Assessment of the environmental impact of genetically modified maize

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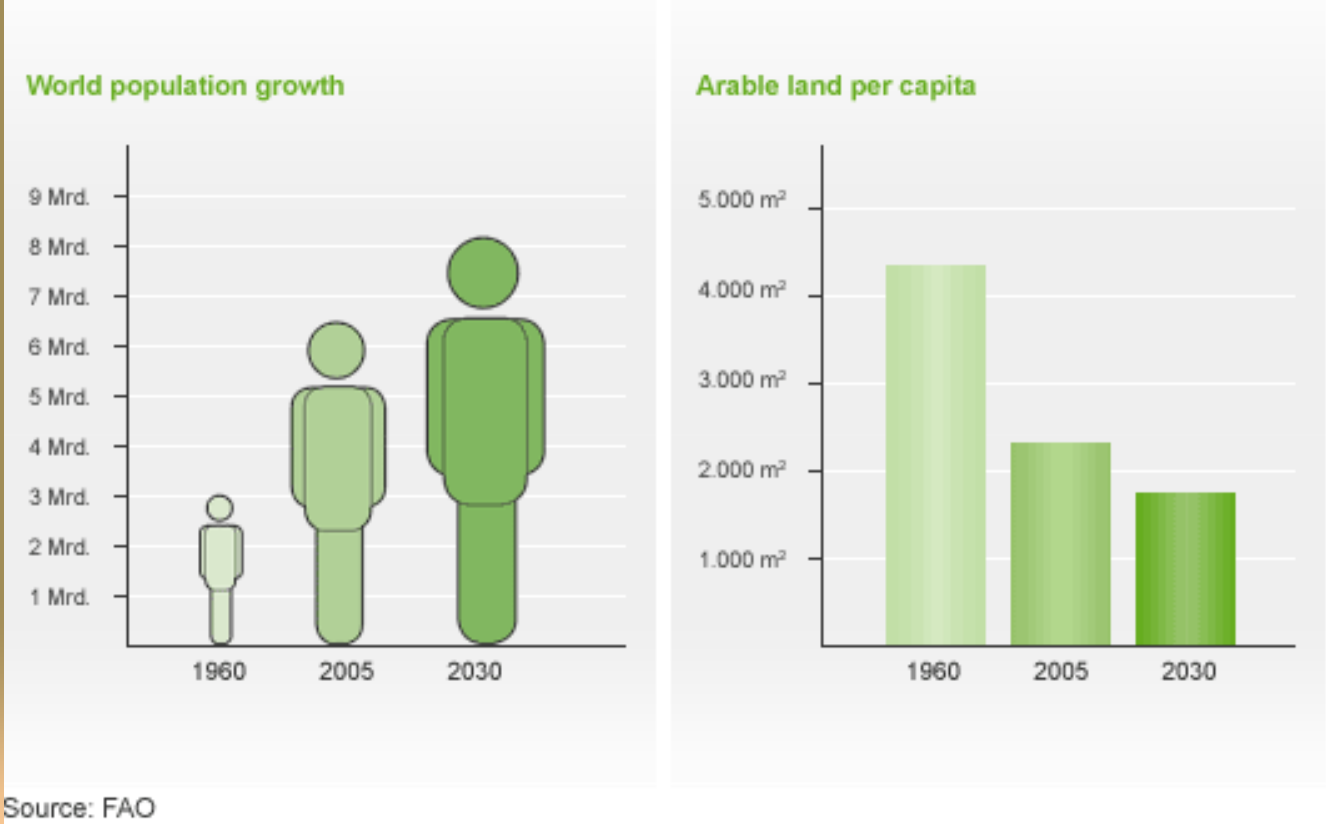
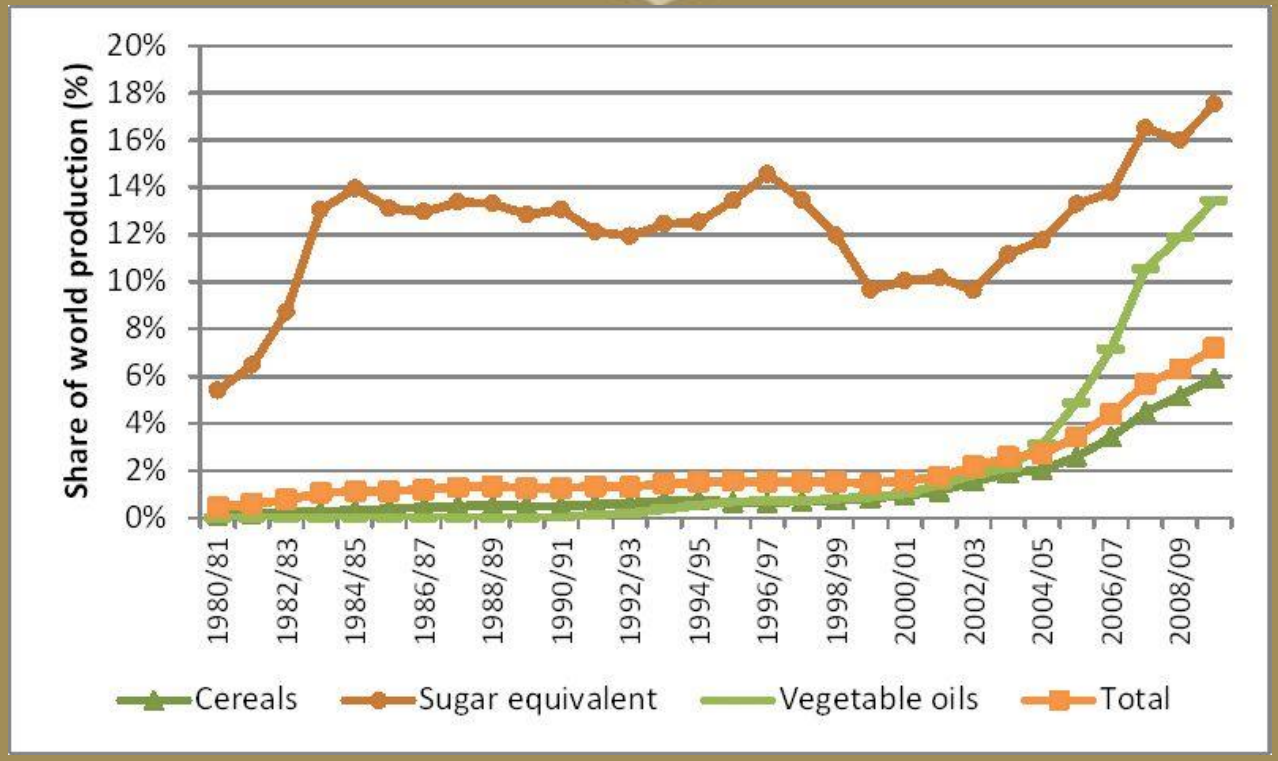
Population growth and the decrease of arable land



