



# Monsanto's risky triple herbicide- tolerant soybeans to enter South Africa's food systems

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In October 2017, the South African government received an application for the commodity clearance (imports of food, feed and processing) of a 'multi-stacked' variety of genetically modified (GM) soybean, MON 87708 x MON 89788 x A5547-127, by Monsanto South Africa (Pty) Ltd.

This GM soybean represents the latest trend in herbicide-tolerant GM crop varieties, developed to withstand not just one or two, but three herbicides, as the spread of weeds resistant to the chemicals forces the development of more extreme versions of these GMOs. MON 87708 x MON 89788 x A5547-127 soybean is designed to withstand applications of glyphosate, glufosinate and dicamba herbicides. The development of these new crops appears to do little more than attempt to maintain the use of increasingly redundant GM technologies and the profits reaped from herbicide sales and patented seeds.

The latest GM soybean will expose South African consumers to yet more chemical pesticides, and novel, complex mixtures of chemical cocktails, the health and safety consequences of which are yet to be fully established.

As detailed below, all three of these individual herbicides are toxic to humans, prompting restrictions and even bans in various global regions. Of particular concern to the South African people is that these GM soybeans will enter the market despite safe legal limits for pesticide residues on soybeans not having been fully established by government. With current legislation thus insufficient to ensure the safety of the South African consumer, MON 87708 x MON 89788 x A5547-127 has no place entering our food systems.

### **Background to MON 87708 x MON 89788 x A5547-127**

This GM soybean variety is a 'stacked' trait developed by conventional breeding of three separate genetically modified soybean varieties:

**MON 87708** was developed by Monsanto. It contains the mono-oxygenase (DMO) protein from *Stenotrophomonas maltophilia* intended to confer tolerance to dicamba herbicides. This crop has not been approved for commodity release as a single event, only as a stacked event (MON 87708 x MON 89788), approved in 2016.

**MON 89788** was developed by Monsanto. It contains the 5-enolpyruvylshikimate-3-phosphate synthase protein from *Agrobacterium sp.* strain CP4 (CP4 EPSPS) intended to confer tolerance to glyphosate herbicide. This variety was approved as a single event in 2013 for commodity release.

**A5547-127** was developed by Bayer. It contains the phosphinothricin N-acetyltransferase (PAT) protein from *Streptomyces viridochromogenes* to confer tolerance to glufosinate herbicide. This was originally approved for commodity release as a single event in 2016.



**According to ISAAA.org, the triple stacked event, MON 87708 x MON 89788 x A5547-127 has yet to be approved for cultivation anywhere in the world and has only been approved for commodity clearance in Mexico and South Korea.**

## Failure of herbicide-tolerant crops

Triple herbicide-tolerant crops entering the market are a testament to the failure of herbicide-tolerant crops.

A number of triple herbicide-tolerant crops are now entering the global market or awaiting approval, including various cotton varieties, such as the Bollgard II® XtendFlex cotton (tolerant to glyphosate, glufosinate and dicamba) developed by Monsanto; as well as other soybean varieties, such as Balance Bean, tolerant to glyphosate, glufosinate and isoxaflutole, and 'Enlist traits™' tolerant to glyphosate, glufosinate and 2,4-D, developed by Bayer and Dow AgroSciences, respectively.

The development of these varieties is testament to the failures of first-generation herbicide-tolerant crops to provide an effective weed management system. Indeed, the advent of GM herbicide-tolerant crops led to a sharp increase in herbicide use and a subsequent acceleration of weeds becoming resistant to them. Although glyphosate (and glufosinate) is considered by regulators and the industry as being low risk with regard to the evolution of weed resistance, at least 36 species (more than 240 populations) have become resistant to it. A reported excess of 28 million hectares of US farmland are now infested with glyphosate-resistant weeds.

These figures expose the limitations of herbicide-tolerant crop technologies, and this trend is only likely to continue with the introduction of GM crops tolerant to dicamba. Furthermore, contrary to widespread assumptions, the cultivation of herbicide-tolerant GM crops does not consistently increase yield. As such, these varieties show limited benefits and instead come with known and unknown biosafety risks to humans and the environment, associated with these chemicals.

## Herbicides linked to serious adverse human health effects

Glyphosate, glufosinate and dicamba have all been linked to serious health effects in humans.

