Les plantes transgéniques rendent-elles sourd ?

Solution d'avenir ou technologie à risque

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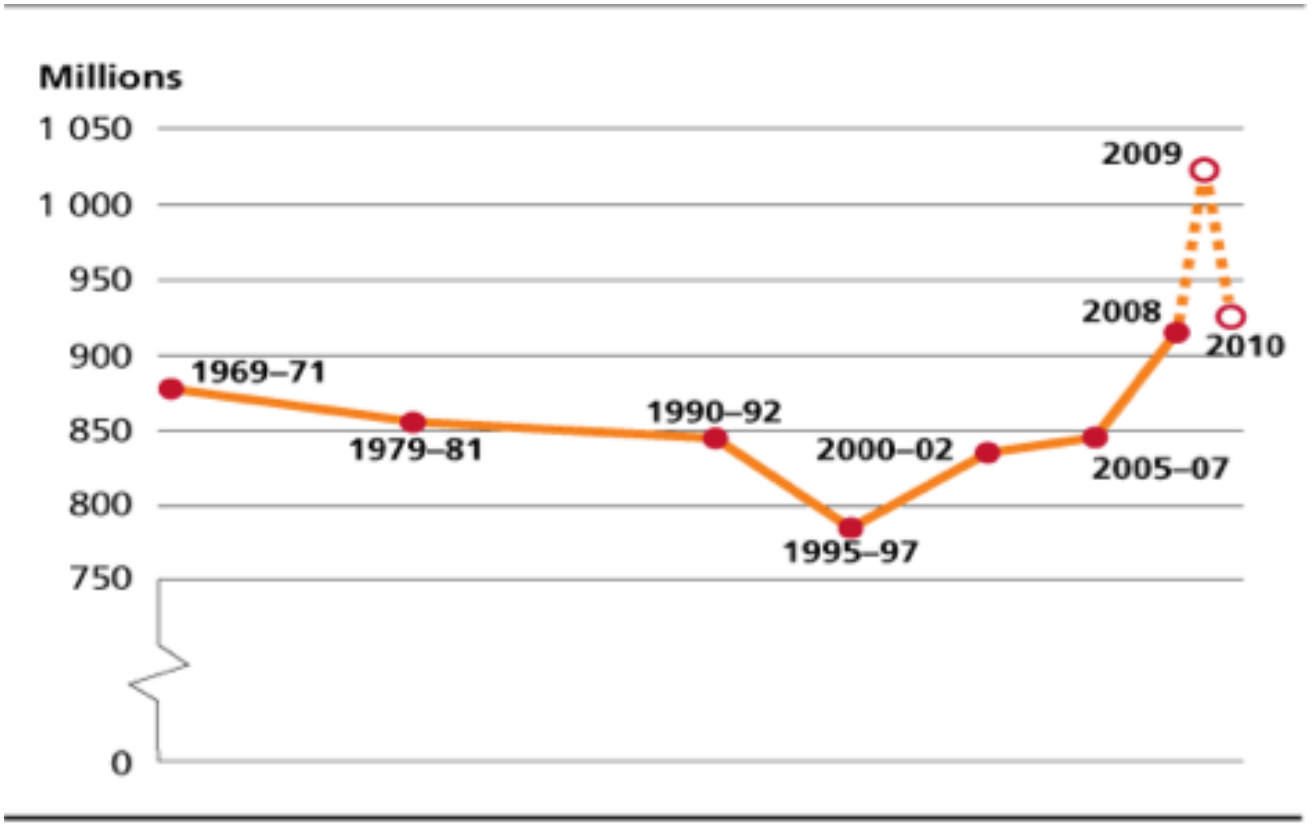
L’agriculture du XXIeme siècle relèvera de nouveaux défis

- Faim
- Ressource
- Inéquité
- Climat

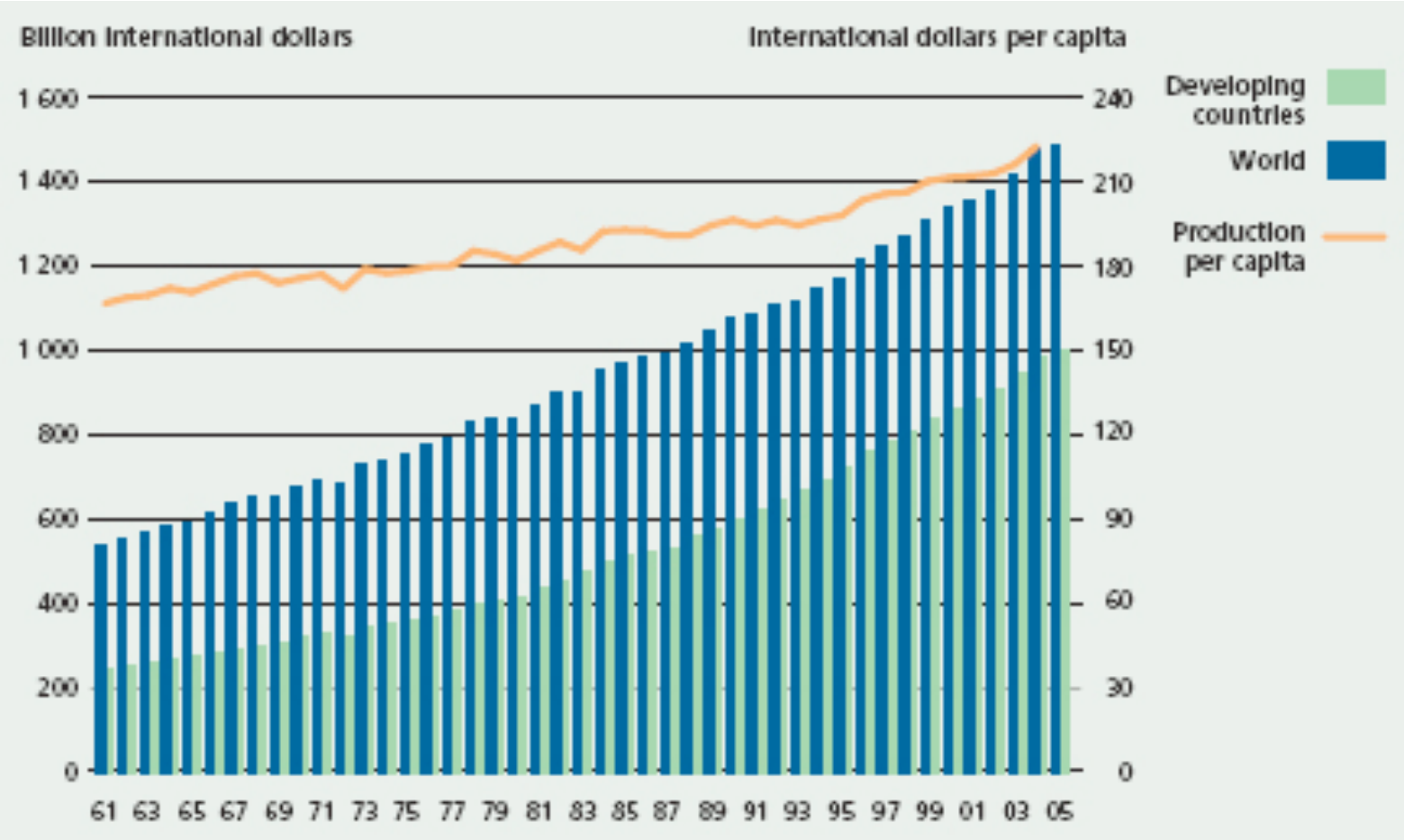
Le nombre de personnes qui ont faim augmente



