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Fact Sheet: GMOs in South Africa

and why we say NO!

What is a GMO?

A genetically modified organism (GMO) is a life form (such as a plant, animal or bacteria) that has been genetically modified (GM) – or more accurately genetically engineered (GE) – by forcefully inserting genes, mostly from another species, into its DNA. GM food crops have genes from bacteria and viruses inserted into their DNA.

DNA (deoxyribonucleic acid) contains the biological information about how something grows, looks and changes through the seasons, and how it reproduces. DNA is passed on from male and female parents to their offspring and is found in every cell of a living organism. The DNA contains coded information, called genes, for making proteins for the organism's body and functioning.

GMOs are unnatural – the process of inserting these foreign genes is carried out by scientists in a laboratory and is a complex process of trial and error. The scientists either use bacteria as shuttles to carry the foreign genes into the plant cell by infecting it, or they use a "gene gun" that fires microscopic particles coated with GM genes into the cell nucleus, where the DNA is found.[1]

Genetically modified crops

In a typical GM crop several gene parts, typically coming from different organisms like bacteria, are inserted together into the target DNA. These could include trait genes, promoter genes, terminator genes, and/or marker genes.

A **trait gene** holds the information for a specific characteristic or trait that the scientist wants the target crop plant to express, such as herbicide resistance. Even though the biotech industry often boasts that GMOs help combat problems such as malnutrition and feeding a growing population, the GM crops that are currently grown commercially do not increase crop yield, but focus on two main traits affecting how the crop is grown:

1. Insect resistant Bt crops have a bacteria gene that makes the plant produce an insect toxin in all its parts, making the plant a living pesticide.
2. Herbicide tolerant crops have a gene that prevents the crop from dying when sprayed with a chemical weed killer. Most GMOs are tolerant of herbicides containing Glyphosate, but recently Dow Chemicals has applied to import new types of GM crops tolerant of older and far more toxic herbicides such as Glufosinate and 2,4-D.

"GMOs are yet another technology that furthers the industrialisation of agriculture, making farmers and consumers dependent on a limited and expensive range of corporate products."

Many GM crops now have both Bt and herbicide tolerant genes – these are called "stacked" genes.

South Africa has also authorised the general release of a controversial trait claiming to make the crop drought tolerant. Other types of GMOs that are being experimented with globally include plants engineered to: produce extra nutrients such as beta-carotene; have different product qualities such as delayed ripening of fruit; produce more starch; resist particular diseases; have less lignin so trees can be more easily processed for paper; and flowers with a rare colour. Some of the most controversial GMOs are those that are engineered to be sterile.[2] There are also many experiments with GM animals. Two controversial GM animals have already been approved: GM mosquitoes carrying genes that make their offspring die have been released in the Cayman Islands and Brazil; and GM salmon engineered to grow larger and faster than is natural can now be bred in the USA for consumption in the USA and Canada. Micro-organisms are also engineered to produce, for example, insulin, fuels, a variety of vaccines, growth hormones, and enzymes used to process foods.

A **promoter gene** "switches on" the trait gene. Most currently commercialised GM crops contain a promoter gene from a virus that attacks cauliflowers (CaMV). This gene works in the DNA of all types of plants to "trick" the plant cell into accepting the foreign genes as part of its own DNA so that proteins will be made for the desired trait.

A **terminator gene** "switches off" the trait gene by stopping it from making the protein, and is usually taken from bacteria.

A **marker gene** is used to identify which cells are successfully modified. Because genetic engineering is so imprecise, scientists need to be able to identify in which experimental cells the modified genes have successfully "recombined". Usually an antibiotic-resistant gene is used as the "marker". The cells that have accepted the foreign genes (called transgenes) don't die when exposed to the antibiotic.

Which crops and foods contain GMOs in South Africa?