Source: FAO

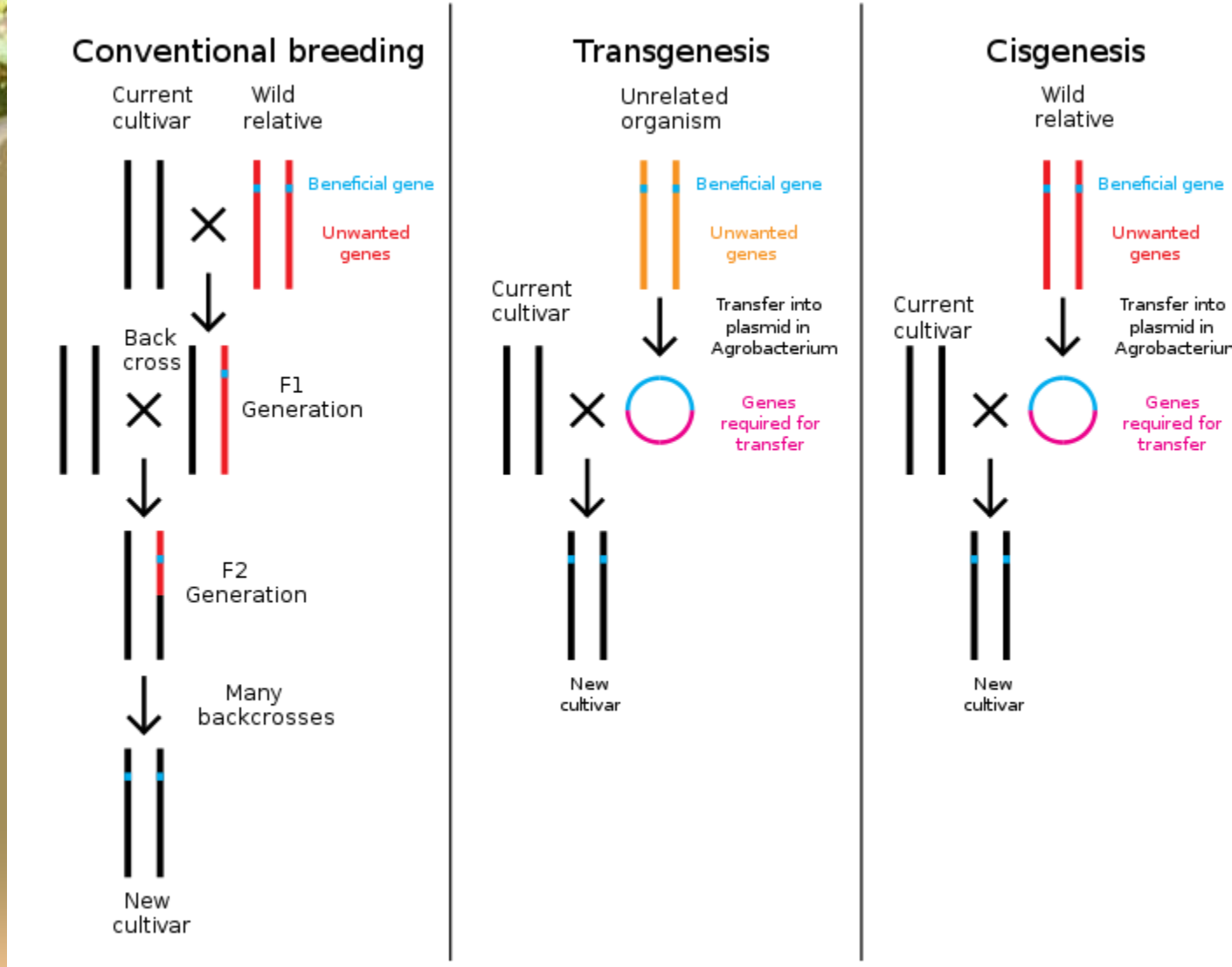
http://www.agro.basf.com/agr/AP-Internet/en/content/competences/health_and_nature/index

