



Bt maize: How to prevent resistance

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The word 'stewardship' is heard a lot in the agricultural industry. This is because producers are inherently custodians of the soil, water and the greater environment in which they farm. Stewardship can be defined as the responsibility of taking care of something. Just like producers need to take care of the natural resources on which they rely, they also need to preserve the products of plant biotechnology that contribute to the sustainability of food production.

In this context, stewardship refers to the responsible introduction and long-term use of plant biotechnology products such as insect-resistant (IR) and herbicide-tolerant (HT) crops. All producers, regardless of whether they are large commercial producers or small-scale farmers, need to know how to plant these valuable crops responsibly and sustainably. According to non-profit industry association, [CropLife SA](#), producers can implement a few things that help oversee the responsible use of plant biotechnology in South Africa.

Integrated pest management

One of the most critical aspects of biotech stewardship in crops, is resistance management. Like weeds become resistant to herbicides if active ingredients are not alternated, insects can become resistant to IR genes in biotech crops that usually repel them. Therefore, producers need to implement an integrated pest management (IPM) strategy to prevent this from happening.

IPM is a holistic approach that uses all available pest management techniques and does not rely only on chemical methods. In fact, it is a legal requirement for technology permit holders to monitor resistance management in terms of the *Genetically Modified Organisms Act, 1997 (Act 15 of 1997)*. This requires technology developers to develop a surveillance plan for detecting resistance development to undertake grower educational programmes, as well as develop a compliance management plan to counteract resistance development.

In South Africa, resistance to [biotech maize](#) with the single Mon 810 IR trait has already been reported. However, according to CropLife SA, the management of resistance to insecticidal proteins from the naturally occurring soil bacterium *Bacillus thuringiensis* (Bt), still requires concerted stewardship efforts. This after biotech crops have been present in the country for 20 years. The goal is to prevent Bt resistance in biotech crops from repeating in future.

Resistance management of Bt crops

A vital component of a resistance management programme for Bt crops, is adopting a refuge strategy to prevent insect resistance from developing. Resistance management also applies to maize with stacked IR and HT genes. A refuge is a strategy to reduce the resistance of insects such as the maize stalk borer (*Busseola fusca*) to Bt maize.



A refuge is an area planted with non-Bt crops that supports the production of Bt susceptible insects. For example, growers using Bt maize are required to plant a refuge area of non-Bt maize. This works by maintaining a population of susceptible insect pests that are not exposed to the Bt protein.

Consequently, high numbers of susceptible insects are available to breed with resistant insects that emerge in the Bt maize field. This method ensures that susceptibility is passed on to offspring, which helps to prevent the emergence of resistant populations over time.

To achieve this a refuge must be planted within 400m of Bt-cultivated maize fields. There are two refuge options. For the first option, the refuge can be a minimum of 5% non-Bt maize that is not treated with an insecticide. For the second option, the refuge can be a 20% non-Bt maize field that may be treated with a registered non-Bt-containing insecticide or biopesticide.

More resistance management tips

Apart from the refuge strategy, CropLife SA shared other important considerations in IPM and resistance management strategies for Bt crops:

- Producers need to know about pest biology and ecology.
- They need to understand the efficacy of available insecticidal traits.
- The selection of locally adapted crop varieties also forms part of this strategy.
- Understanding local cropping systems will also improve IPM.
- Scouting and monitoring for target pest damage is an important step in pest management.
- When needed, the application of alternative pest management options is essential.
- Continuous education and training on responsible use is a must.

Co-operation for a sustainable future

Although South African growers have successfully adopted biotech crops such as maize, the benefits of these crops depend on these technologies' stewardship. In 2018, South African producers planted an estimated two million hectares of biotech maize, according to the [International Service for the Acquisition of Agri-biotech Applications \(ISAAA\)](#). Of the two million hectares, 207 000 hectares comprised IR maize, 460 000 hectares HT maize, and 1,3 million hectares stacked IR/HT maize.

It is evident that the maize industry relies heavily on plant biotechnology to remain sustainable. – *Ursula Human, AgriOrbit*

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