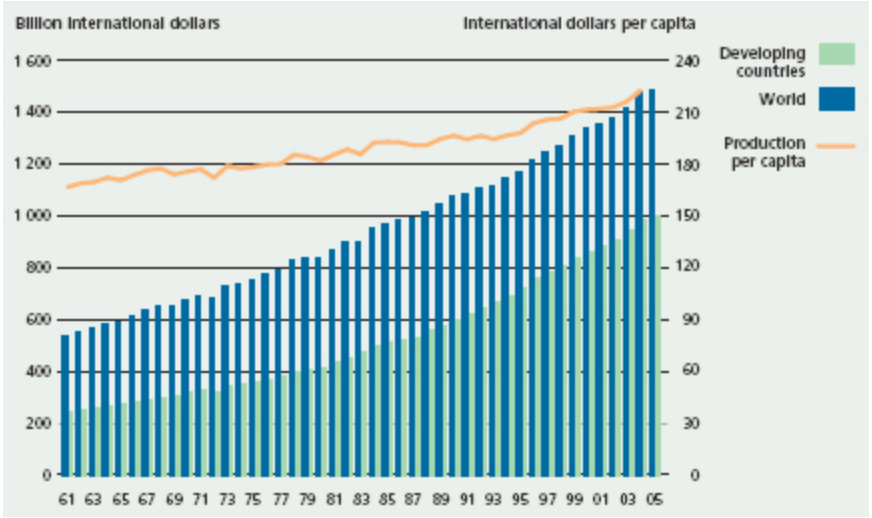
Note: Figures for 2009 and 2010 are estimated by FAO with input from the United States Department of Agriculture, Economic Research Service. Full details of the methodology are provided in the technical background notes (available at www.fao.org/publication/sofi/en/).

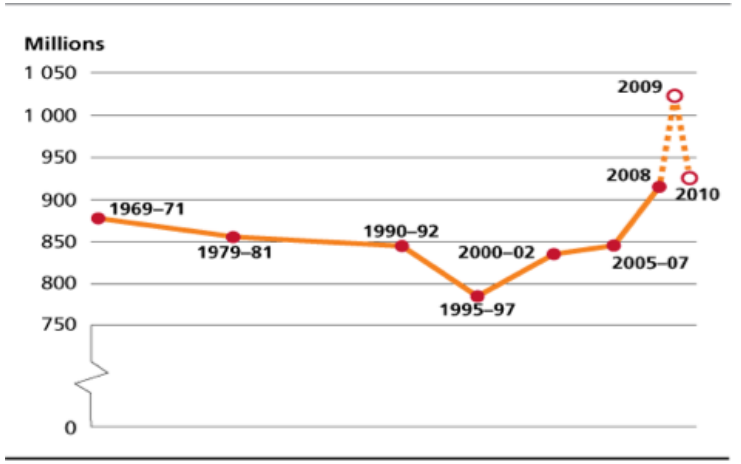
Source: FAO.

La production augmente de façon linéaire et constante



La production augmente de façon linéaire et constante

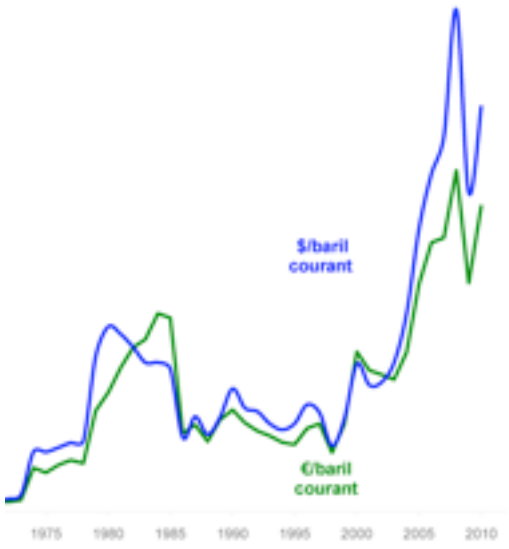


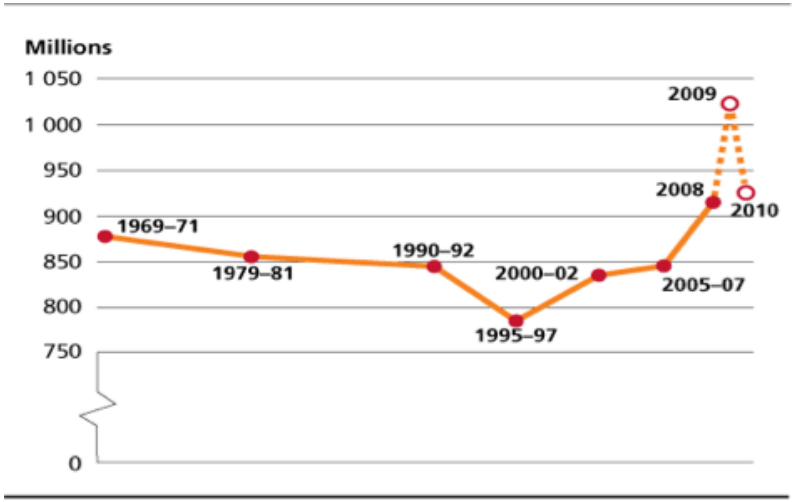


Note: Figures for 2009 and 2010 are estimated by FAO with input from the United States Department of Agriculture, Economic Research Service. Full details of the methodology are provided in the technical background notes (available at www.fao.org/publication/sofi/en/).

