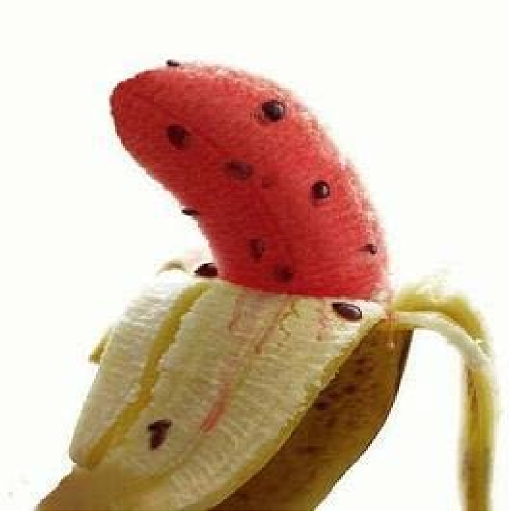
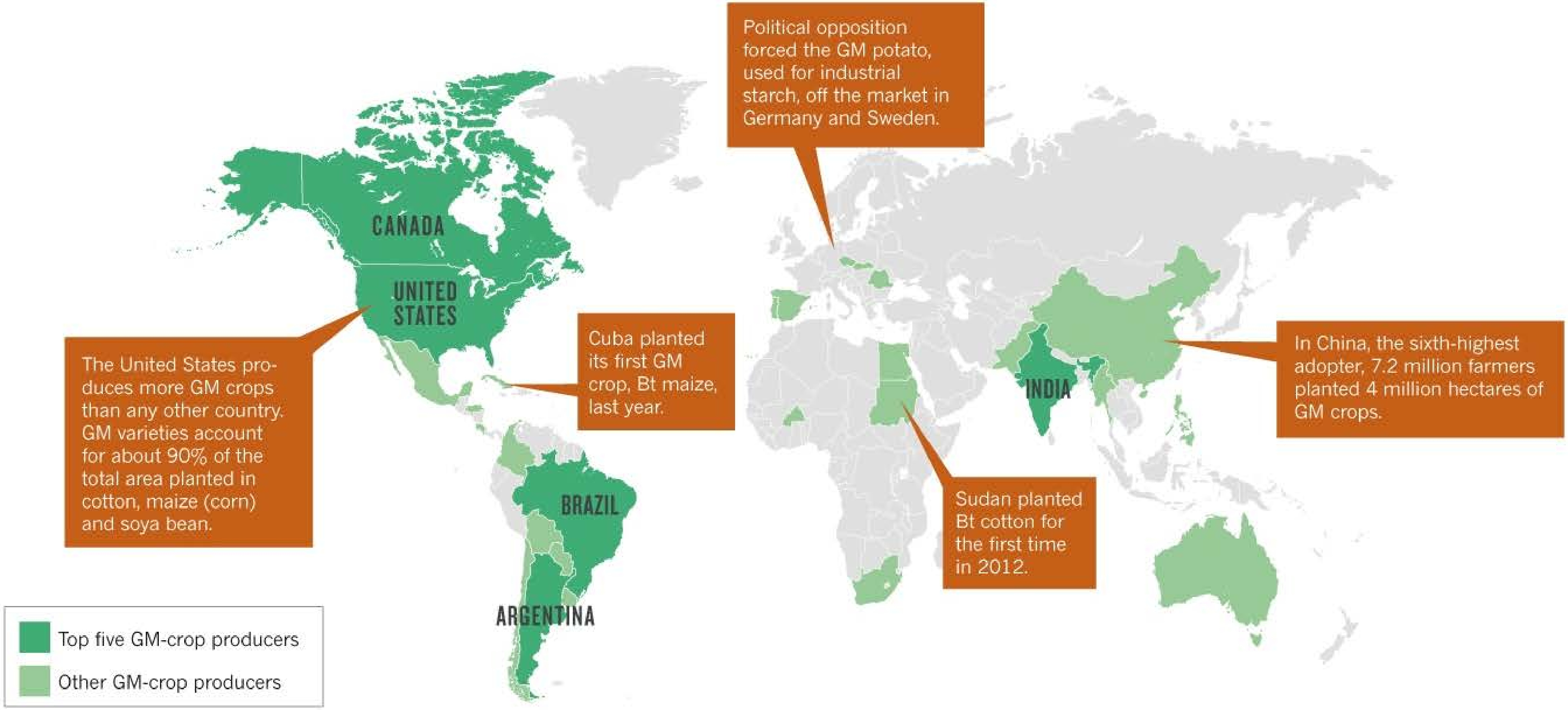
Organismes Génétiquement Modifiés



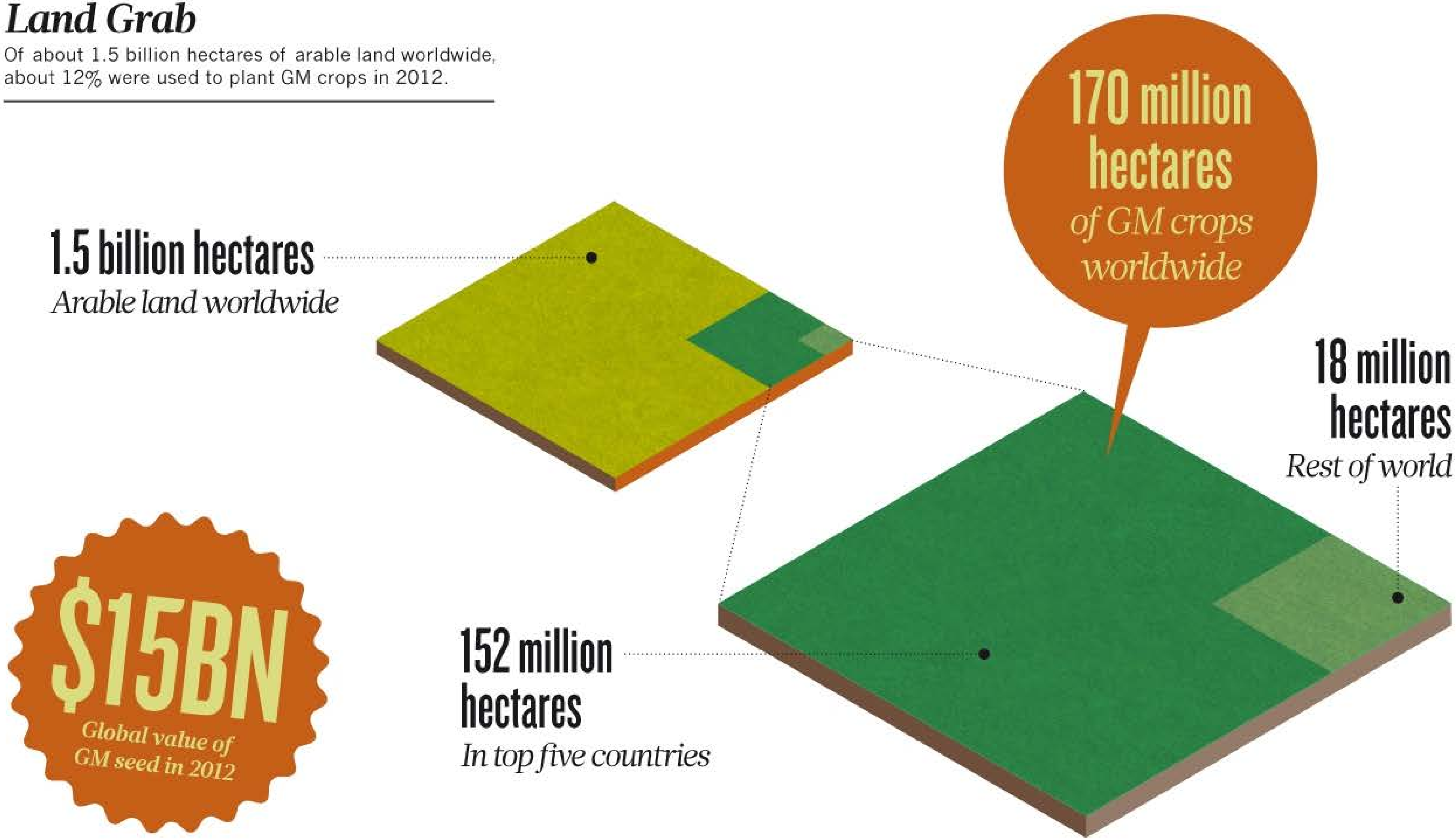
The global picture

Twenty-eight countries planted GM crops in 2012, but most were grown in just five countries: the United States, Brazil, Argentina, Canada and India.