% agricultural production for bio-energy

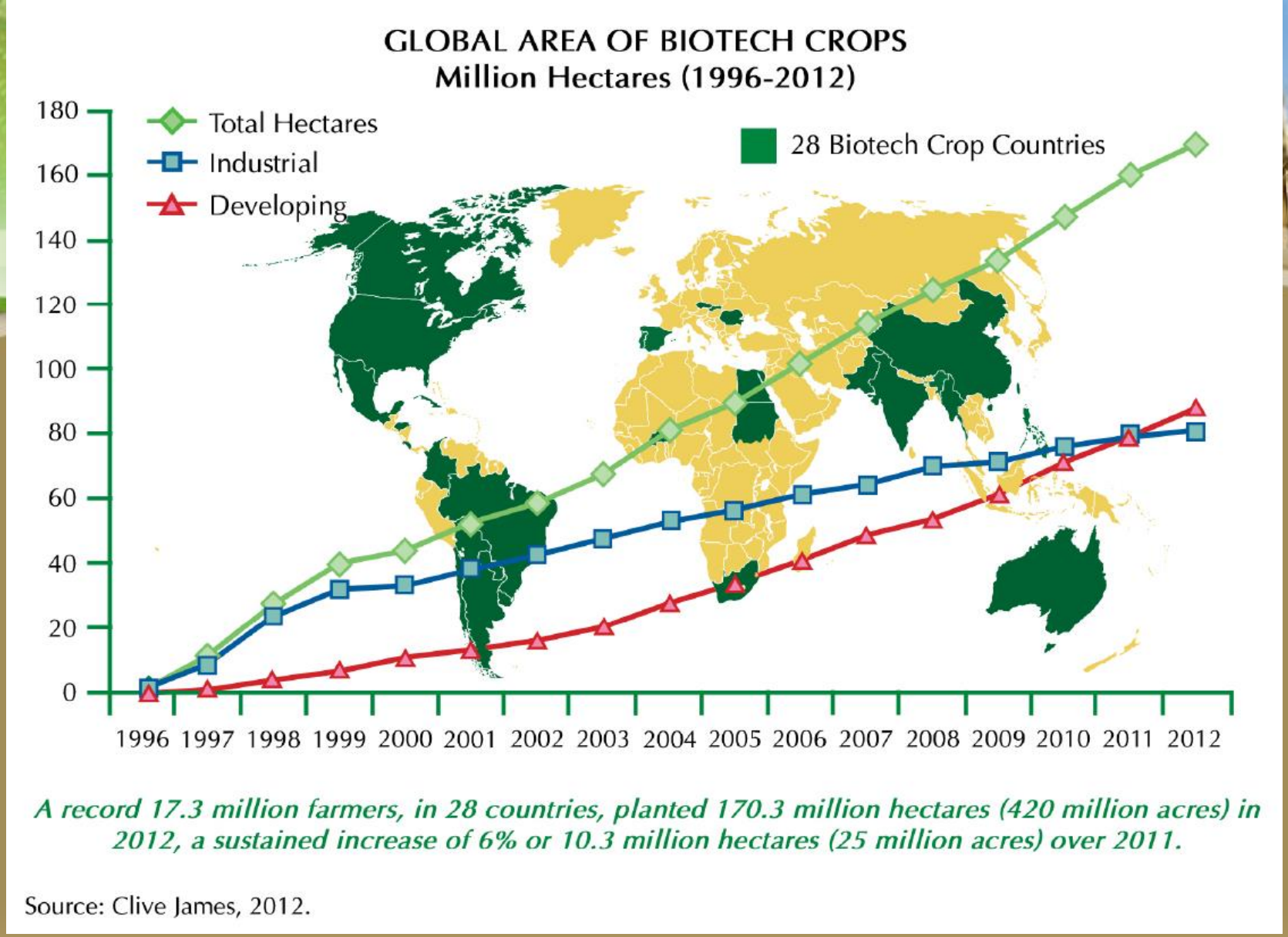


Shares of world production of cereals, vegetable oils and sugar plants (in sugar equivalent) used for biofuel production, 1980/81 to 2009/10; Source: INRA estimations from various sources

