Understanding the Concept of Proportionality - Low Risk Activities and the Future of Biosafety Regulation

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Conflict and Disclosure

I have no actual or potential conflict of interest in relation to this presentation.

Disclosure Statement:
My participation in this conference is supported by USAID through the South Asia Biosafety Program
Introduction to the ILSI Research Foundation
  ◦ My background in risk assessment

The Concept of Proportionality
  ◦ Where does it come from and why is it important

What does our experience with biosafety of genetically modified organisms over the last 25 years tell us about low risk activities
  ◦ What might we consider low risk
  ◦ How does this inform biosafety

How can this be applied to future technologies
About US

As a non-profit, public charitable organization the ILSI Research Foundation collaborates with experts to respond to relevant issues that have a global impact through applied research, capacity building, education and outreach.

Our Work

All our programs are for public benefit and focus on contributing to long-term solutions. Our primary areas of activity include:

- Biosafety Capacity Building
- Environmental Risk Assessment
- Sustainable Nutrition Security
- Food and Feed Safety Assessment
Highlights from Around the World

In the past year, the ILSI Research Foundation’s work contributed to the following sustainable development goals (SDGs). Icons attached to each pin help signal how our work ties to the SDGs.

- **Zero Hunger**
- **Good Health and Well-Being**
- **Sustainable Cities and Communities**
- **Responsible Consumption and Production**
- **Climate Action**
- **Partnerships for the Goals**

This is only a sample of events for which the ILSI Research Foundation was either a co-organizer (org.) or delivered presentations (pres.).

In the past 12 months, our team engaged with an audience of **2000+ people in 15 countries** through meetings, presentations, seminars, conferences, workshops, and symposia. The ILSI Research Foundation website reached **21,700 users**.
A Little Bit About Me

Joined the ILSI Research Foundation in 2009
  ◦ Spent the last decade studying risk assessment
    ◦ Both as an academic discipline, as well as a practiced art.

Previously worked at the U.S. Department of Agriculture
  ◦ Regulation of GE plants
  ◦ International affairs (related to the regulation of GE Plants)

My academic discipline is cell and developmental biology
  ◦ Molecular biology and genetics
What Do We Mean By Proportionality?

Proportional: “corresponding in size, degree, or intensity”
- Merriam Webster Online Dictionary

This is a common-sense concept that is applied to a great many things
- We want to spend our time and energy dealing with things that are important rather than things that are trivial
- Our responses should correspond to the need
“Don’t worry about the gnats in your office…”

“While the elephants are running loose in the halls.”
Proportionality in International Context

The WTO has addressed the concept of proportionality

- In both the Sanitary and Phytosanitary (SPS) agreement and the Technical Barriers to Trade (TBT) agreement

In short, the idea is that your risk prevention and risk mitigation measures need to be proportionate to the potential risk you are trying to prevent

Precaution is fine, but your requirements need to be proportionate to risks
What Does Experience Teach Us?

What is our experience?

- We started conducting field trials with GE plants in the mid 1980s
- The first approvals and commercial plantings took place in the 1990s

We have accumulated a substantial amount of knowledge related the use of GE plants and their interactions with the environment

- This means we can look at the evidence to see what the potential sources of risk might be
- And identify activities and/or characteristics of GE plants that are likely to pose low risk
The “classical” risk equation

\[
\text{Risk} = \text{Hazard} \times \text{Exposure}
\]

There are other ways of expressing this, but the fundamental truth remains the same:

- If Exposure is very low or zero, then there can be no risk
- If Hazard is extremely minor or non-existent there can be no risk

So, low risk activities can be readily defined as those activities where either the hazard or the exposure (or both) is known to be very low or non-existent based on our experience
A Note: Biosafety Risk

Since there is often conflation of a number of social and political issues surrounding GE organisms and new technologies in general, it should be clear that for this presentation I am considering Biosafety “Risks” here mean possibility of defined harms to human or animal health, or harms to the environment or biodiversity caused by the GE organism itself.

- I’m not addressing social, economic, or aesthetic values

Biosafety is distinct from other considerations

- That doesn’t mean that it is the only basis for decision making
Low Risk Activities: Laboratory Research

Laboratory research with GE organisms
  ◦ No harms to the environment or human health have ever been associated with laboratory research or development of GE organisms in laboratories
  ◦ This makes sense given what we know about plants and about laboratories

Unless the parent organism poses some known risk, risk assessment and review of laboratory research adds little value for protection of the environment or human health
Low Risk Activities: Field Trials

Harm to the Environment or Human Health has never been observed as a result of a field trial.

Loss of confinement has been observed – occasionally leading to regulatory or trade problems.

- But this is a result of failure of procedure not failure of risk assessment.
- And it isn’t harm to the environment or human health.
Low Risk Activities: Import of Material for Food, Feed or Processing

For agricultural products, no harm to the environment has resulted from imports for use in food, feed or processing

- Although these activities do sometimes lead to the unwanted presence of GE plants in the environment, this presence is transient and has not been harmful
- A LOT of study has looked at this
Are concerns about feral genetically modified herbicide tolerant oilseeds resulting from seed import spills scientifically justified?