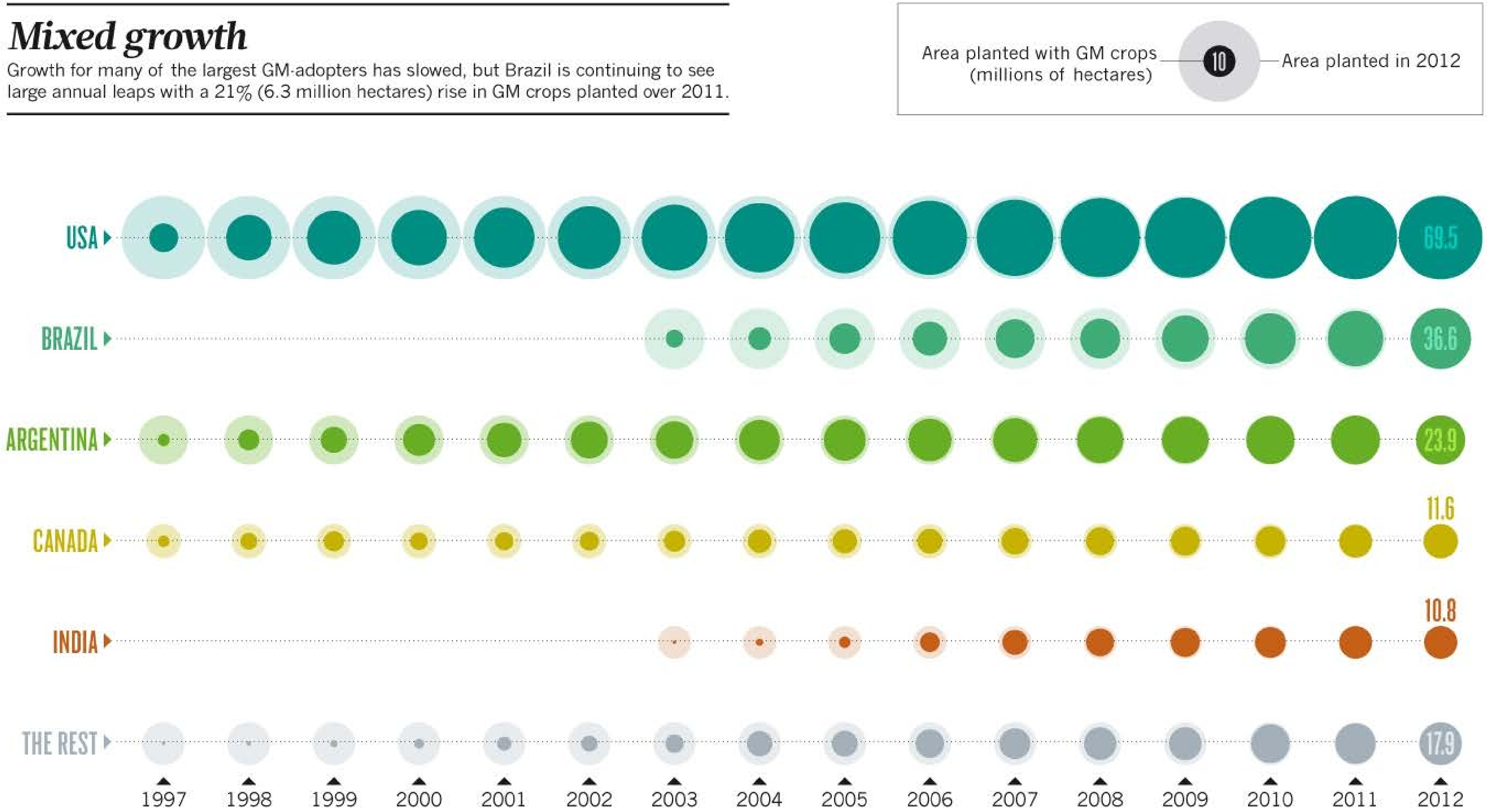
Land Grab

Of about 1.5 billion hectares of arable land worldwide, about 12% were used to plant GM crops in 2012.



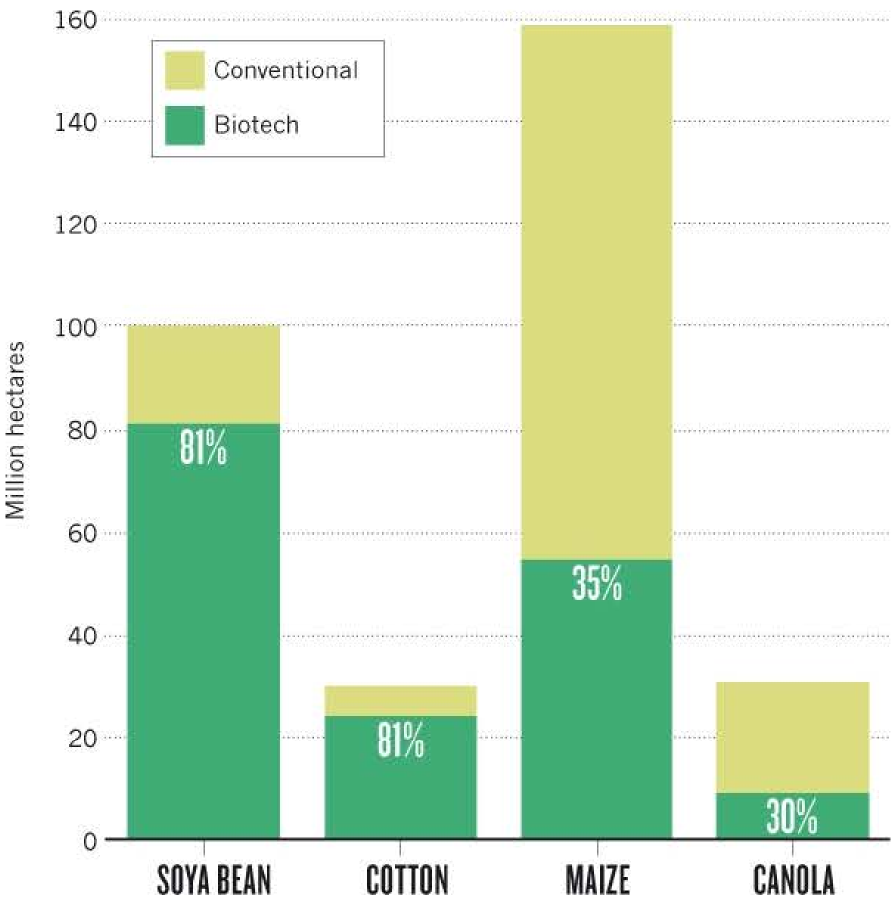
Mixed growth

Growth for many of the largest GM-adopters has slowed, but Brazil is continuing to see large annual leaps with a 21% (6.3 million hectares) rise in GM crops planted over 2011.



