best be illustrated.
12. Finally, we call on the African Union (AU), as the most important pan-African Organisation.to play a pivotal role in cordinating and overseeing the implimentation of Africa's biotechnology agenda by providing the leadership and insitutional support and by strengthening knowledge, management and information sharing among African countries on biotechnology policy,practice,and capacity building.

BRIEF BACKGROUND ABOUT UNAS.

The Uganda National Academy of Sciences (UNAS) is an autonomous, honorific and service organization comprising a diverse group of scientists from the physical, biological, social, and behavioral sciences. It was founded in 2000 and granted a charter to operate as the National Academy of Uganda in January 2009. Our vision is to improve the prosperity and welfare of the people of Uganda through science by generating, promoting, sharing and using scientific knowledge and giving evidence-based advice to Government and society.

UNAS is a membership organization and its membership includes Founding members, Fellows of the Academy, Foreign Fellows and Honorary Fellows. Currently the Academy has 56 Fellows and 60 Members.