A chart demonstrating foreign gene insertion

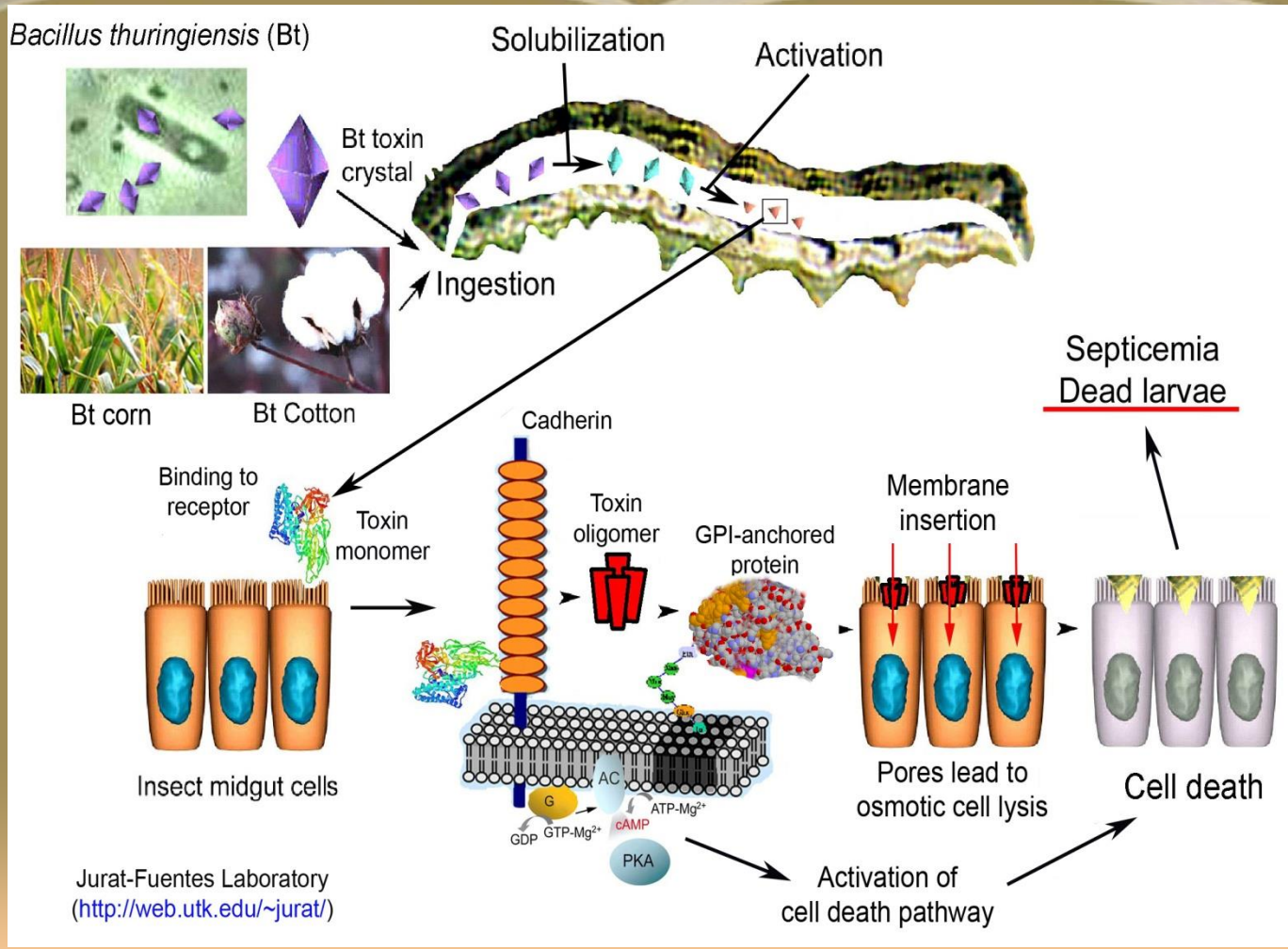


http://en.wikipedia.org/wiki/File:Breeding_transgenesis_cisgenesis.svg



Graphs showing the rate and a map showing the distribution of GM crops deployment

Cry toxins – mode of action



http://web.utk.edu/~jurat/Btresearchtable.html

Why are Cry toxins inactive on the vertebrates:

- They are activated in the digestive tract at alkaline pH but the stomach of vertebrates is very acidic and threfore destructive for the Cry toxins
- Cry protein bind to specific receptors that are absent in the digestive tract of vertebrates

Some people fear that the genetically modified crops may damage environment, in particular by reducing biodiversity. We have therefore launched a complex study exploring biodiversity in the plantations of the genetically modified maize and standard maize. Experiments were performed on large plots between 2003 and 2012.