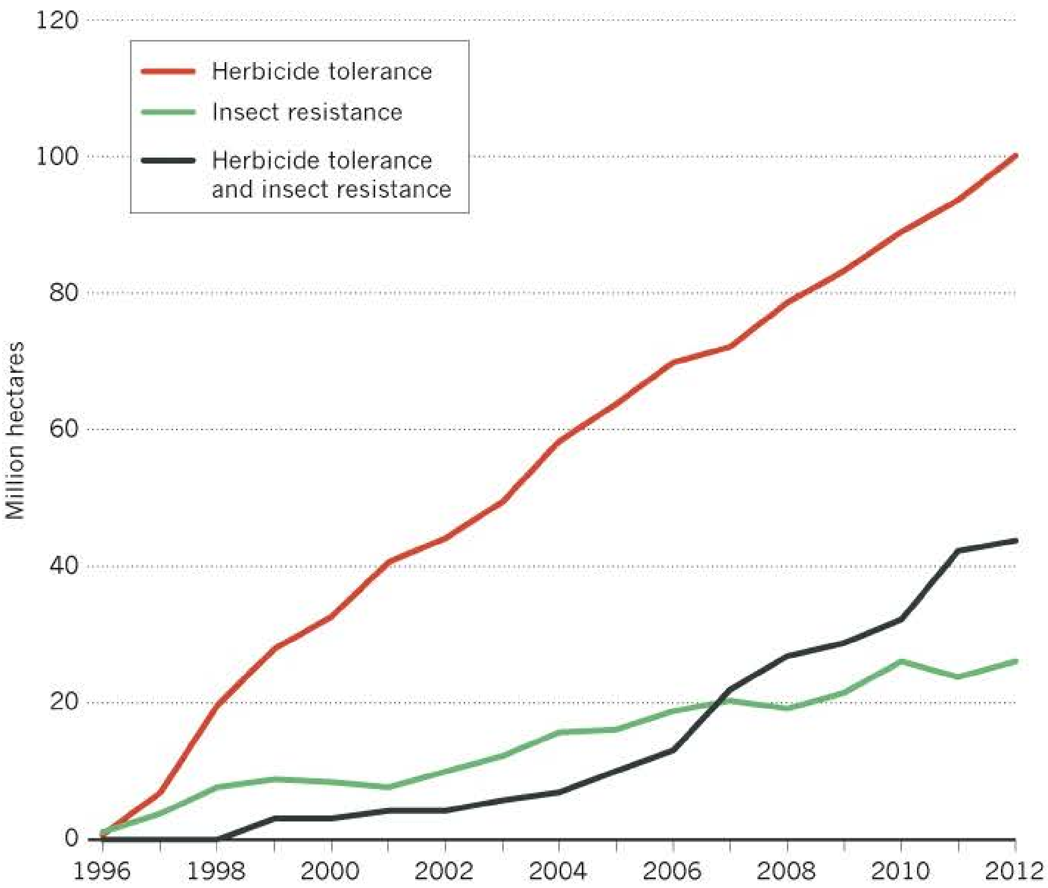
Popular crops

GM soya bean, maize (corn), cotton and canola crops accounted for nearly all GM crops grown in 2012.



Popular traits

Of some 30 traits that are currently engineered into plants for commercial use, the most popular are those that confer herbicide tolerance, insect resistance or both 'stacked' traits.



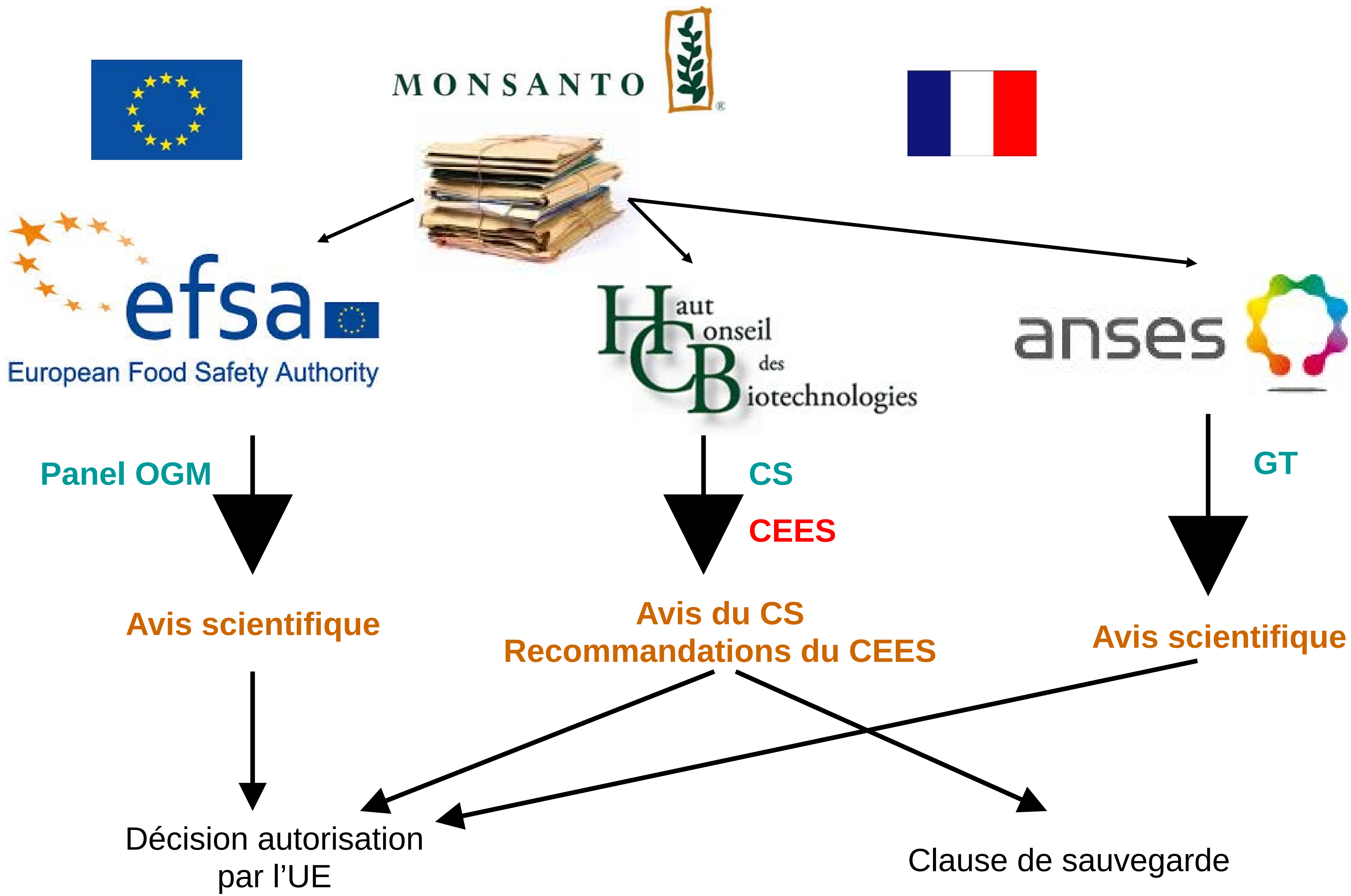
Cultures transgéniques en Europe

Autorisés à l'importation, pour introduction dans les filières alimentaires pour les animaux ou pour les hommes :

Maïs Bt 11, importé pour l'alimentation du bétail,
Maïs Bt 11, importé dans du maïs doux,
Maïs NK 603, importé pour l'alimentation du bétail,
Maïs MON 863, importé pour l'alimentation du bétail.

Autorisés en culture, ou plus précisément, la commercialisation des semences des variétés correspondantes est autorisée :

Maïs Bt 176,
Maïs MON 810,
Maïs T25,
Pomme de terre Amflora.


MONSANTO
efsa
European Food Safety Authority
Haut Conseil des Biotechnologies
anses
Panel OGM
CS
CEES
GT
Avis scientifique
Avis du CS
Recommandations du CEES
Avis scientifique
Décision autorisation
par l'UE
Clause de sauvegarde