The first GM crops were planted in South Africa in 1997. According to the ISAAA, a biotech industry body that tracks GM crops worldwide, South Africa was the 9th largest producer of GM crops in 2016, growing almost 2.7 million hectares of GMOs,[3] covering 2.5% of South Africa's arable land.[4]

We are the only country in Africa to allow our staple food to be GM. Farmers in South Africa are allowed to plant three GM crops:

1. MAIZE
2. SOYA
3. COTTON

In the 2016/175–90 growing season the percentage of these crops planted as GM varieties[5] was:

- **Maize – 85–90%**
- **Soya – more than 95%**
  Both soya and maize are used in thousands of processed foods including bread, baby food, baked goods, sweets, meat and dairy substitutes.
- **Cotton – 100%**
  Cotton seed oil is used to preserve tinned sea foods and to fry fast foods.

South Africa also imports GMOs. The same crops that are grown in South Africa may also be imported. South Africa has approved the importation of one type of GM rice (known as Liberty Link) and several types of GM Canola for food and animal feed only, but there have been no imports of these to date.[6]

New crops undergoing contained or open experimental trials in South Africa include banana, cassava, sorghum and sugar cane.[7] Several GM vaccines are also being trialled on animals and people.

South Africa has also approved the use of rBST – a GM hormone injected into cows to increase their milk production.

Why Biowatch does not support the use of GMOs

Biowatch does not support the use of GMOs in our farming. There are many reasons for both farmers and consumers to avoid and speak out against GMOs.

GMOs DO NOT HELP SMALL FARMERS

GM does not change the performance of the crop other than the trait the genes are designed to express – which is either to be a living pesticide or to withstand applications of herbicide. The GM gene segments are inserted into hybrid varieties of the crop already being grown commercially. Unlike farmer varieties which are bred for local conditions and are resilient to changes in climate, these hybrid varieties usually only grow well with regular irrigation and applications of fertilisers, which most small-scale farmers cannot afford. In addition, when one saves hybrid seeds these do not grow with the same vigour and characteristics in the following seasons. If GM crops are growing nearby they can contaminate local varieties, especially in wind pollinated crops like maize.[8] This means that traits like herbicide resistance may be introduced that are of no value to small-holder farmers, at the expense of traits that are important in local varieties.

GMOs are patented. This means that the company that created the inserted genes owns the seeds and crop. Farmers must pay the company an extra fee to use them and replant seed from them.

Biowatch is against the patenting of life – nature is a global inheritance. Farmers have been saving, selecting and sharing seeds for centuries and this is a basic right all farmers have. GM crops are more expensive to grow: the seeds cost more and must be bought every year; they need extra fertiliser to grow; and farmers must buy the associated herbicide. Many small-scale farmers get into debt to pay for these technologies. Although biotech companies claim that GM crops use less pesticides, after a few good years the target pests develop resistance to the Bt toxins and secondary pests become more of a problem. Research with cotton farmers in China found that within seven years the farmers were spending as much on pesticides as non-Bt farmers, but were paying more for the GM seeds.[9] Small-scale farmers in Makhathini in KwaZulu-Natal had the same experience with GM cotton. Falling cotton prices, and farming

challenges including drought and development of secondary pests, plunged the farmers into debt. The Land Bank, which had provided loans for the costs of inputs, ceased lending in Makhathini in 2004, with R22.7 million outstanding in defaulted loans.[10]

GMOs ARE CONTRIBUTING TO THE CORPORATE CONTROL OF OUR FOOD SYSTEM

Multinational corporations own the transgenes and resultant GM seeds and crops. The same corporations also own and supply the chemical fertilisers, pesticides and herbicides that must be used to grow them. GMOs are yet another technology that furthers the industrialisation of agriculture, replacing ecologically and culturally appropriate and diverse traditional seeds, foods and farming methods to make farmers and consumers dependent on a limited and expensive range of corporate products. This makes communities economically vulnerable to hunger and puts the entire food system at risk of collapse in the context of disease outbreaks and climate change.

