Issue 8:
Monthly Newsletter

GMASSURE
Assuring Agricultural and Food Safety of Genetically Modified Organisms (GMOs) in Southern Africa

In this issue:

Letter from the Editor

Over the past few decades, much research has been conducted on the safety of GM crops. An interesting report was recently published in this regard, which is presented in this issue of the newsletter.

Good progress is also being made with the WEMA project, and Dr Kingstone Mashingaidze gives readers an update on new crop varieties that could improve food security in Southern Africa.

Ella Nyakunu
Editor

The effect of Europe's perception of GMO acceptance on SADC

Dr Jane Morris, former Director of the African Centre for Gene Technologies (ACGT) in South Africa, retains an active interest in the development of biotechnologies and biosafety in Africa as a part-time consultant to the ACGT on the GMASSURE project. She now resides in Yorkshire, England, and shares her views with the GMASSURE editorial team.

"Unfortunately, progress towards the use of biotechnology – and particularly genetically modified organisms (GMOs) – in alleviating food insecurity is very slow," remarks Dr Morris.

"Even in South Africa, where genetically modified (GM) crops are widely grown, local researchers find it difficult to overcome regulatory hurdles and introduce new GM crops.

"The negative attitudes towards GMOs and some other relevant technologies in Europe has had a negative impact on the world's food supply, as Western Europe imports as much food as the whole of Africa – and much of this is genetically modified.

"Despite Europe having the luxury of enough money to import the food it needs, its rejection of GMOs has had an impact on the acceptance of these foods in the Southern African Development Community (SADC) region.

"In contrast to Europe, developing regions like SADC have less money to pay for food imports, and need to be more self-sufficient to ensure food security. For this reason, it is important that countries in SADC make use of all available technologies, including GMOs.

"Although European scientists are in favour of approval for the cultivation of GM crops, politicians have chosen to ignore scientists and have surrendered to negative public perception.

"While there is much debate on the introduction of GMOs, some of the new gene editing techniques may change the playing field. The Department of Agriculture in the USA has already ruled that a gene-edited mushroom will not be regulated. Sweden has also stated that some gene-edited plants do not fall under the definition of GMOs. While the European Commission has not yet given its view on the matter, SADC countries need to participate in international discussions on these issues to benefit from new technologies," she concludes.

ACP S&T PROGRAMME

Dates to diarise

In 2016, GMASSURE is planning a number of exciting events that will aim to meet the action's objective of empowering stakeholders. These events include a workshop on navigating cultural and religious issues in relation to GMOs, and a workshop on the impact of new biotechnologies. A number of interactive workshops are also planned for Namibia, South Africa and Zimbabwe.

- **20 to 21 July 2016:**
  Cultural and Religious Issues Workshop (South Africa)
- **25 July 2016:**
  Cultural and Religious Issues Workshop (Zimbabwe)
- **15 August 2016:**
  Cultural and Religious Issues Workshop (Namibia)
- **5 September 2016:**
  Interactive Workshop (South Africa)
- **26 September 2016:**
  Interactive Workshop (Namibia)
- **11 October 2016:**
  Interactive Workshop (Zimbabwe)

Looking ahead

The next event to be hosted by GMASSURE is the South African Cultural and Religious Issues Workshop from 20 to 21 July.

The workshop will create awareness of the concepts of biotechnology and GMOs among cultural and religious leaders. It also aims to share the perceptions and identify the concerns of traditional and religious leaders on biotechnology and GMOs, while discussing ways of addressing these concerns.

The facilitators will present and discuss the implications of the adoption and regulation of biotechnology and GMOs globally, regionally and nationally. Ultimately, the workshop aims to facilitate discussion on the way forward for stimulating debate around the further development (and regulation) of biotechnology and GMOs in SADC.

When: 20 to 21 July 2016

Where: Valley Lodge and Spa, Magaliesburg

Information about forthcoming events will be posted on the website as it becomes available.

Meet GMASSURE partner Dr Kingstone Mashingaidze

Dr Kingstone Mashingaidze heads the Grain Crops Institute of the Agricultural Research Council (ARC) in Potchefstroom as senior research manager. He has a PhD in Plant Breeding and Genetics from Michigan State University in the USA.