Source: FAO.

La courbe de la faim suite celle des prix du pétrole





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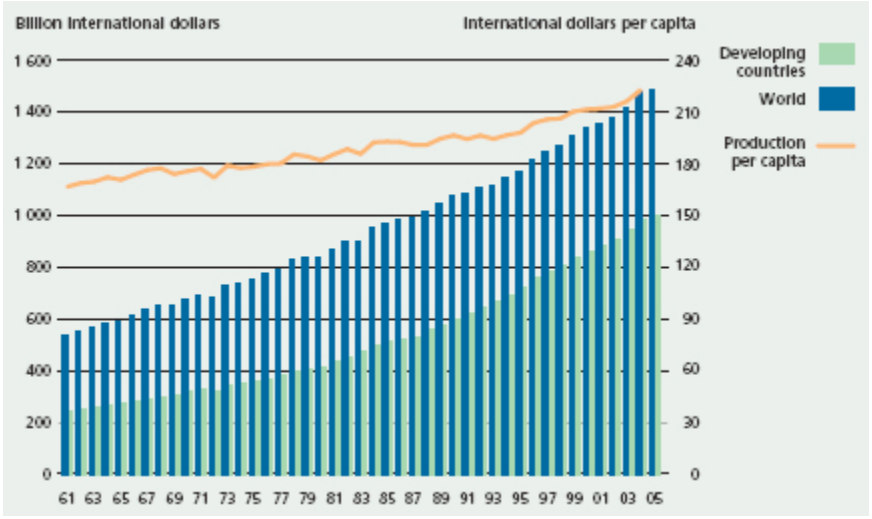
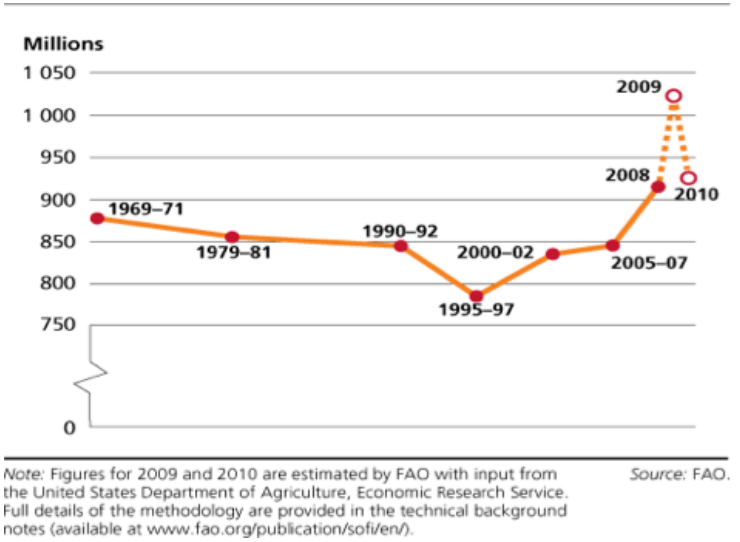
Source: FAO.

La production augmente de façon linéaire et constante

- **Concurrence entre food et non food via les agrocarburants**
- **L'agriculture industrielle est énergivore**
- **Spéculation**





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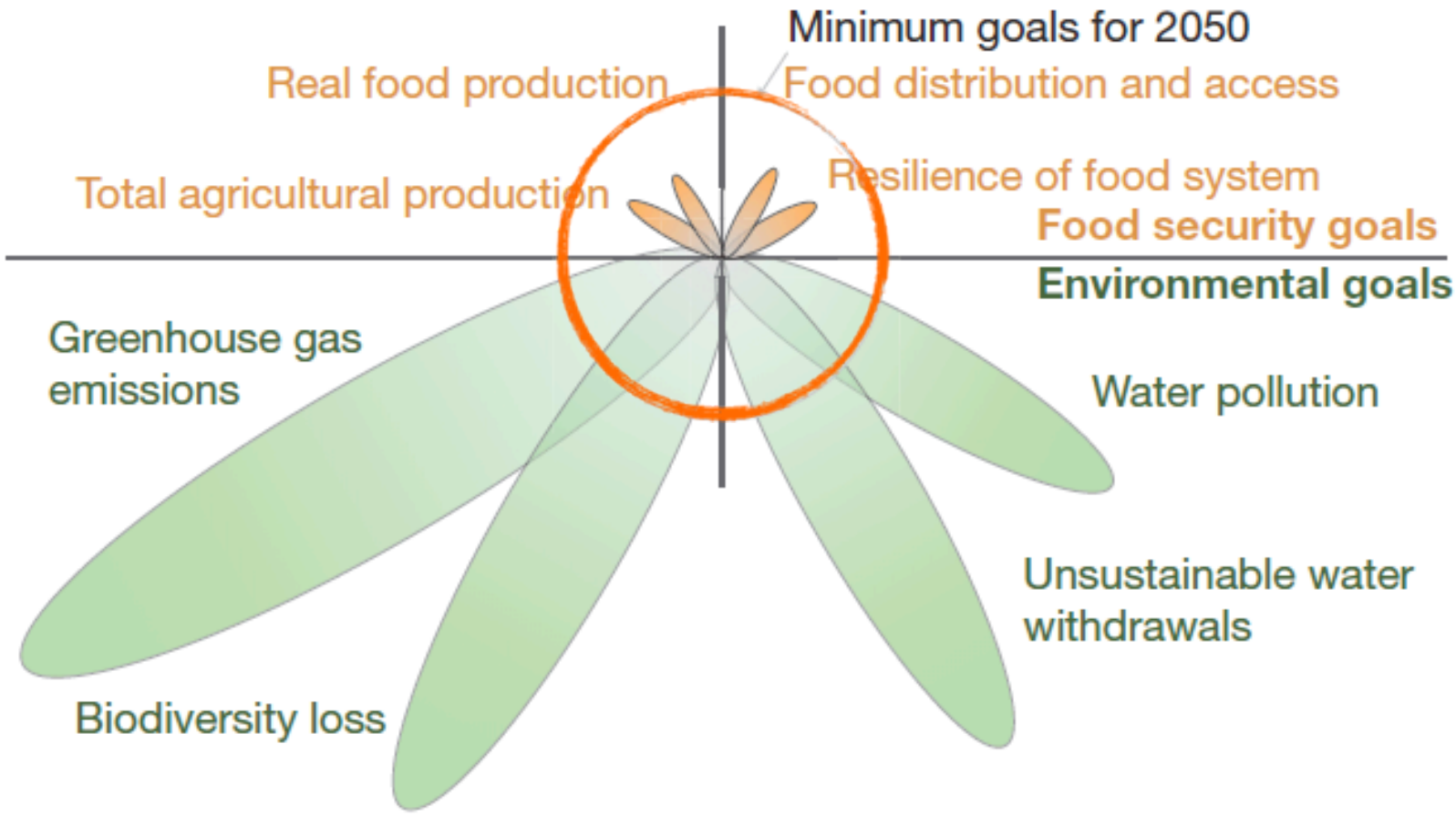
Source: FAO.