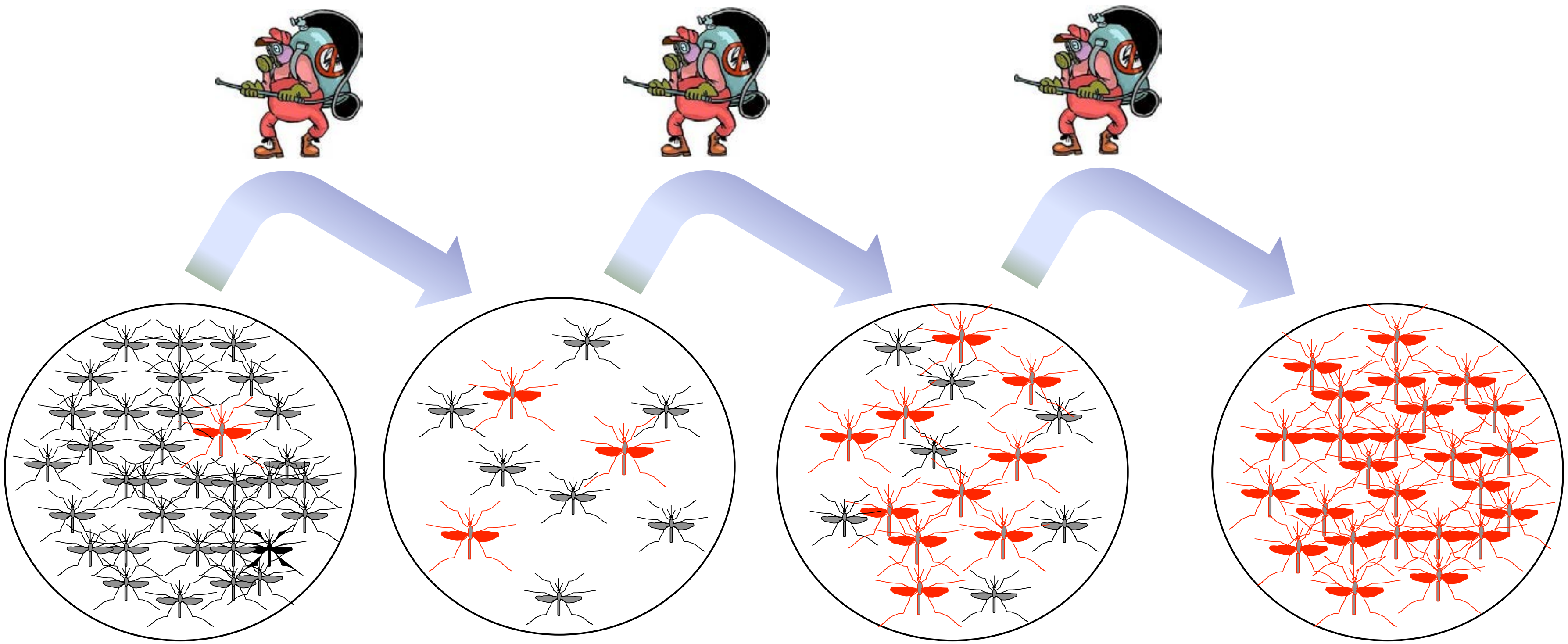
Impacts environnementaux

- **Resistance des organismes cibles**
- **Impacts sur les organismes non-cibles**
- Hybridations interspécifiques
- Hybridations intraspécifiques

PGM et apparition de résistances aux protéines insecticides

Cadre général

Traitements pesticides



Individu résistant (R)

Individu sensible

La résistance : un phénomène classique

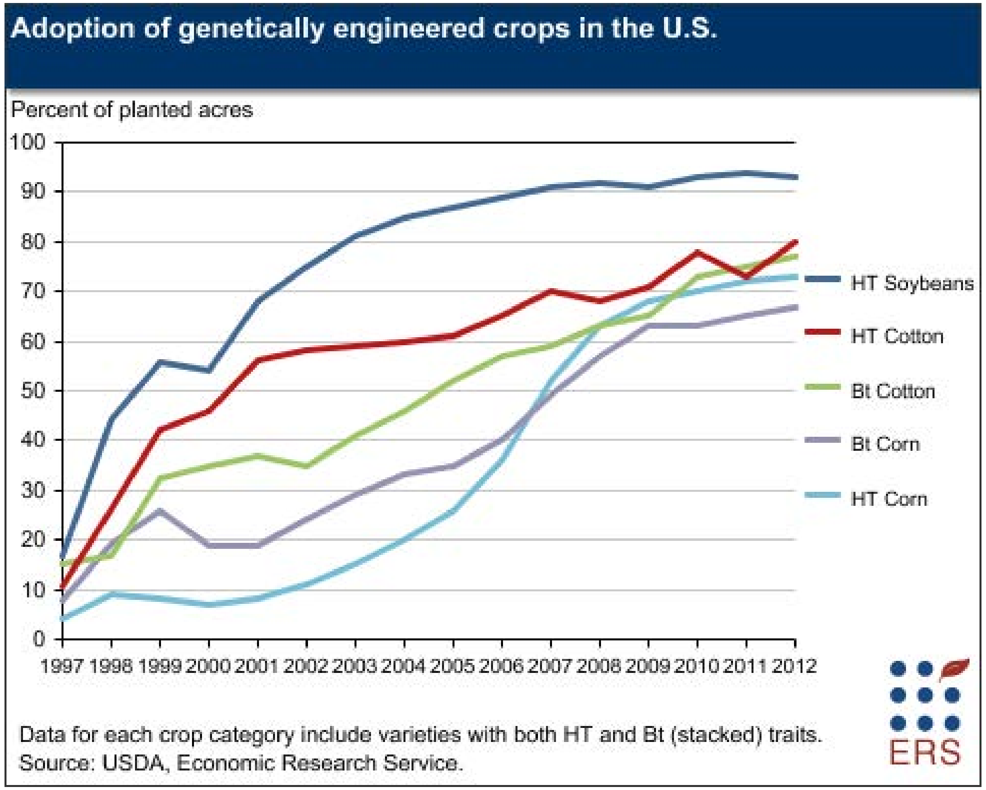
Insecticides : 8000 cas concernant 300 molécules et > 500 espèces d'arthropodes

Fongicides : 300 cas concernant 30 fongicides et 250 espèces de champignons pathogènes

Herbicides : 390 cas pour 210 espèces d'adventices

Antibiotiques : 400 types de gènes de résistance à 250 molécules dans 1700 espèces de bactéries

PGM et résistances



Risque de résistances

PGM Bt → aux *toxines de Bt* dans les populations d'*insectes*

PGM HT → au *glyphosate* dans les populations d'*adventices*

Pourquoi éviter ces résistances?

Le glyphosate est considéré aussi important en agriculture que la pénicille en santé humaine

Les toxines de Bt produites par les PGM peuvent être considérées comme des biens communs

La résistance peut conduire à la réutilisation de pesticides plus nocifs/toxiques

Le nombre de pesticides/molécules homologués diminue et les nouvelles homologations se font rares

Augmentation des mycotoxines

Résistance aux protéines insecticides

Résistances aux maïs *Bt*

Ostrinia nubilalis (Etats-Unis & Europe)

Busseola fusca (Afrique du Sud)

Sesamia nonagrioïdes (Europe)

Ostrinia furnacalis (Philippine)

Diabrotica virgifera (Etats-Unis)

Diatraea saccharalis (Etats-Unis)

Diatraea grandiosella (Etats-Unis)

Spodoptera frugiperda (Porto Rico)




Résistances aux cotonniers *Bt*

Pectinophora gossypiella (Etats-Unis)

Pectinophora gossypiella (Chine)

Helicoverpa zea (Etats-Unis)

Helicoverpa punctigera (Australie)

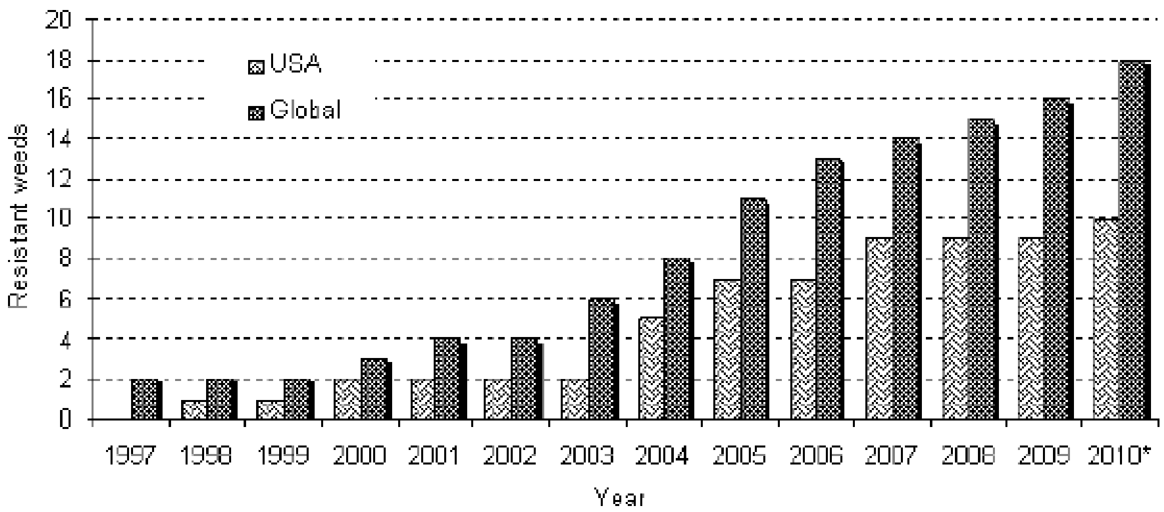
Helicoverpa armigera (Australie)