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Abstract: One of the concerns surrounding the import (for food and feed uses or processing) of genetically modified herbicide tolerant oilseed rape (GMH10 SMOR) is that, through seed spillage, the herbicide tolerant (HT) trait will escape into agricultural or semi-natural habitats, leading to environmental or economic problems. Whether the concerns posed by feral GMH10 SMOR from seed import spills are scientifically justified is debatable. While ORs show characteristics such as secondarily dormancy and small seed size that enable it to persist and be reestablished in the landscape, the presence of ORs is not in itself an environmental or economic problem. Criciferous ORs, however, can become invasive outside cultivated and ruderal habitats, and HT traits are not likely to result in increased invasiveness. Feral GMH10 ORs has the potential to introduce HT traits to volunteer weeds in agricultural fields, but would only be amplified if the herbicides to which HT volunteers are tolerant were used extensively in the field. This worst-case scenario is most unlikely, as seed import spills are mostly confined to port areas. Economic concerns revolve around the potential for feral GMH10 ORs to contribute to GMO admixtures in non-GM crops. Since feral plants derived from cultivation (distinct from import) occur at too low a frequency to affect the coexistence tolerance threshold of 0.99% in the EU, it can be concluded that feral GMH10 ORs resulting from seed import spills will have little relevance to potential or seed GMO admixtures. This paper concludes that feral ORS in Europe should not be routinely managed, and certainly not in semi-natural habitats, as the benefits of such action would not outweigh the negative affects of management.

Key words: Coexistence, fertility, genetically modified oilseed rape, herbicide tolerant, introgression, invasive, persistence, seed spillage

Introduction

The potential environmental and economic concerns of genetically modified (GM) herbicide tolerant oilseeds andclease (GMH10 SMOT) have become particularly contentious in the context of the evaluation of market approval applications in the EU. Some EU Member States contend that GMH10 ORS, imported for food and feed uses or processing, will escape and persist outside agricultural fields as feral plants and thereby mediate transgene movement among sexually compatible plants in the landscape. Herbicide tolerance (HT) traits may cause

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Environmental risk assessment of GE plants under low-exposure conditions

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As a result of extensive study, Japan is waiving local field trial requirements for GE grain imported for food, feed or processing.

- For familiar crops with familiar traits

The effort being put into collecting data was not adding value.

- And was *disproportionate* to the risk
When risk assessment for GE organisms was first proposed, a variety of sources of hazards were envisioned:

- The introduced trait/novel proteins or substances
  - Introduced genetic material
    - Interactions with viruses
    - The transformation process*
      - Unintended genomic effects
    - Horizontal gene transfer
  - Unanticipated unintended effects
    - Usually dealt with through monitoring
Unlikely Hazards: Introduced Genetic Material

A lot of early risk assessment literature includes a disproportionate focus on the interaction of genetic material with pathogens
  ◦ i.e. viral recombination

While the phenomenon is possible, it’s unlikely to produce harm
Unlikely Hazards: Unintended Genomic Effects

We know that unintended genomic effects DO occur during Genetic Engineering

- But the types and numbers of unintended effects are less than those associated with traditional breeding methods

These molecular phenomenon are unlikely to produce meaningful changes that result in risk

- Our history with traditional breeding provides ample evidence of this
Unlikely Hazards: Unintended Genomic Effects

This is probably the largest source of uninformative data collected for risk assessments

- Thousands of pages of molecular characterization can be included in a dossier

Molecular characterization tells you what organism you have

- But these detailed analyses of genomes have no relation to risk
Unlikely Hazards: Horizontal Gene Transfer

Horizontal gene transfer takes place between bacteria with meaningful frequency

- But not between higher organisms

In order to produce a meaningful hazard, the gene transfer would need to affect an organism in a way which leads to harm to the environment or human health.
There are several memorable historical examples of unanticipated risks

- Environmental chemicals
- Medicines/side effects

But risk assessments for GE plants have proven remarkably accurate

- The plants have behaved as predicted by risk assessments
Familiarity Makes Assessments Reliable

GE plants to this point have been species with which there is a high degree of familiarity
  - Intended for uses where we have a high degree of experience

Our ability to predict potential harms and assess them is high

Organisms and activities that are familiar are relatively easy to assess
What Does All of This Mean?

Low Risk Activities can be identified as those where

- Exposure is known to be low
- Hazards are known to be low
- Where you have some familiarity with the organism and its use

Measure you take should be proportionate to risks

- Low risk activities don’t need to be subject to lengthy regulatory reviews
- Extensive new data collection is unlikely to provide additional value for assessment and management of low risk activities
  - But it will cost a lot of money and waste a lot of time
Managing Low Risk Activities

Risk Assessment or case specific regulatory review may not provide much value for activities/organisms that you know are low risk.

Management through **Performance Standards** may be more appropriate and proportionate to the risk:

- Performance Standards include things like guidance for laboratory work to prevent unwanted environmental release or requirements for containers or labeling.

You don’t want to spend a lot of time and energy reviewing low risk applications:

- It’s bad regulatory practice, and keeps you from devoting time, energy and resources to things that require more attention.
Thank You!

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