Agriculture faces major challenges



New century, new challenges

The New Green Revolution:
How Twenty-First-Century Science Can Feed the World

by Olivier De Schutter and Gaëtan Vanloqueren

UN Photo/Eric Kanalstein

A farmer gathers wheat in Bamiyan, Afghanistan.

"Our strategy today must recognize the connection between climate change and food security. It must leverage the potential of the new sustainable agriculture paradigm (…)"

Cette agriculture a besoin d'innovation

- **Cahier des charges**

  1. Nourrir neuf milliards d'êtres humains

  2. Respecter les contraintes du système Terre

  - **diminuer les consommations**
  - **vivre sur les intérêts de la biosphère et non sur le capital**

  3. Réduire les inégalités

Les plantes transgéniques actuelles ne répondent pas à ce cahier des charges

Table 1. Global Area of Biotech Crops in 2011: by Country (Million Hectares)**

Rank	Country	Area (million hectares)	Biotech Crops
1	USA*	69.0	Maize, soybean, cotton, canola, sugarbeet, alfalfa, papaya, squash
2	Brazil*	30.3	Soybean, maize, cotton
3	Argentina*	23.7	Soybean, maize, cotton
4	India*	10.6	Cotton
5	Canada*	10.4	Canola, maize, soybean, sugarbeet
6	China*	3.9	Cotton, papaya, poplar, tomato, sweet pepper
7	Paraguay*	2.8	Soybean
8	Pakistan *	2.6	Cotton
9	South Africa*	2.3	Maize, soybean, cotton
10	Uruguay*	1.3	Soybean, maize
11	Bolivia*	0.9	Soybean
12	Australia*	0.7	Cotton, canola
13	Philippines*	0.6	Maize
14	Myanmar*	0.3	Cotton
15	Burkina Faso*	0.3	Cotton

Les plantes transgéniques actuelles sont uniquement évaluées sur les risques

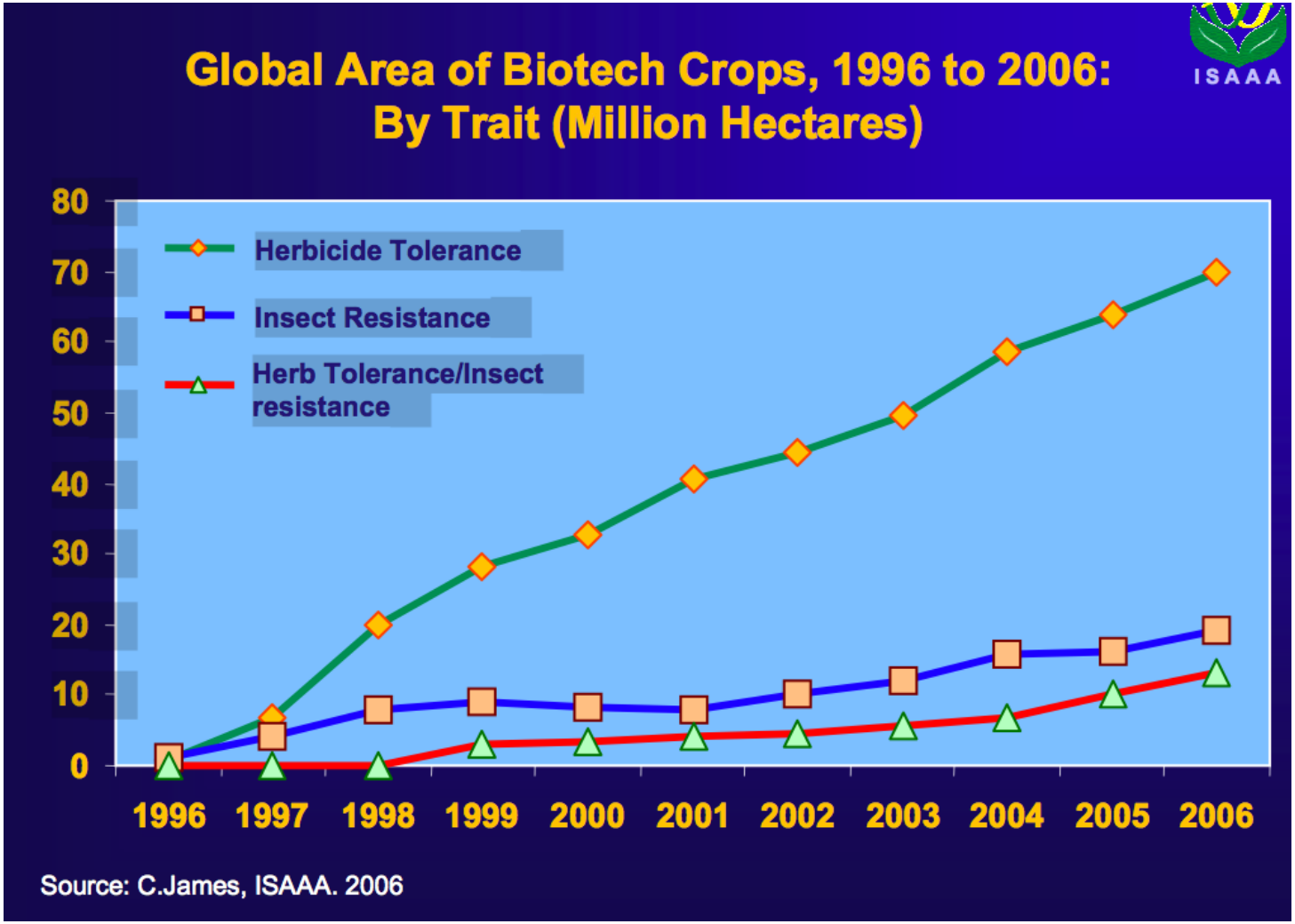
- **Risques pour la santé**
  - toxicité et allergie
  - des risques classiques
  - un débat nourrit par une vision du vivant