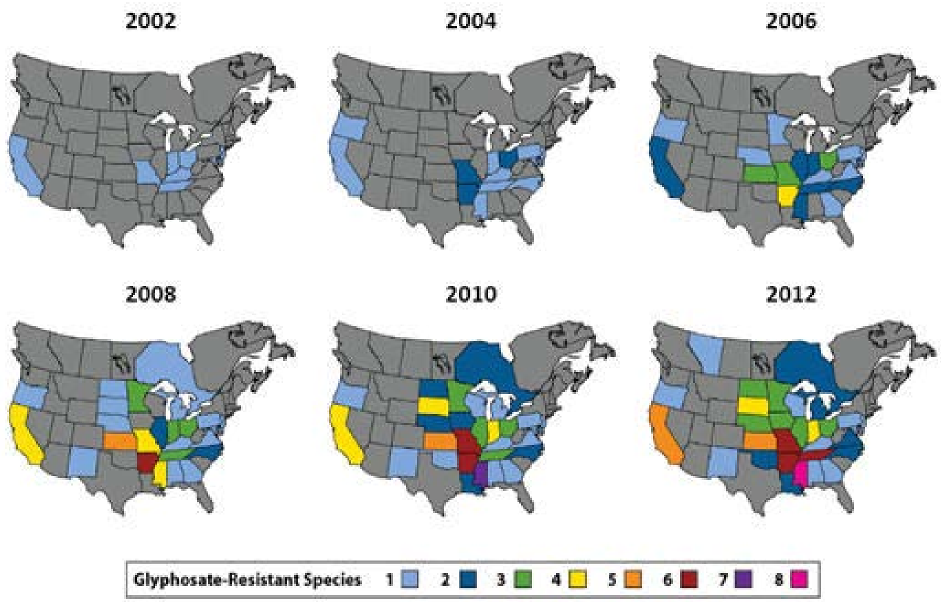
Helicoverpa armigera (Chine et Inde)

Heliothis virescens (Etats-Unis)




Résistances au glyphosate





Impact sur les organismes non cibles

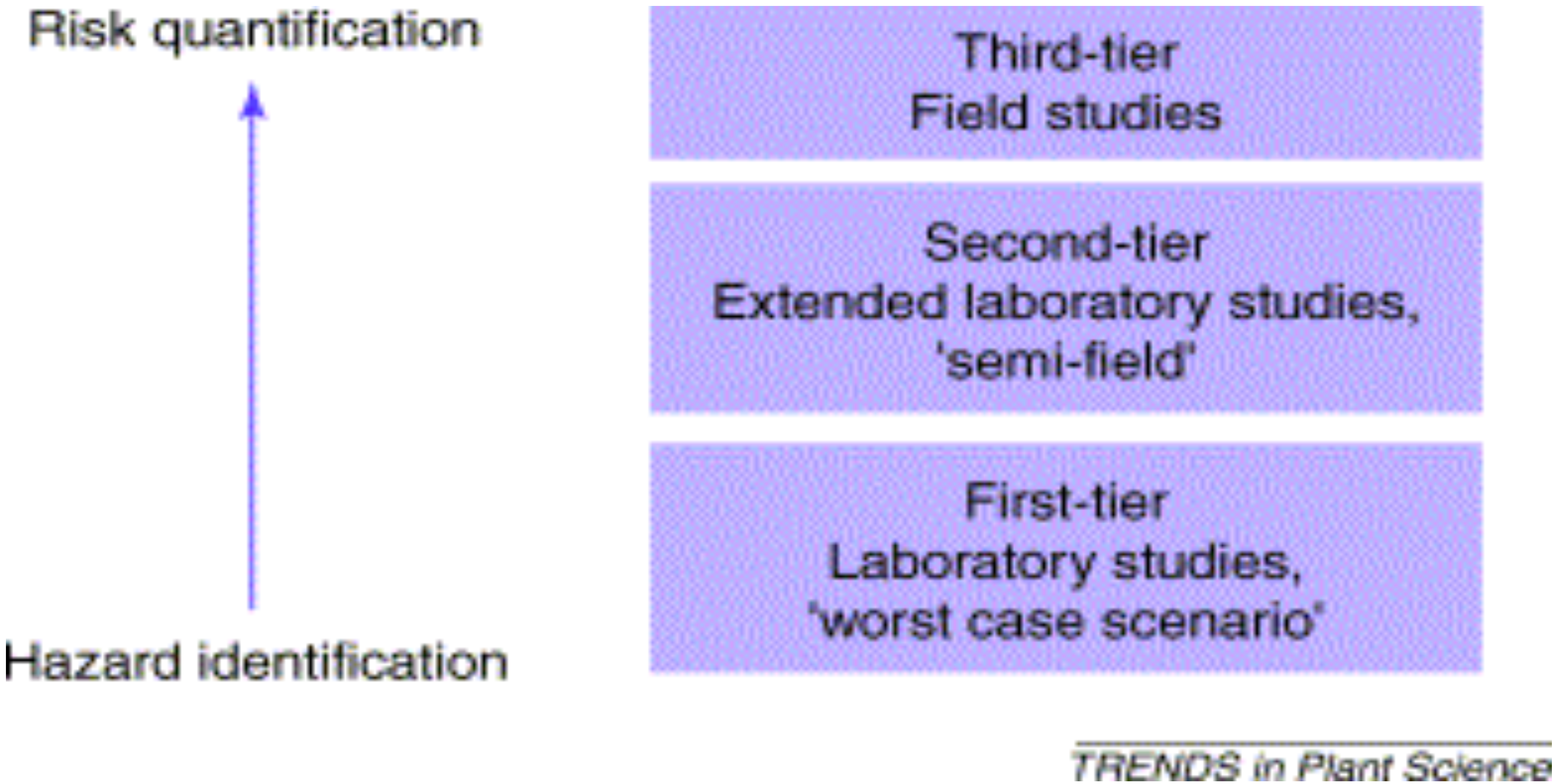
What is Risk?

Risk is defined as a function of the adverse effect (hazard or consequence) and the likelihood of this effect occurring (exposure).

Risque =

Probabilité d'exposition x Probabilité d'effet toxique

Tiered approach



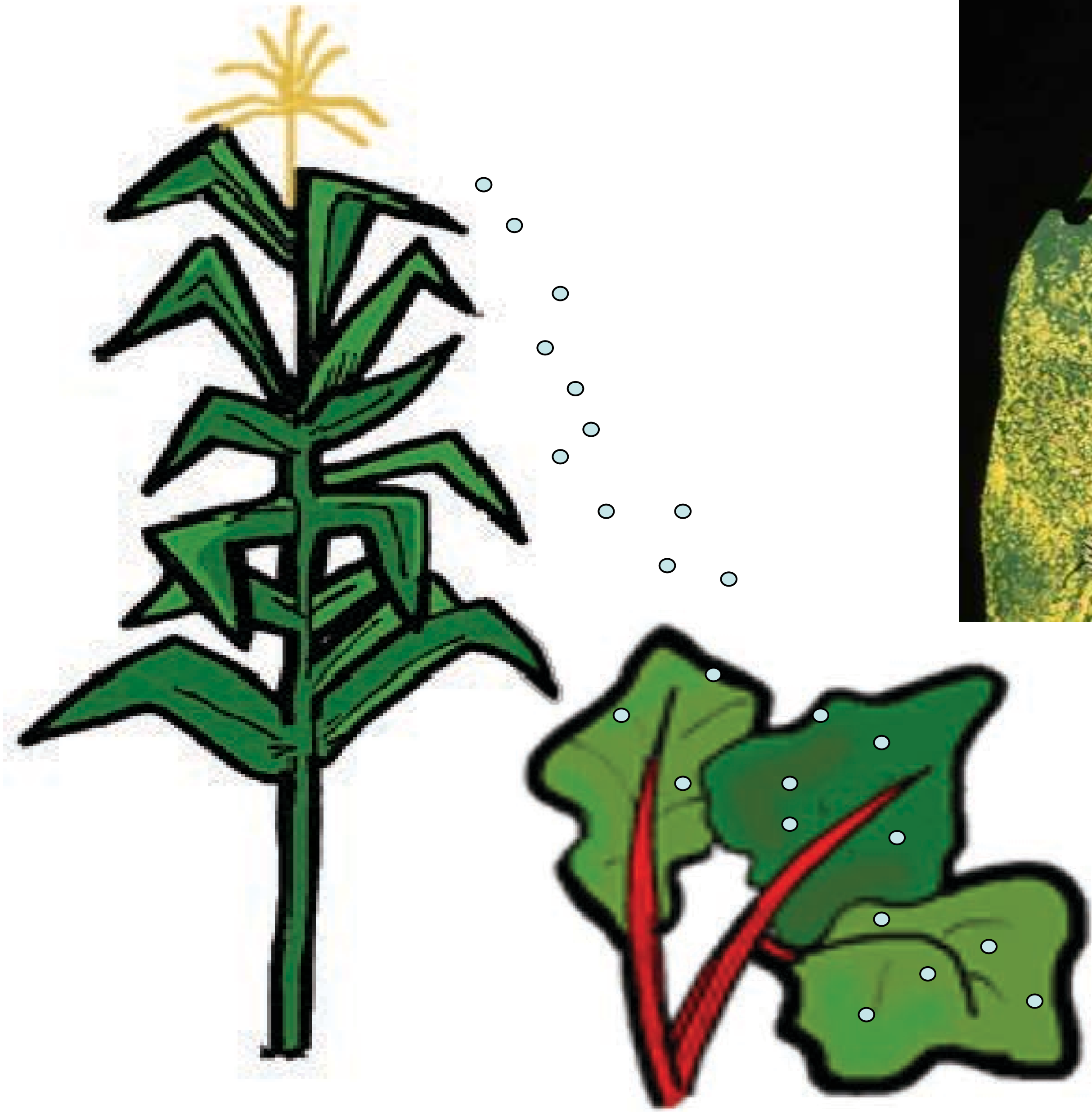
Wilkinson et al. 2003 Trends Plant Sci 8: 208

