

Understanding the Risks and Benefits of Genetically Modified Agricultural Products

Global information Needs BIGMAP Symposium

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Dr. Moisés Burachik
Biotechnology Office,
Secretariat of Agriculture, Livestock, Fisheries and Food,
Argentina

GM AGRICULTURAL PRODUCTS:

- **ENVIRONMENT**
- **HUMAN WELFARE**
- **TRADE**
- **REGULATION**

ENVIRONMENT

RISKS

- Undesired gene flow
- Weediness
- Development of Pest resistance
- Changes in plant phenotype and interactions with the environment
- Long-term effects

ENVIRONMENT

RISKS?

- Although there is no scientific evidence that these effects will happen, we can't rule out that they may occur
(at an international meeting, on "*long term effects on the environment*")
- There is no connection between the probability of something happening and the extent of the damages produced by its occurrence
(at an international meeting, on horizontal gene transfer)
- **Natural** Electrotransformation of Lightning-Competent... (a bacterial strain)... in **Artificial** Soil Microcosms
(title of a research paper, bold letters are ours)

ENVIRONMENT

Although indicated as risks,
harmful effects on the environment have not
been reported

REGULATIONS REVISITED?

ENVIRONMENT

BENEFITS

- Biodiversity conservation (selective agrochemicals)
- Less agrochemicals
- Less soil erosion (organic matter, structure)
- More efficient use of arable land
- More efficient use of water
- Less emission of greenhouse gases (no-till)

HUMAN WELFARE

RISKS

- Allergenic or toxic potential
- Levels of natural toxicants and anti-nutrient factors
- Antibiotic resistance marker genes entering the food chain

HUMAN WELFARE

RISKS?

- Food safety and company survival: the StarLink case
- Differential post-translational modifications. The case of the expression of bean α -amylase inhibitor-1 in peas (*J.Agric.Food Chem.*, **53**:9023-9030, 2005)

Lesson: Regulatory issues should be considered
EARLIER in the development!

HUMAN WELFARE

BENEFITS

- Nutritional improvement
- Functional improvement
- Less mycotoxin contamination in food

HUMAN WELFARE

BENEFITS

Other potential benefits (not yet in the pipeline)

- Toxicant suppression by gene silencing
- Allergens suppression
- Nutritional improvement
- Nutraceuticals

TRADE ISSUES

RISKS

EXTREME INTERPRETATION OF “PRECAUTION”:

- SPS AGREEMENT

In cases where relevant scientific evidence is insufficient, a Member may provisionally adopt sanitary or phytosanitary measures ***on the basis of available pertinent information, ...***” (Article 5.7)

- RIO DECLARATION (quoted in the Cartagena Protocol)

“... ***lack of full scientific certainty*** shall not be used as a reason for postponing ***cost-effective measures*** to prevent environmental degradation.” (Principle 15)

TRADE ISSUES

RISKS

EXTREME “PRECAUTION” LEADS TO:

- Restrictive “biopolitics” (EU 1998-2005 moratoria)
- Hidden agendas perturbing technical discussions
- Non-science based safeguards
- Unjustified labeling requirements (segregation, sampling rules, analytical methods, thresholds)
- Labeling: Consumers’ right to know vs. educated choice

TRADE ISSUES

RISKS

- Need for food safety assessment in situations of asymmetric approval of GM products
- Limited capacity for risk analysis (importer or exporter)
- Impacts on International Fora: IPPC, CBD, *Codex Alimentarius*

TRADE ISSUES

BENEFITS

- Higher yields, quality, availability (contribution to UN's Millennium poverty and hunger goals—*Only part of the solution!!*)
- New producers entering the market
- GM crops entering new markets (pharmaceuticals, industrial products)
- Higher value added to agricultural products

BENEFITS ARE COMPLEX TO ANALYZE

- Different views on values
- Complexity of Nature
- Broad social issues
- Longer timeframes (policy-dependent)

ALL OF THEM AFFECT GMO REGULATION

REGULATIONS– Inconsistencies (may turn into risks)

1. Regulate the product, not the method (1991, general recommendation):

The method for breeding, MAS and chimeroplasty is not regulated whereas the method for GM products is regulated

But:

Products from both technologies raise similar environmental concerns (e.g., imidazolinone-resistant canola, wheat, corn, sunflower; being imi an ALS inhibitor, it will quickly develop weed resistance)

REGULATIONS – Inconsistencies (may turn into risks)

2. Discrete vs Extensive modifications

GE: discrete modifications, high concern,
stringent regulations

Breeding: extensive modifications, no concern,
no regulations

REGULATIONS – Inconsistencies (may turn into risks)

3. Phenotype complexity

Genomic-guided GE modifications (regulated)
Breeding (not regulated)

However:

Similar goals (yield, plant morphology,
tolerance to stresses)

REGULATIONS – Drawbacks (may turn in to risks)

1. High cost (\$ 20m?): barrier to developing countries, public institutions, small companies
2. Delay in approval: Society does not benefit in time to save lives (golden rice) or to distribute these benefits (humanitarian food shipments to Zambia)
3. Efforts to build confidence: work in (very slow) progress!

THEREFORE...

Are current GMO regulations sensible?

Is there a need to change?

- In the beginning, GMO-regulation was sensible and precautionary
- The key argument was that technology led to “unpredictable and uncontrolled alterations of the genome”.
- After 25 years of experience, scientific progress, and data from biosafety research and deregulation, there is scientific consensus that technology does not, in principle, present a novel quality of risks.

*(From Ingo Potrykus,
about the delay in the approval of golden rice)*

- At present, public institutions and developing countries cannot use and harness the potential benefits of the technology to reduce the hunger and malnutrition of poor populations.
- Due to all that, millions of people – mostly children and women suffer from severe health problems or die.
- Regulation should prevent harm, not cause it.
Therefore, GMO-regulation must be adjusted to the present state of knowledge.

*(Modified, from Ingo Potrykus,
about the delay in the approval of golden rice)*

FINALLY...

“We must learn to operate within the bounds imposed by our understanding of nature, to accept that our calibration of biodiversity is imperfect, and, perhaps most importantly, to be very clear about how we employ such terms as ‘risk’, ‘harm’, ‘impact’ and ‘change’.”

Chairman’s Foreword to Advisory Commission on Releases to the Environment (UK)
1999 Annual Report

Quoted in: ALAN J. GRAY, “Ecology and government policies: the GM crop debate”.
Journal of Applied Ecology (2004) 41: 1–10, 12th British Ecological Society lecture.

THANK YOU