Damage of maize by insects facilitates infection by Fusarium:

Cultivar MON 810

- Resitant to the European corn borer
- Released in EU in 1998

http://www.invasive.org

Cultivar MON 88017

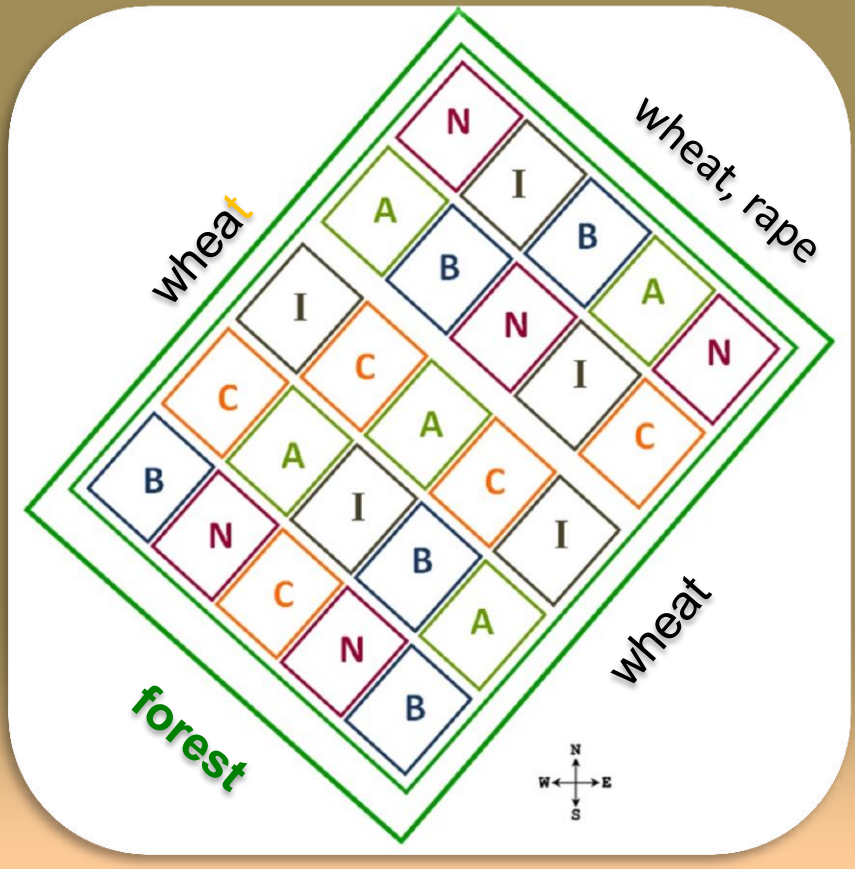
- Tolerant to glyphosate herbicides
- Rartly resistant to Western root worm *Diabrotica*
- Approved for commercial use in USA in 2005
- Authorized in EU as GM food and feed until October 2019

http://www.vodoley.dn.ua/eng

Experiment design

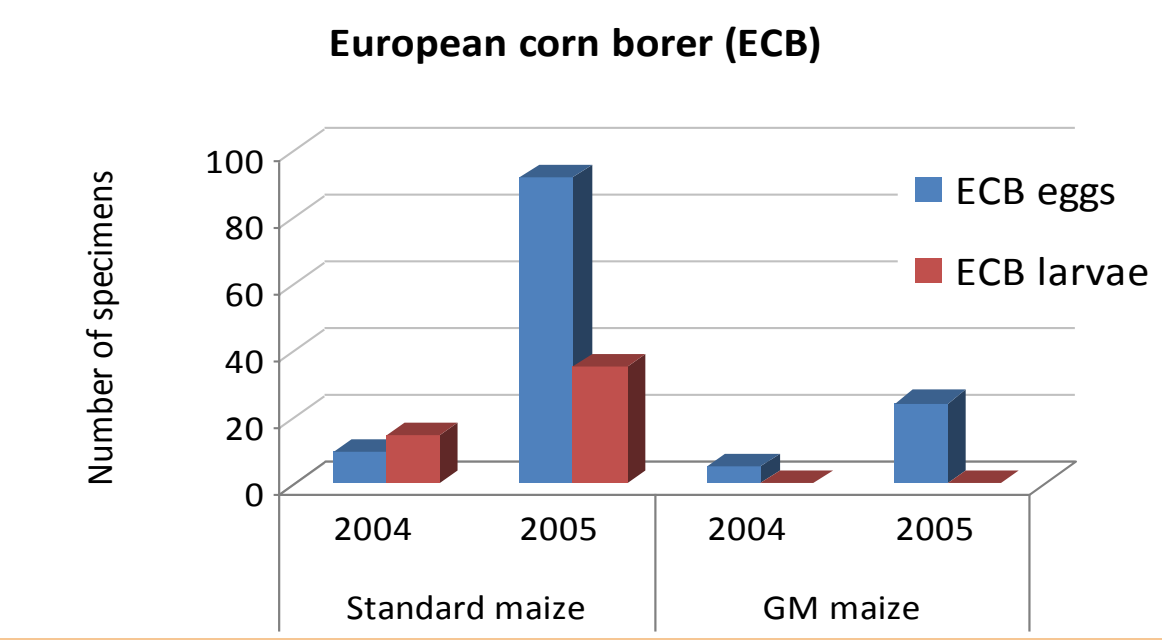
- 25 plots, 0.5 ha
- pre- and postemergence herbicides, fertilizers
- 1.year: shred in waxy stage and ploughed
- 2.,3. year: fermented in biogass station, the digestate was applied and ploughed