L’impact des maïs Bt sur les populations du monarque *Danaus Plexippus*

Transgenic pollen harms monarch larvae

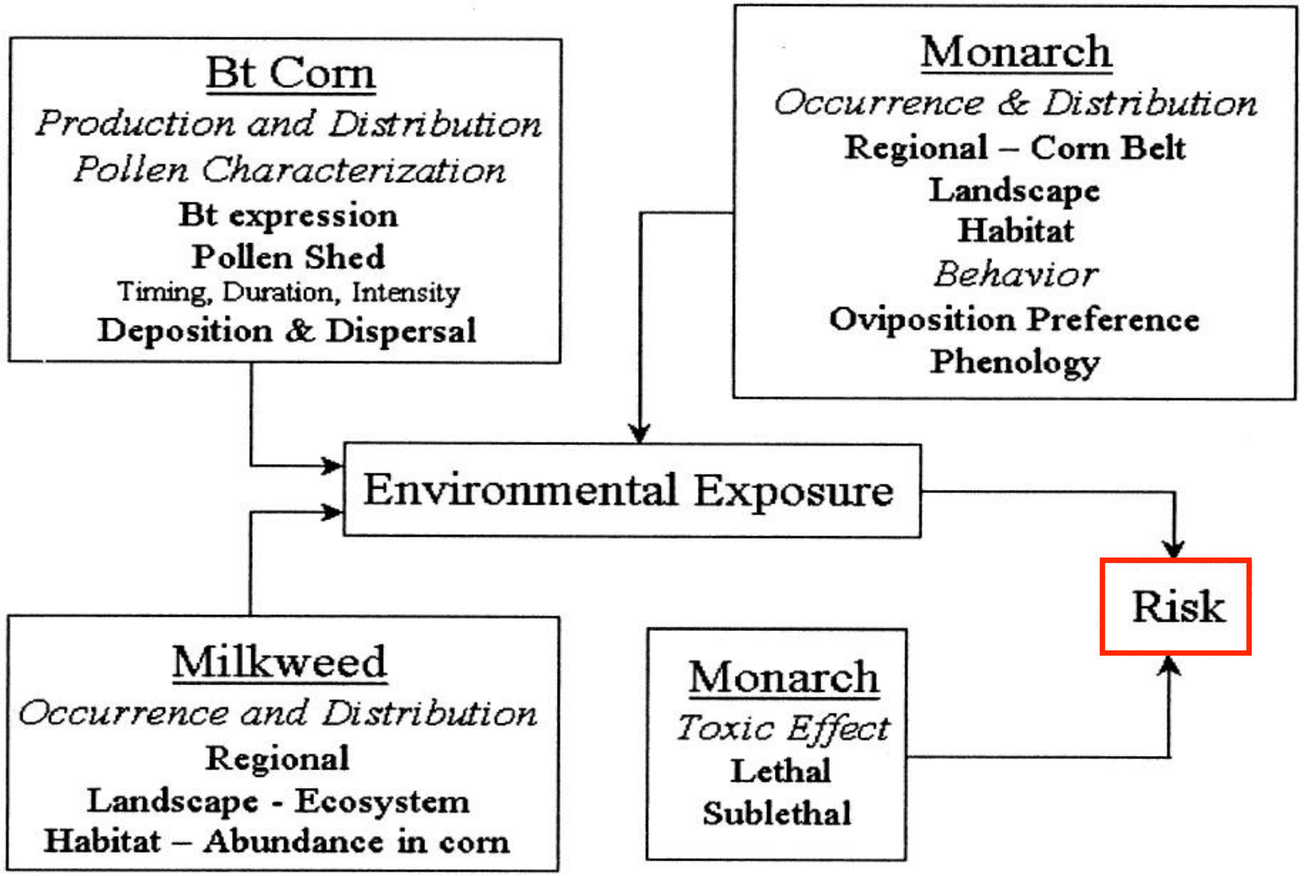
JOHN E. LOSEY, LINDA S. RAYOR & MAUREEN E. CARTER

Although plants transformed with genetic material from the bacterium *Bacillus thuringiensis* (*Bt*) are generally thought to have negligible impact on non-target organisms, *Bt* corn plants **might represent a risk** because most hybrids express the *Bt* toxin in pollen, and corn pollen is dispersed over at least 60 metres by wind. Corn pollen is deposited on other plants near corn fields and can be ingested by the non-target organisms that consume these plants. In a laboratory assay we found that larvae of the monarch butterfly, *Danaus plexippus*, reared on milkweed leaves **dusted with pollen** from *Bt* corn, **ate less, grew more slowly and suffered higher mortality** than larvae reared on leaves dusted with untransformed corn pollen or on leaves without pollen.




RIP

Bt and Monarch Risk Model



Impact of *Bt* corn pollen on monarch butterfly populations: A risk assessment

Mark K. Sears[*,†], Richard L. Hellmich[‡], Diane E. Stanley-Horn[*], Karen S. Oberhauser[§], John M. Pleasants[¶], Heather R. Mattila[*], Blair D. Siegfried[‖], and Galen P. Dively[**]

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Edited by M. R. Berenbaum, University of Illinois at Urbana–Champaign, Urbana, IL, and approved August 17, 2001 (received for review June 28, 2001)

A collaborative research effort by scientists in several states and in Canada has produced information to develop a formal risk assessment of the impact of *Bt* corn on monarch butterfly (*Danaus plexippus*) populations. Information was sought on the acute toxic effects of *Bt* corn pollen and the degree to which monarch larvae would be exposed to toxic amounts of *Bt* pollen on its host plant, the common milkweed, *Asclepias syriaca*, found in and around cornfields. Expression of Cry proteins, the active toxicant found in *Bt* corn tissues, differed among hybrids, and especially so in the concentrations found in pollen of different events. In most commercial hybrids, *Bt* expression in pollen is low, and laboratory and field studies show no acute toxic effects at any pollen density that would be encountered in the field. Other factors mitigating exposure of larvae include the variable and limited overlap between pollen shed and larval activity periods, the fact that only a portion of the monarch population utilizes milkweed stands in and near cornfields, and the current adoption rate of *Bt* corn at 19% of North American corn-growing areas. This 2-year study suggests that the impact of *Bt* corn pollen from current commercial hybrids on monarch butterfly populations is negligible.

Concern regarding nontarget effects of transgenic crops containing transgenes from the organism *Bacillus thuringiensis* (*Bt*) arose after the publication by Losey *et al.* (1) on the potential risk of corn pollen expressing lepidopteran-active Cry protein to the monarch butterfly, *Danaus plexippus* L. However, the U.S. Environmental Protection Agency (EPA) concluded in an earlier report that the potential impact of *Bt* corn pollen, which contains variable amounts of Cry protein, on sensitive larvae of Lepidoptera was negligible because of factors that limit environmental exposure (2). Clarification of the risk posed by *Bt* corn pollen to monarch butterflies can now be undertaken because of the data reported in this issue of PNAS (3–6) that address exposure and toxic effects of *Bt* corn pollen.