He joined the ARC in 2004, after spending15 years as a senior lecturer at the University of Zimbabwe and Africa University.

Before assuming his current position, he was a research team manager in plant breeding at the Grain Crops Institute. He has provided research leadership in breeding programmes for dry beans, groundnuts, maize and sorghum. He has extensive experience in maize breeding and is the principal investigator for the Water Efficient Maize for Africa (WEMA) and Stress Tolerant Maize for Africa (STMA) projects.

The WEMA project aims to develop and deploy drought-tolerant and insect-protected maize hybrids to smallholder farmers.

The STMA project aims to develop and deploy improved multiple stress-tolerant maize varieties that effectively address emerging and future production challenges. At the same time, it aims to increase genetic gains, and improve and share products that have been developed and knowledge gained.

His expertise also includes transgenics, crop physiology, agricultural biotechnology, plant phenotyping and seed technology.

WEMA makes progress with GM maize varieties

Maize is the staple food crop of rural diets in South Africa. South Africa is generally not suitable for crop production as only about 13% of the country is arable due to low rainfall and poor soils. South Africa is reported to be the 39th driest country in the world. Only about 20% of the maize in South Africa is grown under irrigation, because of limited water resources. Climate change is predicted to worsen the situation with more variable rainfall and above-average temperatures.

The high sensitivity of maize to drought stress discourages smallholder farmers from risking investment in best agronomic management practices, including quality hybrid seed and fertilizer. As a result, average maize yields are only about one tonne per hectare. Yields obtained by large commercial farmers growing maize under rain-fed conditions are also relatively low (4.5 to 5.0 tonne per hectare) as the impact of drought is reduced through low plant populations.

Insect pests also present a challenge for smallholder maize farmers who have little to no resources to effectively manage them. In times of drought, maize is particularly susceptible to pests and farmers can suffer severe losses.

To address these challenges, the Agricultural Research Council (ARC) participates in a public-private partnership: Water Efficient Maize for Africa (WEMA). The aim of the project is to develop low-cost, drought-tolerant, insect-protected maize hybrids for use by smallholder farmers. The hybrids are developed through a range of techniques, including conventional breeding and genetic modification. The drought-tolerant hybrids are expected to improve yields by at least 25% in moderate drought conditions.

The ARC has made considerable progress in developing WEMA hybrids. Elite conventional experimental hybrids and newly registered hybrids are currently being evaluated in on-farm trials and demonstration plots in collaboration with smallholder farmers, researchers and extension officers in the Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga and North West. The on-farm trials and demonstrations enable researchers to evaluate and verify the performance and acceptance of newly released and pre-released elite varieties under smallholder farming conditions. This will enable farmers to assess new varieties under their own management practices and make informed decisions about varieties suited to their needs. The trials also allow seed producers to direct the marketing of varieties towards areas where they perform well.

The ARC released and registered eight drought-tolerant hybrids in 2015.

The drought tolerance of conventional hybrids will be enhanced by a drought tolerance transgene. Data collected in regulated trials conducted in South Africa, Kenya and Uganda indicated that the drought tolerance transgene gives a yield advantage under moderate drought that is experienced during flowering.

In addition, the transgene does not reduce yield under favourable moisture conditions.

> During drought, maize is particularly susceptible to pests and farmers can suffer severe losses.

The drought transgene was approved for commercial release in South Africa in May 2015. It is deregulated in the USA and in GM maize hybrids, and is marketed under the brand name DroughtGard™. In 2013, US farmers planted about 50 000 hectares of DroughtGard™, and in 2014 this increased to 275 000 hectares.

The yield benefit of WEMA drought-tolerant hybrids will be further protected by the inclusion of a transgenic factor to enhance resistance to stem borers. Insect protection will improve grain quality due to reduced insect damage and mycotoxins. It will also reduce the need for pesticide use, which will benefit both the environment and human health. Hybrids with royalty-free MON 89034 will be available to smallholder farmers from 2016.

Regulated trials of GM hybrids with stacked drought-tolerance and insect-resistant transgenes are already underway in South Africa. The commercial release of transgenic stacked drought-tolerant and insect-protected maize hybrids in South Africa is expected to start in 2017, subject to regulatory approvals.