- **Risques pour l'environnement**
  - déséquilibre écologique et menace pour la biodiversité
  - des risques aux propriétés nouvelles
  - difficiles à mesurer
  - un débat sur l'importance du risque

Les plantes transgéniques ne sont pas un bien public

- **La pertinence est définie par le marché**
- **Les plantes transgéniques sont un produit industriel couvert par des brevets**
- **Le risque est à charge de la société**

Leur pertinence est définie par le marché

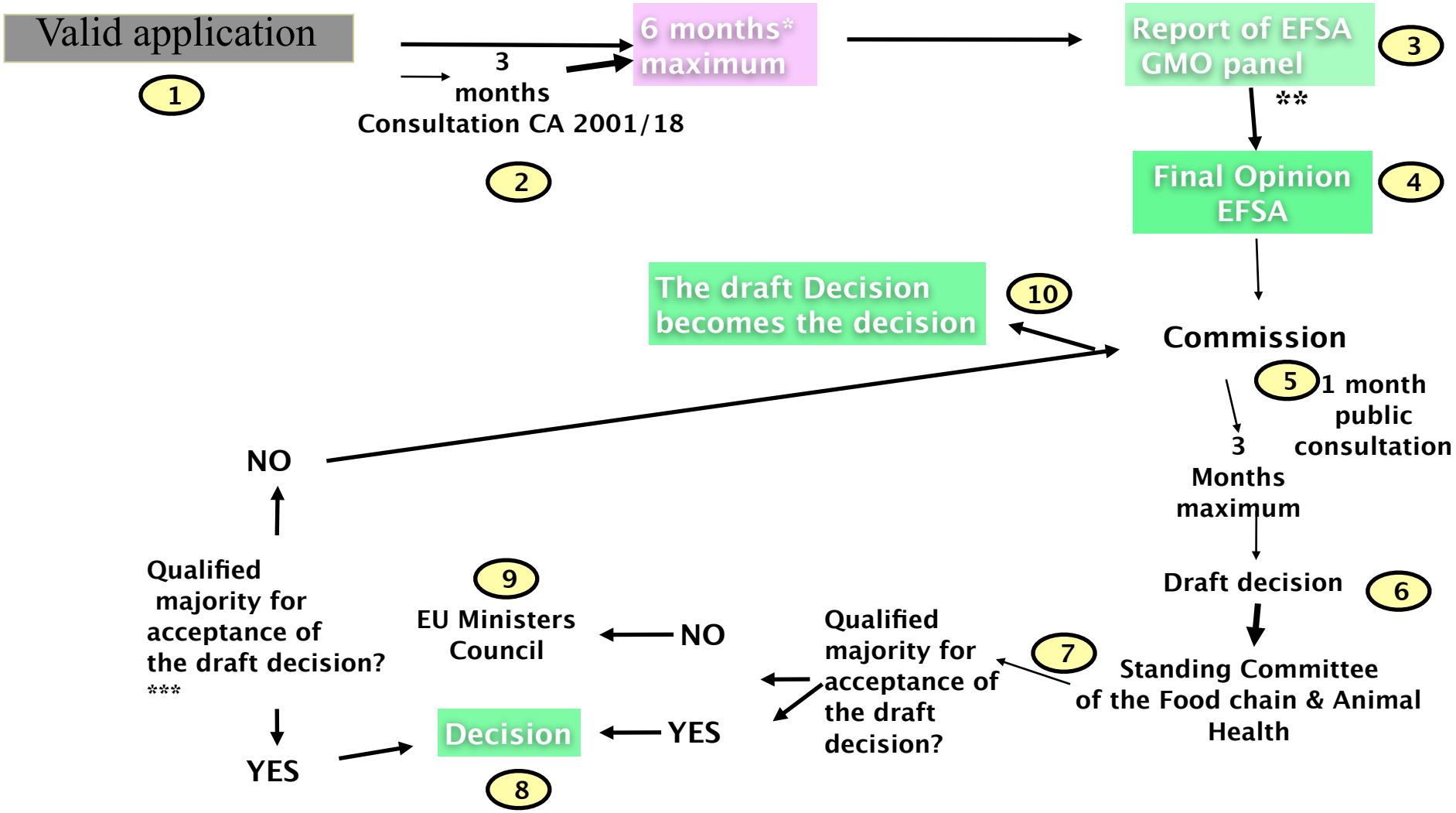


Food or chemicals

Chemical	Food
Material usually simple, chemically precise substance	Complex mixture of many compounds
Highest dose level should produce an effect	Effects improbable at the maximum dose level that can be incorporated in the diet for the test species
Small dose (usually less than 1% of diet)	High intake (usually greater than 10%)
Easy to give excessive dose	Intakes above those normally present in the diet difficult
Acute effects obvious	Acute effects difficult to produce (usually absent)
Generally independent of nutrition	Nutrition dependent
Specific route of metabolism simple to follow	Complex metabolism
Cause/effect relatively clear	Cause/effect, if observed at all, may be confused

Table 1: Differences Between Chemical and Food Toxicity Evaluation, based on a paper by Dr P J Rodgers [1].