The research contributions reported here represent a collaborative effort established to specifically address the question of risk associated with *Bt* corn pollen to the monarch butterfly. In December 1999, the EPA issued a data call-in requesting industry, researchers and all interested parties to submit information and comments by March 2001 for use in evaluation and potential reregistration of corn hybrids containing Cry proteins (http://www.epa.gov/pesticides/biopesticides/otherdocs/bt_dci.htm). The U.S. Department of Agriculture Agricultural Research Service (USDA–ARS) sponsored a Monarch Research Workshop in February 2000 to identify research priorities regarding *Bt* corn and monarch butterflies, to establish cooperation among researchers, and to respond to the EPA request for data. A request for proposals based on workshop priorities was announced in April, after which a steering committee, including Adrianna Hewings (USDA–ARS), Eldon Ortman (Purdue University), Mark Scriber (Michigan State University), Eric Sachs (Monsanto), and Margaret Mellon (Union of Concerned Scientists) selected projects to be funded. Funding came from a grant pool provided by ARS and the Agricultural Biotechnology Stewardship Technical Committee (7). The guiding principles for problem formulation followed by the consortium were the elements of risk assessment that underlie the approach by EPA to ecological risk assessment (http://www.epa.gov/NCEA/ecorsk.htm).

Only three papers concerning the impact of *Bt* corn pollen on nontarget Lepidoptera have been published (1, 8, 9), and they are limited in their application to risk assessment (7). For example, the dose of pollen was not specified in the exposure study by Losey *et al.* (1), and the study by Jesse and Obrycki (8) used pollen collection and handling techniques that probably resulted in contamination from corn anthers or tassel fragments, which contain significantly higher levels of Cry protein than the pollen (3). Finally, neither study addressed the spatial or temporal potential for exposure by monarch larvae to pollen in cornfields, thereby precluding a risk assessment.

In this paper, we develop a weight-of-evidence approach to the risk of exposure of monarch larvae to *Bt* corn pollen and the impact of such exposure on populations of the monarch butterfly in eastern North America by using recently published information based on collaborative research by scientists in the U.S. and Canada (3–6). We use an approach to risk assessment that has been performed for many nontarget species in relation to pesticides (10–14), industrial by-products (15, 16), and other potential toxicants found in the environment (17). The approach to this process is consistent, well documented, and standardized (http://www.epa.gov/NCEA/ecorsk.htm). It requires consideration of both the expression of toxicity and the likelihood of exposure to the toxicant as the basic components for a risk assessment procedure.

AGRICULTURAL SCIENCES

Materials and Methods

Hazard Identification. Toxicity of purified *Bt* proteins to larval stages of butterflies and moths is well known (18, 19). Studies conducted on the use of *Bt* sprays in forests for gypsy moth control have shown that Cry proteins can adversely affect nontarget Lepidoptera (20, 21). Field data from these studies indicated a temporary reduction in lepidopteran populations during prolonged *Bt* use, although widespread irreversible harm was not apparent (22). Lepidopteran-active *Bt* protein expressed in pollen of *Bt* corn hybrids may pose a risk to sensitive species, such as monarch butterflies, in or near cornfields during anthesis (1, 8). Milkweeds, *Asclepias* spp., and especially common milk-

This paper was submitted directly (Track II) to the PNAS office.

Abbreviations: *Bt*, *Bacillus thuringiensis*; USDA–ARS, U.S. Department of Agriculture Agricultural Research Service; EPA, U.S. Environmental Protection Agency; LOEC, lowest-observable-effect-concentration.

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Sears *et al.*

Risque = Pe x Pt

- Pe = proba d'exposition
  - 0.0042 pour #176
  - 0.0168 pour Mon810 et Bt11
- Pe = proba d 'effet toxique
  - 0.9 pour #176
  - 0.007 pour Mon810 et Bt11
- Proportion de la population soumise à un risque
  - 0.0038 due à la présence #176
  - 0.00012 due à la présence de Mon810 et Bt11

0.4% des populations de monarque

Conclusions

1) Quelques cas polémiques - chrysope, adalia, mornarque…
2) Il existe forcément des impacts sur ces organismes non cibles (eg parasitoïdes des espèces cibles, papillons non cibles…)
3) Effets sans aucun doute moindres que ceux liés aux pesticides
4) Les études sont - et resteront - de puissance limitée
5) Nécessité de suivi de long terme - mais pb de lien cause/effet
6) Conséquences écologiques de ces effets?


BOUFFER DU MAÏS TRANSGÉNIQUE
EST-CE DANGEREUX ?
BÔF!

L'«Affaire» Séralini

Contents lists available at SciVerse ScienceDirect

Food and Chemical Toxicology

journal homepage: www.elsevier.com/locate/foodchemtox

Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize

Gilles-Eric Séralini [a,*], Emilie Clair [a], Robin Mesnage [a], Steeve Gress [a], Nicolas Defarge [a], Manuela Malatesta [b], Didier Hennequin [c], Joël Spiroux de Vendômois [a]

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NK603
Rat
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Endocrine disrupting effects

ABSTRACT

The health effects of a Roundup-tolerant genetically modified maize (from 11% in the diet), cultivated with or without Roundup, and Roundup alone (from 0.1 ppb in water), were studied 2 years in rats. In females, all treated groups died 2–3 t
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files were comparable. Females devel
before controls, the pituitary was the
ified by GMO and Roundup treatme
times higher. This pathology was co
and severe kidney nephropathies were
palpable tumors than controls which
significant kidney chronic deficiencie
were kidney related. These results c
Roundup, but also by the overexpress

ABSTRACT

The health effects of a Roundup-tolerant genetically modified maize (from 11% in the diet), cultivated with or without Roundup, and Roundup alone (from 0.1 ppb in water), were studied 2 years in rats. In females, all treated groups died 2–3 times more than controls, and more rapidly. This difference was visible in 3 male groups fed GMOs. All results were hormone and sex dependent, and the pathological profiles were comparable. Females developed large mammary tumors almost always more often than and before controls, the pituitary was the second most disabled organ; the sex hormonal balance was modified by GMO and Roundup treatments. In treated males, liver congestions and necrosis were 2.5–5.5 times higher. This pathology was confirmed by optic and transmission electron microscopy. Marked and severe kidney nephropathies were also generally 1.3–2.3 greater. Males presented 4 times more large palpable tumors than controls which occurred up to 600 days earlier. Biochemistry data confirmed very significant kidney chronic deficiencies; for all treatments and both sexes, 76% of the altered parameters were kidney related. These results can be explained by the non linear endocrine-disrupting effects of Roundup, but also by the overexpression of the transgene in the GMO and its metabolic consequences.

Table 1 Mortalité sur 2 ans et mortalité précoce

Mortalité	***MALES***				***FEMELLES***			
	Contrôles*	**11%**	**22%**	**33%**	**Contrôles***	**11%**	**22%**	**33%**
OGM	3 (0)	5 (1)	1 (0)	1(1)	2 (2)	3 (2)	7 (6)	4 (4)
OGM + R		3 (1)	5 (3)	3 (0)		4 (1)	7 (6)	4 (3)
Roundup A,B,C***		3 (1)	4(2)	1 (0)		5 (5)	5(5)	4 (4)

	MALES	FEMELLES
Contrôles	**30 %** (3/10)	**20 %** (2/10)
Traités OGM	**30 %** (18/60)	**48 %** (29/60)
Traités R	**32 %** (19/60)	**48 %** (29/60)

*Décès prématurés (avant 500 jours **)*

	MALES	FEMELLES
Contrôles	**10 %** (1/10)	**0 %** (0/10)
Traités OGM	**10 %** (3/30)	**20 %** (6/30)
Traités OGM + R	**16 %** (5/30)	**10 %** (3/30)
Traités Roundup	**0 %** (0/30)	**0 %** (0/30)

** Un seul groupe de contrôles mâles (10 rats) et femelles (10 rats) pour 9 groupes expérimentaux mâles (n=90)et 9 groupes femelles (n=90)*