- **C**: MON 88017
- **N**: isogenic cultivar DK 315
- **I**: isogenic cultivar DK 315 treated with Dursban 10G .
- **A**: reference cultivar KIPOUS
- **B**: reference cultivar PR38N86

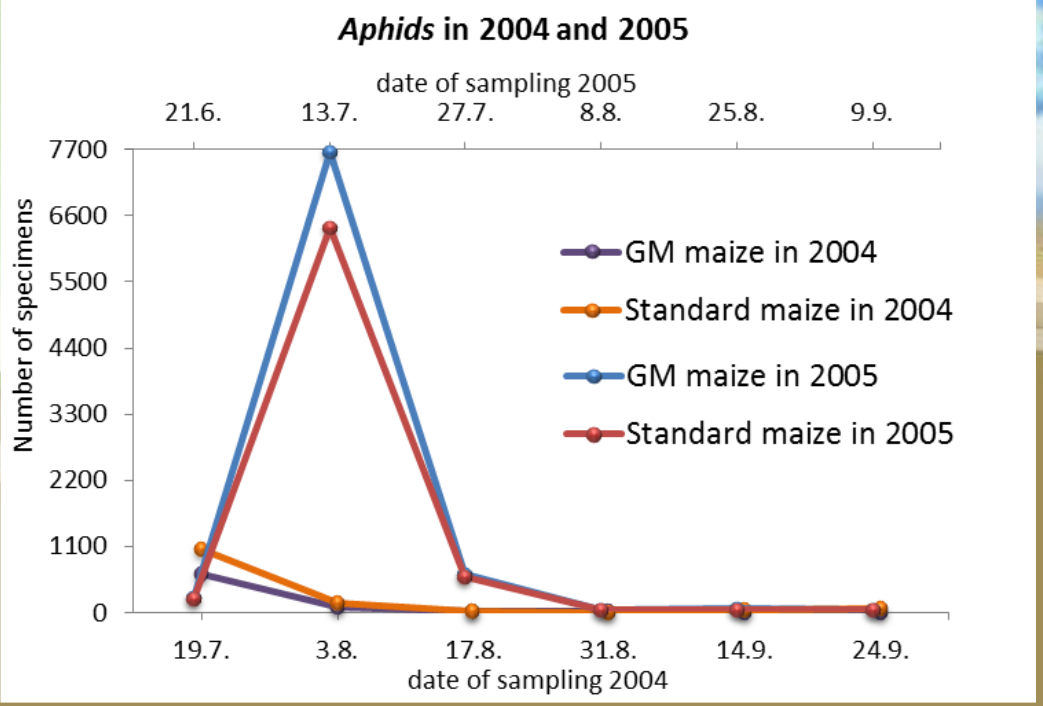


Effect of MON810 on *Ostrinia nubilalis*

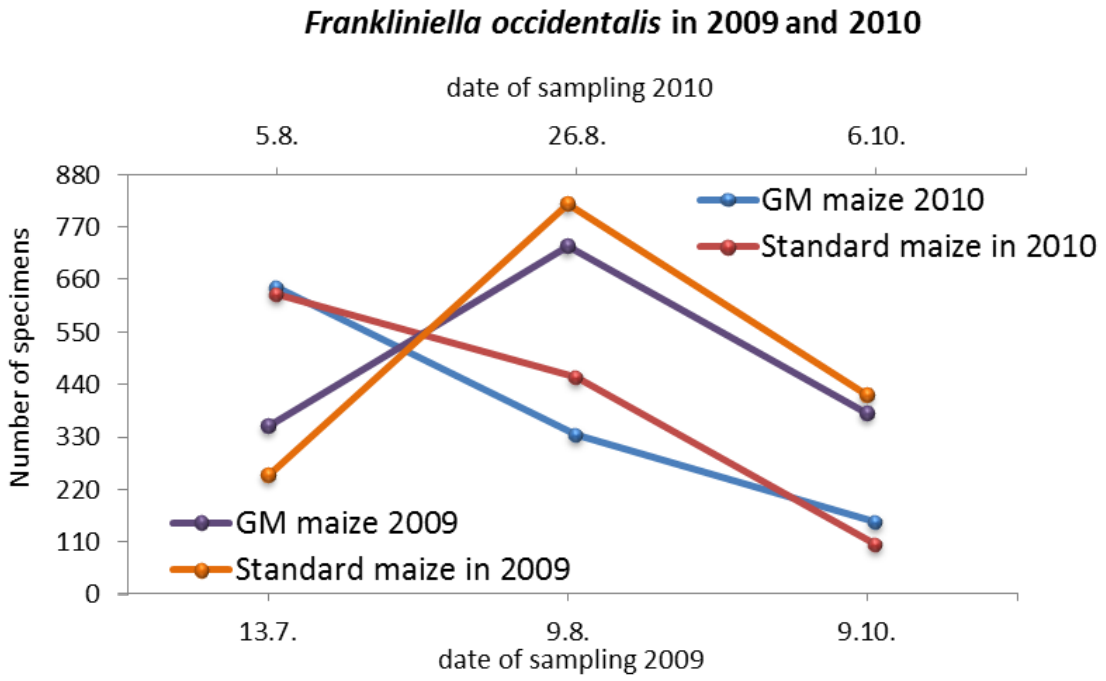
- 2003 – 2005, MON 810:
- eggs were laid on both maize types but the larvae survived (and caused damage) only in the non-GM cultivar