Les risques qu'elles présentent sont peu ou mal évalués



* Clock stop when request for additional info

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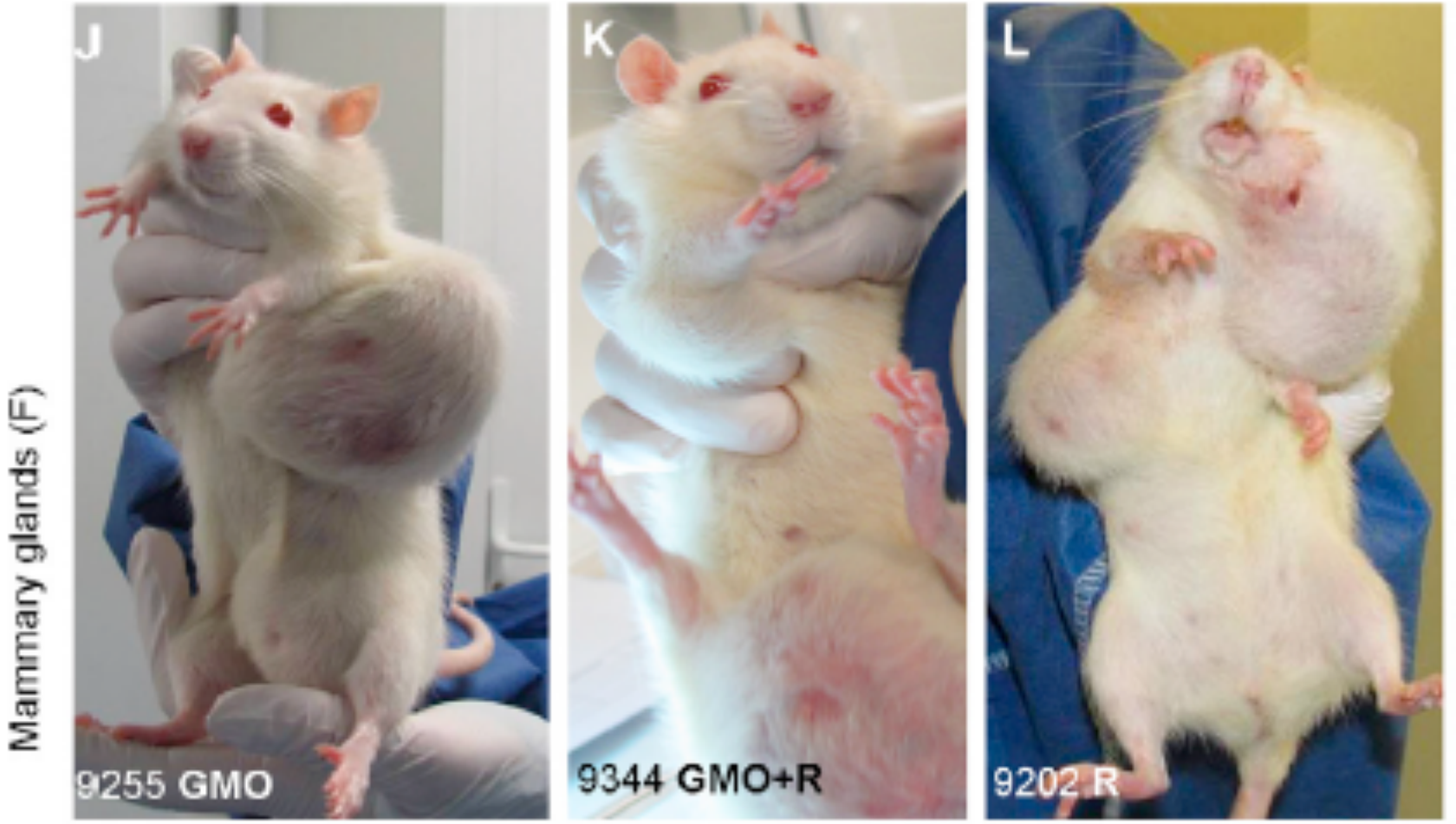
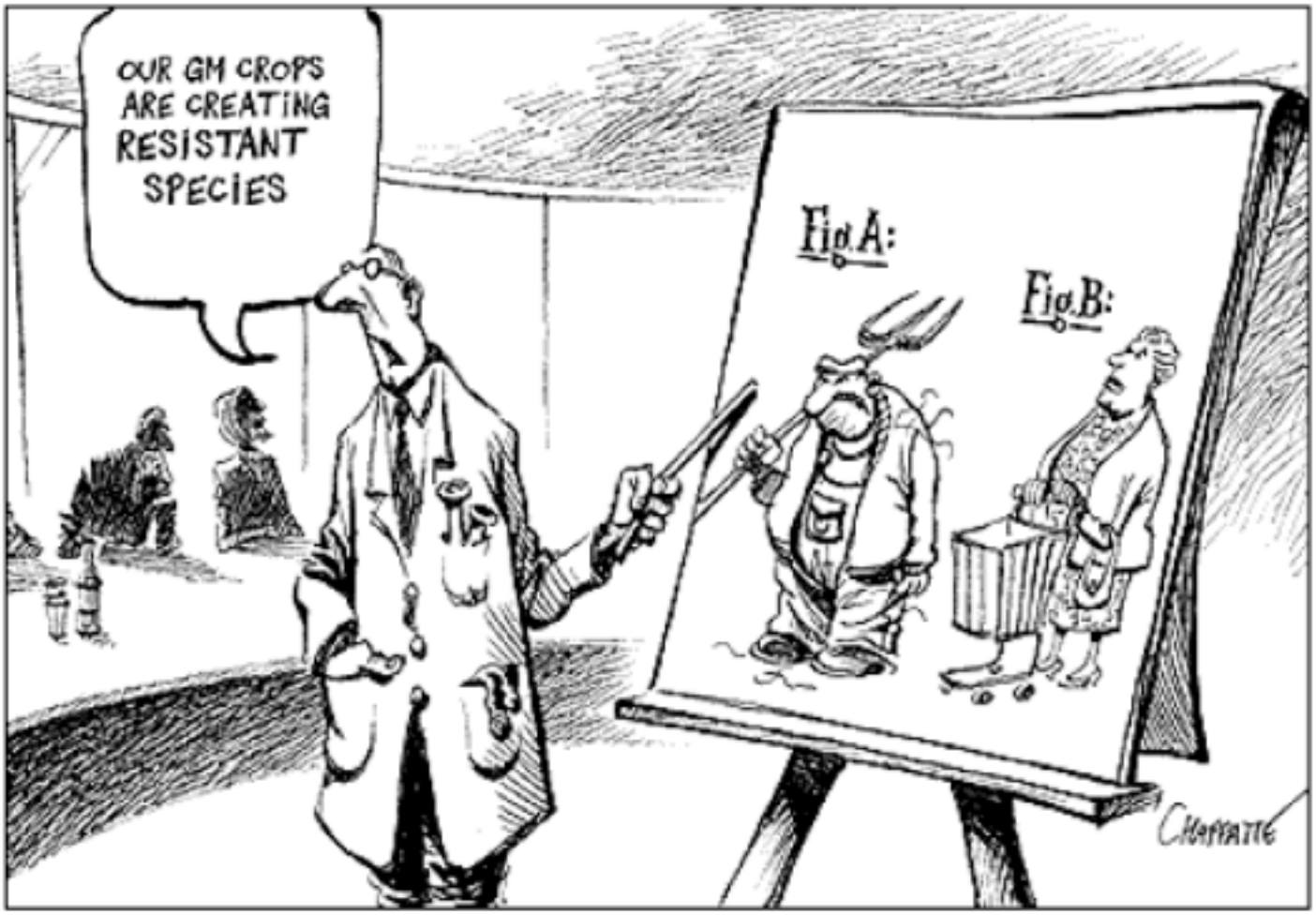


Comparer !