*** Date à laquelle tous les groupes commencent à mourir à peu près au même rythme*

**** Doses de Roundup A, B, C*
( ) rat euthanasié

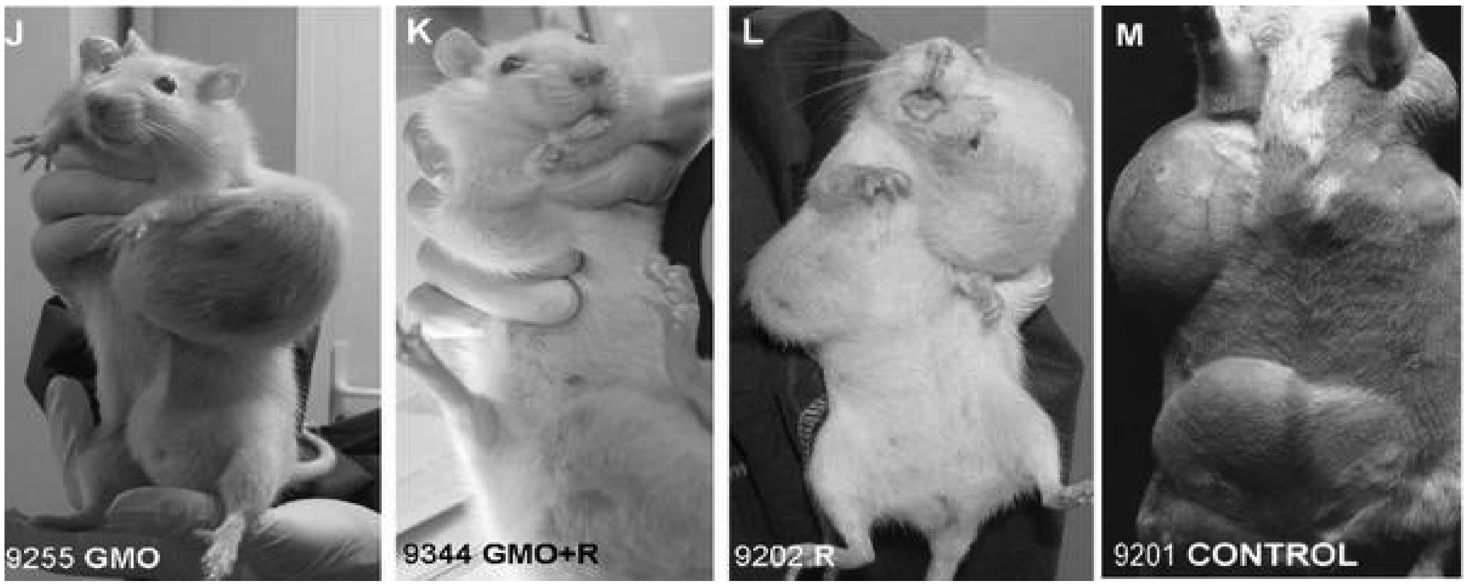
Table 2. Nombre de tumeurs palpables

	MALES				FEMELLES			
	Contrôles	11%	22%	33%	Contrôles	11%	22%	33%
OGM	13 (0)●	14 (2)	16(2)	13(1)	19 (6)	26(10)	19 (7)	25 (9)
OGM + R		8 (2)	6 (1)	6 (0)		20 (7)	19(8)	24 (7)
Roundup		8 (0)	8 (0)	12 (0)		26 (14)	20(12)	22 (11)

		Males		Femelles
Contrôles	**Tumeurs /rat :**	**1.30**	(13/10)	**1.90** (19/10)
Traités OGM		**1.05**	(65/60)	**2.21** (133/60)
Traités Roundup		**0.85**	(51/60)	**2.18** (131/60)

● *Un seul groupe de contrôle de 10 mâles et 10 femelles pour 9 groupes expérimentaux mâles (n=90) et femelles (n=90)*

( ) rat euthanasié



[OGM : "Le protocole d'**étude** de M. **Séralini** présente des lacunes ...]
www.lemonde.fr/.../ogm-le-protocole-d-**etude**-de-m-**seralini**-presente-des...
20 sept. 2012 - Or, l'**étude** de Gilles-Eric **Séralini** se fonde sur neuf groupes de vingt rats ... Vous dénoncez par ailleurs des insuffisances dans la **présentation** ...

[L'**étude Séralini** sur la toxicité des OGM "enterrée" par les experts ...]
www.lemonde.fr/.../ogm-l-agence-europeenne-de-securite-alimentaire-re...
28 nov. 2012 - L'agence a constaté une série de lacunes scientifiques dans l'**étude** menée par le professeur Gilles-Eric **Séralini** sur la toxicité du maïs NK603.

[PDF] [L'**étude** du professeur **Séralini** sur le maïs OGM va être évaluée]
sebastien.ledien.free.fr/Statistique%20Générale%20Séance%202%20Arti...
L'**étude** du professeur **Séralini** sur le maïs OGM va être évaluée .... inhabituelle : les journalistes qui l'ont lue avant sa **présentation** ont dû signer une clause de.

[Les OGM des poisons ? L'**étude de Séralini** est clownesque ! | Rue89]
www.rue89.com/.../les-ogm-des-poisons-l**etude-de-seralini**-est-clownesq...
12 nov. 2012 - Près de deux mois après la parution de l'article de Gilles-Eric **Séralini** portant sur la toxicité supposée d'un OGM -- ou plus exactement une ...

[OGM : les conclusions de l'**étude Séralini** réfutées - Libération]
www.liberation.fr/.../ogm-les-conclusions-de-l-**etude**-**seralini**-refutees_85...
22 oct. 2012 - OGM : pour Batho, l'**étude Séralini** montre la «nécessité de bouger» ... la présidente de ce comité, lors d'une **présentation** de l'avis du HCB à la ...

[OGM : l'**étude Seralini** mise en pièce, son auteur sauvé du déshonn...]
www.marianne.net/OGM-l-**etude**-**Seralini**-mise-en-piece-son-auteur-sauv...
25 oct. 2012 - Les critiques de l'**étude** de Gilles Eric **Séralini** sur les OGM se suivent et ... **présentation** des résultats utilisés pour échafauder des hypothèses ...


ET ÇA ! C'EST PAS UNE PREUVE ?


OGM: ÇA DERNIÈRE ÉTUDE EST-ELLE FIABLE?
IL A MANGÉ DU MAÏS TRANSGÉNIQUE ET APRÈS 5 MIN AU MICRO-ONDE VOICÀ CE RÉSULTAT
EN FAIT... VOUS AVEZ FAIT DU POP-CORN


GMO
RESEARCH
HERO
GILLES-ERIC
SÈRALINI
Follow his work here: gmoseralini.org


LES TRUCAGES DE SÉRALINI DÉNONCÉS...
IL NOUS AVAIT PROMIS DES PROTHÈSES MAMAIRES GRATOS
...PAR DES COBAYES


SÉRALINI FAIT PARLER LES PLANTES
CE MAÏS 810
VIENT D'AVOUER QU'IL VOULAIT EMPOISONNER LE MONDE

OGM : que reste-t-il de "l'affaire des rats" de Séralini" ?

LE MONDE | 17.10.2013 à 10h43 • Mis à jour le 17.10.2013 à 13h13 |

Par **Stéphane Foucart**

"Le bilan de cette affaire n'est pas inintéressant", juge aujourd'hui Marc Mortureux, le directeur général de l'Anses. De fait, les questions soulevées par les travaux soutenus par le Criigen ont donné lieu à deux appels à projets scientifiques, pour un budget prévisionnel total de plus de 5 millions d'euros. Un premier projet, financé par l'Union européenne, devra répliquer les travaux de M. Séralini – mais cette fois dans un cadre suffisamment contraint pour pouvoir conclure. Le second, lancé au niveau national, devra explorer de nouvelles techniques d'évaluation des effets à long terme de la consommation d'OGM.

Ce n'est pas tout. Depuis la publication de M. Séralini, les tests réglementaires ont été étendus à quatre-vingt-dix jours – contre seulement dix-sept auparavant. Et le Haut Conseil des biotechnologies (HCB) a rendu, le 15 octobre, un avis demandant l'accès obligatoire aux données brutes des expériences toxicologiques menées par les industriels – sous un format exploitable. Enfin, l'Autorité européenne de sécurité des aliments (EFSA) n'a rendu le premier avis négatif de son histoire sur un OGM, que quelques mois après le pataquès de l'affaire Séralini… Simple hasard ?

Un travail scientifique de piètre qualité peut donc en lui-même ne pas faire avancer la connaissance, mais créer les conditions d'une augmentation du savoir. La cocasserie de tout cela est qu'en publiant son étude, M. Séralini a en réalité brisé une sorte de paix armée entre opposants et partisans des OGM. Jusqu'à présent, chaque partie pouvait mobiliser une ignorance suffisante pour affirmer ce que bon lui semblait. Les prochaines années verront sans doute se dissiper ce flou ; il n'est pas sûr que les anti-OGM en sortent gagnants.

Principe de précaution

Produit sur le marché si absence de risques démontré (règle OMC)

OR Risque zéro n'existe pas !

Risque acceptable ?

Aux citoyens et non aux experts de décider