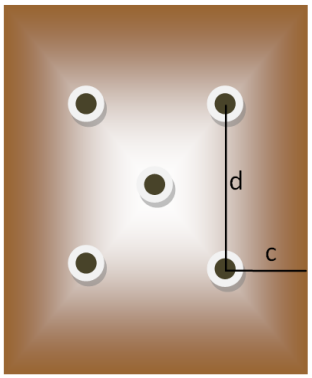


Example of the non-target insects on plants



Changes in the numbers of aphids and thrips, respectively, during the growing seasons of two successive years. Numbers of individuals per 50 plants in each data point are provided

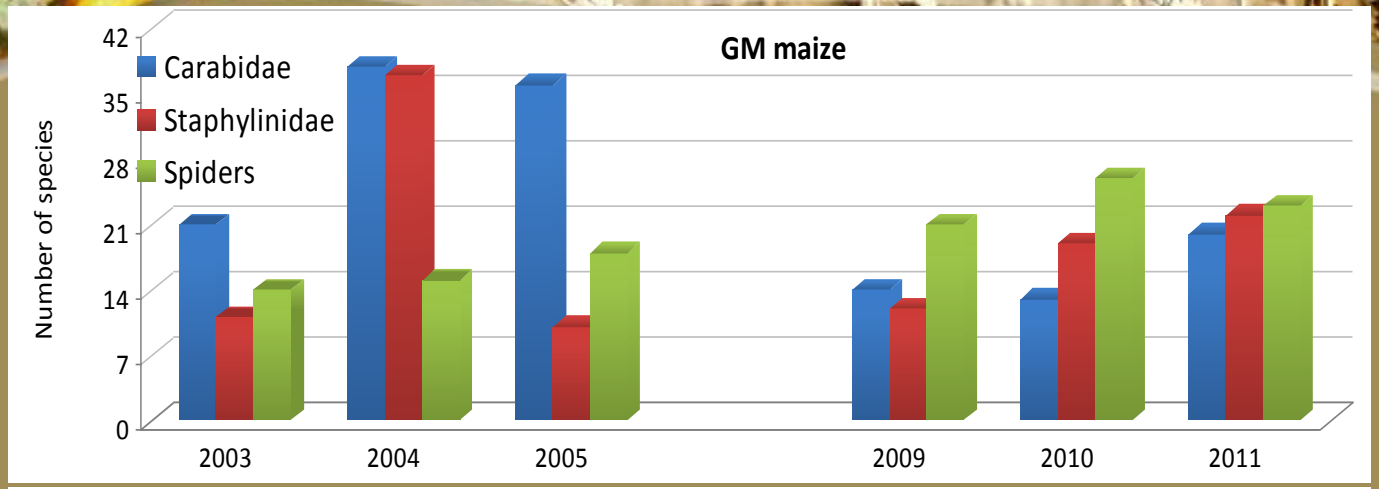


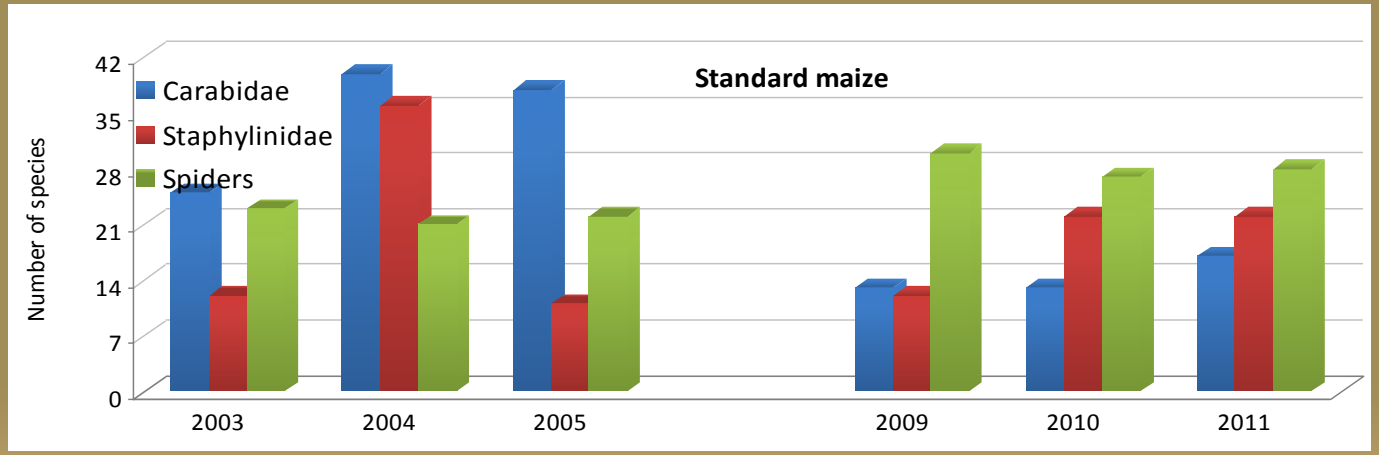


http://www.biolib.cz

Example of epigeic arthropods

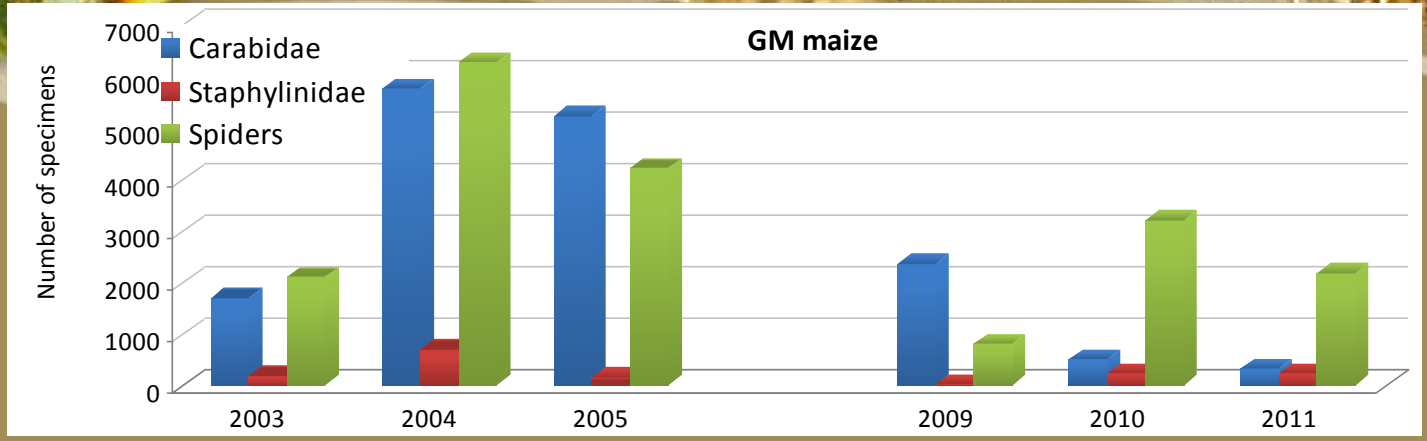