**Glyphosate** has been linked to cancers, birth defects and reproductive problems, as well as kidney and liver disease. It was recently classified a 'Class 2A probable human carcinogen' by the World Health Organization (WHO)'s oncology arm, the International Agency for Research on Cancer (IARC).

Over 150 studies have shown adverse effects of glyphosate to humans and the environment. A recent study found that below legal limits of glyphosate were sufficient to induce liver disease in laboratory rats.

Glyphosate has received bans in Sri Lanka and El Salvador, though yet to be signed into law. The European Union recently banned certain formulations of glyphosate and the Netherlands has



banned non-commercial use. Many other restrictions or bans have been put in place across the world (see this list by Pesticide Action Network, UK: [https://issuu.com/pan-uk/docs/glyphosate\\_restrictions\\_and\\_bans\\_ar](https://issuu.com/pan-uk/docs/glyphosate_restrictions_and_bans_ar)).

**Glufosinate** is linked to neurological and reproductive/developmental problems. It is known to mimic a natural brain chemical, called glutamate, and, as such, has been associated with interrupting brain cell signalling, resulting in learning and memory problems, structural abnormalities in the brain and impaired brain development in laboratory animals. In humans, paternal exposure has been linked to developmental defects in children.

Due to concerns over the toxicity of Glufosinate, its use is currently restricted in the EU. Further, in 2017, France withdrew the licence for glufosinate, citing uncertainty over its effects on health.

**Dicamba** and/or its metabolites have been linked to both reproductive and developmental toxicity, including increased abortions, skeletal abnormalities, endocrine (hormone) disruption, and DNA damage.

Additional uncertainties remain over the degradation products that are present following application of these three pesticides, depending on the species of plant, the gene constructs inserted and the amount and frequency of pesticides used. Further, combinatorial effects of residues can far exceed the toxicity of single substances, as can formulation products in comparison to the active ingredient alone.

These issues were not addressed in the application submitted to the South African authorities for MON 87708 x MON 89788 x A5547-127, raising further biosafety hazards that are yet to be fully established. No details were provided of any experiments testing the safety of the whole plant on laboratory animals; let alone the whole plant with pesticide residues on them.

## Incomplete safe legal limits established for herbicides on soybean

Legal limits of pesticide residues are usually established for food to prevent adverse health effects to consumers, known as Maximum Residue Levels (MRLs). Each foodstuff has its own limit for each pesticide; an MRL for glyphosate on soybean may be a different limit to that for chicken liver or maize. MRLs are determined by several factors, including agronomic use and long-term toxicity testing, though such regulations are limited, due to reliance on industry and not independent data.

Independent data shows toxicity of certain pesticides, such as glyphosate at extremely low doses, raising the concern that there are, indeed, no safe levels of pesticides yet to be established. Nonetheless, of critical importance – with the new trend of GM crop varieties being developed to withstand higher doses of herbicides as well as multiple herbicides in one crop – is that some regulatory oversight and monitoring of pesticide residues be in place. However, regulatory oversight is currently lacking in South Africa. There appears to be no MRL set for either glufosinate or dicamba on soybeans, and in 2017 an MRL for glyphosate on soybeans was established for the first time.



## Unapproved single-gene events again being sneaked into stacked events

As revealed recently with GM crops utilising RNA interference – technologies that recently received regulatory approval in South Africa – this latest stacked soybean variety confirms a new trend of sneaking in single events that have not received prior approval as a single variety. According to the ISAAA.org website and the South African Department of Agriculture, Forestry and Fisheries, MON 87708 has not been approved as a single event. This means that a regulatory review of its safety has not been independently assessed. To date, approval of stacked events/ varieties has been based on prior approval of the parental single event varieties, but this practice appears to have been abandoned as the growing tide of stacked events enters the country.

### To conclude

While there is a lack of scientific consensus surrounding safe levels of the three pesticides that will be applied to MON 87708 x MON 89788 x A5547-127, there are clear concerns with regards to their toxicity, as well the capacity for the South African government to adequately regulate and monitor their levels in the food crops entering the country.

As such, the introduction of a triple-stacked, herbicide-tolerant soybean into the South African food systems is risking the very safety of South Africa's soybean supply, adding further to other herbicide-tolerant varieties already on the market. This will only result in an increased toxic pesticide burden in the bodies of exposed people and animals.