Pest resistance against Bt maize in South Africa and challenges for African farmers (and regulators)

Johnnie van den Berg
Unit of Environmental Sciences and Management
North-West University
Potchefstroom
• Resistance evolution - African stem borer
• The African context
African maize stem borer: *Busseola fusca* (in Bt maize)
Monsanto pays for insecticide applications on Bt maize
Insect resistance management

High dose / refuge strategy

High dose of Bt Cry protein in plant
Refuge of non-Bt maize that ensures pest survival
IRM: High Dose and Refuge

Few surviving moths almost all are RR

Killed by high dose of Bt maize

Many moths almost all are SS

Bt Maize

Refuge Maize

1994  First testing of various Bt maize events

1998  Commercially released

2005/6  First official report of field resistance of *Busseola fusca* (2007)
Resistance of *Busseola fusca* and *Sesamia calamistis* would most likely develop in center pivot irrigation systems in the Highveld region.


First report of resistance of *Busseola fusca* to Bt maize was made in 2007 from an irrigation scheme in the Northern Cape Province.

Larval survival noticed on Bt-maize (2004/05)

71 % stalks with over wintering *Busseola fusca* larvae
MON810

600 km range
Approx: 150 hostspots
How did it happen?

Bt maize
The incidence of farmers signing contracts and complying to refuge requirements for the first time between the 1998 and 2007 growing seasons.

Reasons for resistance development:

1. non-compliance to refuge requirements (farmer is blamed)

2. protein expression levels
“Remedial” action

IRM strategy

- Enforce compliance
- Introduce stacked genes
IRM strategy

Yieldgard I : Cry 1Ab (1998 - ....)

Yieldgard II : Cry 2Ab + Cry 1A105 (2011 - ....)

What will the impact be of the continued planting of MON810 on future efficacy of new MON89034?
The African context
IRM: possible strategies / actions

- Gene stacking
- Enforce refuge compliance
- Refuge in a bag (seed mixtures)
- Wild host plants

- Setting aside of land (Bt cotton / Bt maize)
  (monophagous / polyphagous species)
Refuge compliance impossible
No wild host plants/thick stemmed grasses
Thick stemmed grasses do not host sufficient numbers of stem borers.
Out of the African Context
Licensing agreements

YOU AGREE
- To use seed containing GM maize technology only for planting a commercial crop in a single season.
- To not supply any of this seed to any other person or entity for any purpose.
- To not use this seed for crop breeding, research, or seed production.
- To pay the applicable Technology Fee for the particular product being purchased.
- To implement a Weed Resistance Management Program specified in the applicable Monsanto "Product Use Guide" for Roundup Ready® maize.
- To implement an Insect Resistance Management Program specified in the applicable YieldGard® maize section of the "Product Use Guide" and to cooperate with Insect Resistance Management programs.
Thank you