Table 1
Protocol used and comparison to existing assessment, and to non-mandatory regulatory tests.

Treatments and analyses	In this work	Hammond et al., 2004
Treatments + controls	GMO NK603, GMO NK603 + Roundup, Roundup, and closest isogenic maize	GMO NK603 + Roundup, closest isog maize, and six other maize lines non substantially equivalent
Doses by treatment	3	2
Duration in months	24 (chronic)	3 (subchronic: 13 weeks)
Animals measured/group/sex	10/10 SD rats (200 rats measured)	10/20 SD rats (200 rats measured/to 400)
Animals by cage (same sex)	1–2	1
Monitoring/week	2	1
Feed and water consumptions	Measured	For feed only
Organs and tissues studied		
Histology/animal	34	17/36
Organs weighted	10	7
Electronic microscopy	Yes	No
Behavioral studies (times)	2	1 (no protocol given)
Ophtalmology (times)	2	0
Number of blood samples/ animal	11, each month (0–3) then every 3 months	2, weeks 4 and 13
Blood parameters	31 (11 times for most)	31 (2 times)
Plasma sex steroids	Testosterone, estradiol	No
Liver tissue parameters	6	0
Number of urine samples	11	2
Urine parameters studied	16	18

Processus d'apprentissage ?



Où en est-on ?

- **Consensus sur l'innocuité**
  - Utilisation massive au Etats-Unis
  - Equivalence en substance
  - Directives EFSA claires et bien suivies

- **Rupture du consensus**
  - En provenance du monde scientifique
    - Putzai – rats/pomme de terre
    - Seralini - Controversial effects on health reported after subchronic toxicity test: 90-day study feeding rats (June 2007) by Seralini, Gilles-Eric, Cellier, Dominique, and Joel Spiroux de Vendomois
  - En provenance du politique
    - MON 810 gouvernement français
  - Appuyés par les groupes de pressions
- **Où en est-on ?**

Textes

Food is considered safe if there is reasonable certainty that no harm will result from its consumption under anticipated conditions. Historically, food prepared and used in traditional ways is conisdered safe on the basis of long-term experience, even though it may naturally contain harmful substances. In principle, food is presumed ot be safe unless a significant hazard has been identified. - OCDE, 1993

Substantial equivalence is established by a demonstration that the characteristics assessed for the genetically modified organism, or the specific food product derived therefrom, are equivalent to the same characteristics of the conventional comparator.

The levels and variation for characteristics in the genetically modified organism must be within the natural range of variation for those characteristics considered in the comparator and be based upon an appropriate analysis of data. – FAO, 1996

Source : Tomlinson in Ruse and Castle (2002)

L'équivalence en substance a-t-elle un avenir ?

- **L'équivalence en substance a une dimension politique forte**
  - Le monde selon Monsanto
  - Eichenwald et al., 2001 in Ruse and Castle (2002)
- **L'équivalence en substance implique une « certaine » confiance des consommateurs**
- **La vérification scientifique du concept est « scant »**
  - Domingo, 2007
- **Des solutions :**
  - Restaurer la confiance
  - Equiper scientifiquement le concept

L'évaluation des OGM doit sortir du rapport de force pour devenir un processus d'apprentissage

Un cadre compliqué ou confus ?

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Highest dose level should produce an effect	Effects improbable at the maximum dose level that can be incorporated in the diet for the test species
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Source : Tomlinson in Ruse and Castle (2002)

Textes

The conclusions of the current review are quite in agreement with those of Zdunczyk (2001), Bakshi (2003), and Pryme and Lembcke (2003), which are in the same line than those also suggested in our previous review (Domingo and G´omez, 2000).

One of our main concerns is related with the use of the principle of "substantial equivalence" to guarantee the safe use of GM/transgenic plants.

- **Why must it be thought that two plants (GM and non-GM) with the same nutritional capacity should also imply similar health risks (or absence of risks)?**

- **Why a similar principle is not authorized, for example, for chemical substances that are going to be commercialized such as pesticides, drugs, food additives, etc.?**

Toxicity Studies of Genetically Modified Plants: A Review of the Published Literature
José L. Domingo (2007) in Critical Reviews in Food Science and Nutrition, 47:721-733

Les risques

- **Risques pour la santé**
  - toxicité et allergie
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Dans un monde où tout est possible, les OGM sont une voie d'innovation potentielle à explorer.

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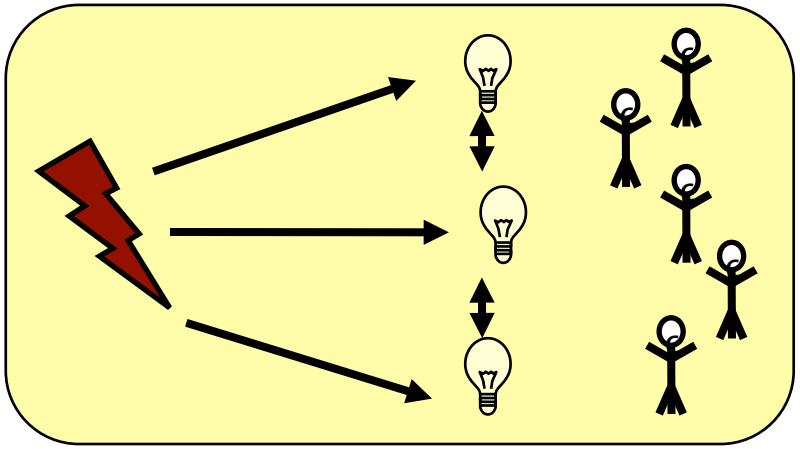
Dans un monde où les ressources sont limitées, nous devons nous focaliser sur les innovations les plus pertinentes

Cela passe par une méthodologie prenant en compte contraintes et bénéfices

« *Le génie génétique est la solution. Mais quel était le problème ?* »

Thomas Brunner et al. (2000)

Cela passe par une méthodologie prenant en compte contraintes et bénéfices



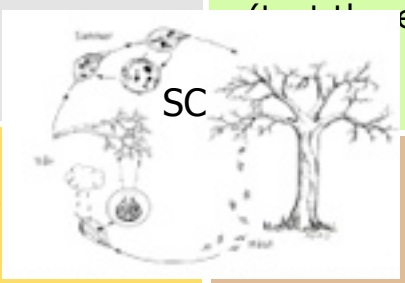
Reconnaître différentes voies d'innovation et les articuler aux besoins réels de nos sociétés.