The maize hybrids will be marketed by licensed local seed companies. The drought-tolerant and insect-protected GM technologies will be provided to smallholder farmers royalty free.

This will make GM hybrids more affordable, as the price will be comparable to that of conventional hybrids. This is expected to have a significant positive impact on the food security, financial security and livelihoods of smallholder farmers and their families.

Dr Kingstone Mashingaidze
WEMA Coordinator and Senior Research Manager:

GM crops: experiences and prospects

An extensive study by the National Academies of Sciences, Engineering and Medicine has found that new technologies in genetic engineering and conventional breeding are blurring the once-clear distinctions between these two crop-improvement approaches. In addition, the research committee found no substantiated evidence of a difference in risks to human health between current commercially available genetically engineered (GE) crops and conventionally bred crops, nor did it find conclusive cause-and-effect evidence of environmental problems from the GE crops.

A tiered process for regulating new crop varieties should focus on a plant's characteristics rather than the process by which it was developed. New plant varieties that have intended or unintended novel characteristics that may present potential hazards should undergo safety testing – regardless of whether they were developed using genetic engineering or conventional breeding techniques. New "-omics" technologies, which dramatically increase the ability to detect even small changes in plant characteristics, will be critical to detecting unintended changes in new crop varieties.

The research committee examined almost 900 publications on the development, use and effects of GE characteristics in maize, soybean, and cotton, which account for almost all commercial GE crops to date. In addition, the committee heard from 80 diverse speakers at three public meetings and 15 public webinars, and read more than 700 comments from members of the public to broaden its understanding of issues surrounding GE crops.

The committee carefully searched all available research studies for persuasive evidence of adverse health effects that could be directly attributed to the consumption of foods derived from GE crops, but found none. Studies with animals and research on the chemical composition of GE foods currently on the market reveal no differences that would implicate a higher risk to human health and safety than from eating their non-GE counterparts.

There is some evidence that GE insect-resistant crops benefit human health by reducing insecticide poisonings. In addition, several GE crops are being developed that are designed to benefit human health, such as rice with increased beta-carotene content to help prevent blindness and death caused by Vitamin A deficiencies in some developing nations.

The use of insect-resistant or herbicide-resistant crops did not reduce the overall diversity of plant and insect life on farms, and sometimes insect-resistant crops resulted in increased insect diversity. Overall, the committee found no conclusive evidence of cause-and-effect relationships between GE crops and environmental problems. However, the complex nature of assessing long-term environmental changes often made it difficult to reach definitive conclusions.

The available evidence indicates that GE soybean, cotton and maize have generally had favourable economic outcomes for producers who have adopted these crops, but outcomes vary, depending on pest abundance, farming practices, and agricultural infrastructure.

Evidence shows that in locations where insect-resistant crops were planted, but resistance-management strategies were not followed, damaging levels of resistance evolved in some target insects. If GE crops are to be used sustainably, regulations and incentives are needed so that more integrated and sustainable pest-management approaches become economically feasible.

Insect-resistant GE crops have decreased crop loss due to plant pests. However, the committee examined data on overall rates of increase in yields of soybean, cotton, and maize in the USA for the decades preceding the introduction of GE crops, as well as after its introduction. There was no evidence that GE crops had changed the rate of increase in yields.

All technologies for improving plant genetics can change foods in ways that could raise safety issues. According to the new report, it is the product and not the process that should be regulated.

In determining whether a new plant variety should be subject to safety testing, regulators should focus on the extent to which the novel characteristics of the plant variety (both intended and unintended) are likely to pose a risk to human health or the environment, the extent of uncertainty about the severity of potential harm, and the potential for human exposure – regardless of whether the plant was developed using GE or conventional breeding processes.

Regulators should be proactive in communicating information to the public about how emerging GE technologies or their products might be regulated and how new regulatory methods may be used. They should also proactively seek input from the public on these issues. Not all issues can be answered by science alone, the report says. Policy regarding GE crops has scientific, legal and social dimensions.

Read the full report at: http://www.nap.edu/catalog/23395/genetically-engineered-crops-experiences-and-prospects

Adapted from an article in *Science Daily.* Available at: https://www.sciencedaily.com/releases/2016/05/160517131632.htm.