GMOs ARE UNHEALTHY

Bacteria are able to take transgenes from their environment into their own DNA. This phenomenon occurring in micro-organisms is called horizontal gene transfer (HGT).The only human feeding trial with GM foods found modified genes from GM soya in intestinal bacteria.[11] This is potentially very serious considering that traits found in currently commercialised GM crops include the ability of these cells to create toxins as well as antibiotic resistance. This could mean that the antibiotics in our current medical arsenal become ineffective. Transgenes not only survive digestion, but have also moved from the gut into the blood, organs[12] and foetuses of research animals.[13]

Although there is not enough independent research into the impacts of GMOs on human health, research with other animals indicates serious health impacts. These include allergic reactions; disturbances in the immune system; problems with the growth and development of cells and organs; inflammation and damage to organs especially the kidneys, gut, liver, and spleen; increased cancerous tumours and earlier development of tumours; and reproductive problems.[14]

GMOs CAUSE DAMAGE IN THE ENVIRONMENT

The impact of horizontal gene transfer (HGT) on bacteria, viruses and other organisms in the soil and water systems is of concern, but has not been adequately studied. It is known that soil bacteria readily incorporate gene fragments from soil into their DNA, and one study found that *A. tumefaciens* bacteria can also infect fungi and transfer GM genes to the fungi in the process.[15] The consequences of this are unknown.

Bt crops have been found to slow the growth of beneficial soil bacteria and *Mycorrhizal* fungi that help plants take up nutrients in the soil. Bt crops negatively impact non-target insects including butterflies and natural pest predators such as lacewings and ladybirds. Bt toxins also interfere with the learning behaviour of bees that enables them to find food nectar. Bt toxins have been found in waterways and harm water fleas – an indicator of environmental toxicity.[16]

Herbicide resistant genes can cross into weeds that are of the same family. Tolerance to herbicides and pesticides is developing in association with GM crops creating so-called "super weeds" and "super pests". Pests and weeds naturally develop resistance to toxins over time, and usually farmers must change and break their chemical spraying regime to prevent this. In Bt crops, where the plant is the pesticide, there is no break in exposure so pests develop resistance quickly. The maize stem borer started developing resistance to Bt maize in South Africa within ten years,[17] and this is one of the reasons that biotech companies are now creating "stacked" GMOs.

Glyphosate - GM's twin menace

The use of Glyphosate herbicide has substantially increased with the introduction of Roundup Ready crops.[18] In South Africa, Glyphosate use rose from 12 million litres in 2006 to 20 million litres in 2011, and imports increased by 177%.[19]

Although the industry claims that Glyphosate is a safe herbicide, a growing body of research shows that it is toxic to humans and the environment. Additional ingredients in formulations such as Roundup increase this toxicity. Known human health impacts include disruption of the endocrine system, and exposure is associated with increased risk of miscarriages, premature birth, chronic kidney disease and the cancer non-Hodgkin's lymphoma.[20] The most recent studies link exposure to commercial concentrations of Glyphosate to resistance to common medical antibiotics.[21]

In March 2015 the World Health Organisation's cancer research arm, the IARC, declared Glyphosate to be "probably carcinogenic" (causes cancer) based on evidence in agricultural workers, and convincing evidence in animal experiments.[22]

Glyphosate is very mobile in water systems and is highly toxic to aquatic life. Glyphosate is also toxic to earthworms and weakens plants by inhibiting their ability to take up nutrients. It also increases susceptibility to plant diseases, especially fungal diseases.[23]

"There is increasing evidence of GMOs creating environmental and health risks and having dubious economic advantages: promised crop yields failing to materialise, increased dependency on pesticides, and contamination of farmers' seeds."

How do you know if a food is GM?

There is no way to see if a plant or food contains GMOs because the changes are at a microscopic level. Expensive laboratory tests are needed to see if transgenes are present.

To ensure our right to choice and to know what we are eating, food producers must label their GM products. This has been controversial as the biotech industry has fought to prevent the labelling of GMOs. In October 2011 the Consumer Protection Act came into force, requiring the labelling of foods with any GM content. However, the resulting labelling regulations have created much confusion for consumers and many companies are still avoiding proper labelling. The legislation only requires products that contain GMOs to be labelled – animals fed on GMOs, and products from them, do not require labelling.

The following labels are mandatory in South Africa when foods contain GMOs:

- **"Contains GMOs"** if there is 5% or more GM content.
- **"Produced using genetic modification"** when the food comes directly from a GM source, for example mielie meal.
- **"May contain GMOs"** when the manufacturer can show that it is impractical to test for GM but suspects that it is.

Food producers can also use the following voluntary labels:

- **"Does not contain GM content"** if there is less than 0.9% GM content.
- **"GM content is less than 5%."**

Notes and References

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