Example of their biodiversity

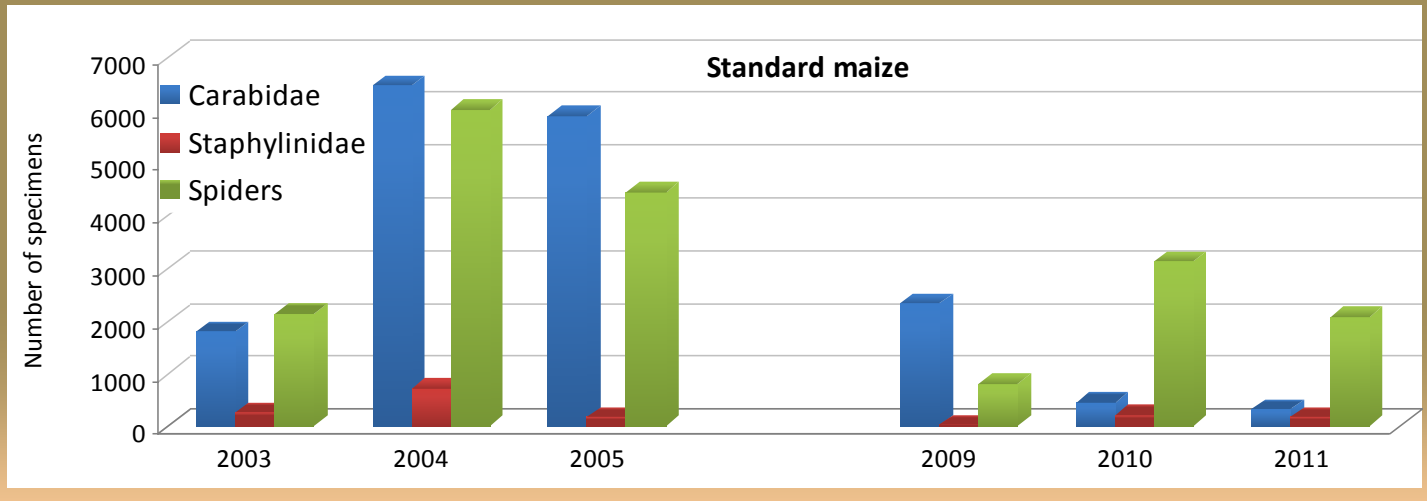




Numbers of ground beetle, rove beetles and spiders identified in annual collections. Five pitfall traps were exposed in 5 plots with each maize type five times per year, each time for 1-2 weeks.

Example of their abundance





Conclusion:
No impact of GM maize was detected on the biodiversity and abundance of the examined arthropods