Le champignon

- Chemical fungicides (improvement of sprayers)
- Inorganic fungicides (test the efficiency of modern Cu or S solutions)
- Organic fungicides (numerous plant extracts)
- Improvement of alert systems

Le pommier

- Scab-resistant varieties (mono- or polygenic resistance)
- Transgenic scab-resistant varieties (mono- or polygenic resistance)
- Elicitors of induced systemic resistance (…efficiency of applications)



- Orchard ventilation (increase inter-lines and inter-tree spaces)
- Interlines-hedgerows (barriers against scab conidia)
- Reduction of parcel mean surface
- Orchards of mixed varieties
- Multi-fruit orchards (apple, pear, cherry)

Le verger

- Direct local sale (increase cultivar diversification in the orchard of the owner)
- Promotion and marketing of old scab-resistant or scab-tolerant varieties

Le marché des fruits

Vanloqueren, G., Baret, P.V. (2004) *Proceedings of the 5th Congress of the European Society for*

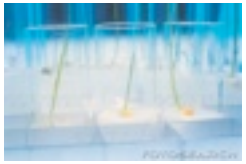
Etre attentifs aux verrouillages

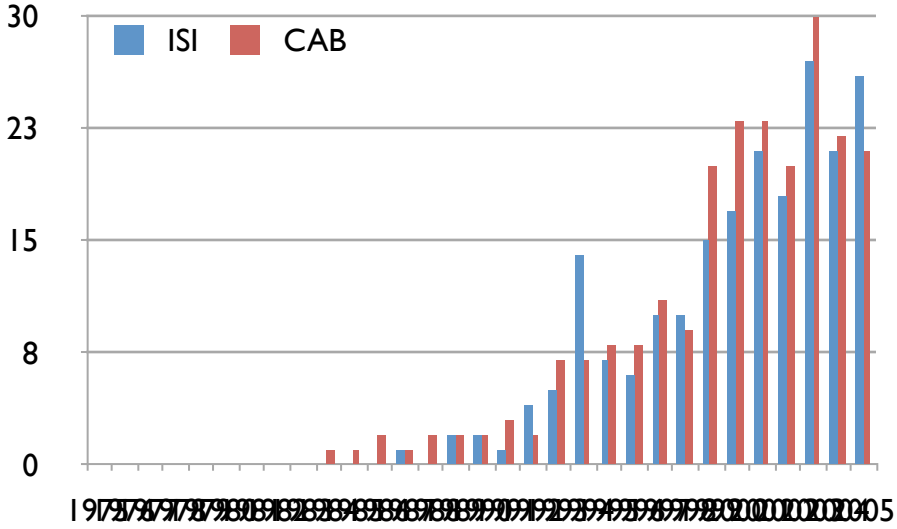
ANALYSIS

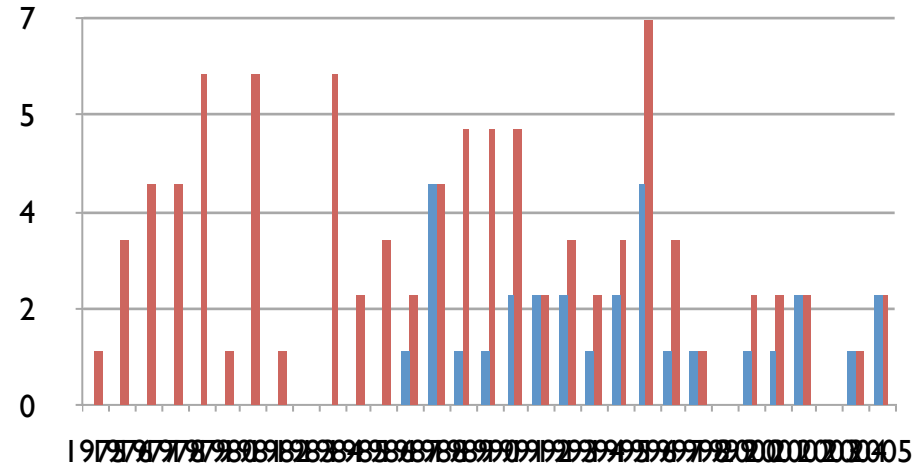
Why are ecological, low-input, multi-resistant wheat cultivars slow to develop commercially? A Belgian agricultural 'lock-in' case study

Gaëtan Vanloqueren, Philippe V. Baret*

Il y a de nettes différences de travaux scientifique sur les deux possibilités







Analyse bibliométrique

nombre d'articles dans bases de données internat. (ISI-SCI, CAB abstracts)

1973-2005

Liste de mots-clés

Conclusions

1. **La transgenèse végétale est une rupture technologique**
2. **Les plantes transgéniques en milieu non confinés présentent des risques faibles, incertains et irréversibles**
3. **Les solutions proposées aujourd'hui sont limitées à des technologies utiles à l'agriculteur américain**
4. **Refuser les plantes transgéniques proposées aujourd'hui n'est**
   - **ni un refus du progrès,**
   - **ni une absence de solidarité avec les agricultures du Sud**

Perspectives

- **Repenser l'évaluation et le débat public**
- **Mieux gérer l'innovation en agriculture**
- **Faire de la solidarité une priorité et non pas un argument marketing**

Acknowledgments

Pierre Stassart, ULg

Gaëtan Vanloqueren, UCL - www.srfood.org

Julie Van Damme, UCL

Le groupe de contact FNRS, Agroécologie