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# GENETICALLY MODIFIED ORGANISMS (GMOs):

# A DANGER TO SUSTAINABLE AGRICULTURE

**A contribution by WWF Switzerland**
**to the international public debate**

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# Introduction

Modern intensive agriculture production systems are the major cause of the environmental degradation in European rural areas. Technological innovations and progress have led to the current production forms we have in Western agriculture using commercial fertilisers and synthetic pesticides massively. New breeding and the wide use of hybrids have resulted in an incredible progress in farming outputs supported by strong state interventions and investment supports on farms to improve their productive infrastructures.

The environmental consequences of this evolution are well-known: reduction of species and habitat diversity, water over-abstraction and pollution, soil loss, desertification, abandonment of high nature value farming systems in marginal areas. A new technological revolution is about to reach the European continent on a large scale. It is at least described as such by economic and some state interests in favour of genetically modified organisms (GMOs). Even the European Union, which since 1998 has had a de facto moratorium on the release of GMOs, liftedthis moratorium in 2004. But there is still a strong controversy as to whether GMOs should be allowed or not for agriculture in EU. A new moratorium is being implemented in the European Union at the moment: regions and local authorities are multiplying GM free initiatives, the high level of dissent among member states paralyses the GM allowance procedures and the new Commission has no political capacity to oppose such tensions.

At the moment, WWF, the conservation organization, pledges for a moratorium of GMO release until the full environmental, social and economic consequences are assessed. Where releases have already occurred, a full assessment of the impacts should be done.

For the WWF in Europe, the question is to know if GMOs are an additional step for “modern” agriculture similar to any other technological progress or, on the contrary, if they bring about a radical change for agriculture practices and food production systems. In other words, the question is whether GMOs will be an additional step towards the promotion of industrialized monoculture and large scale farming practices in Europe, thereby putting extensive farming systems especially in an enlarged Europe more under pressure or is reality just much more complex?

This new technology raises some questions and among them the following: Do we want GMOs in Natura 2000 sites? Is it possible to promote extensive farming systems and let them co-exist with GMO fields? What about food exports, trade and commercial relations including GMOs, food quality and labelling in general? To help the decision making process , WWF Switzerland commissioned this report in order to stimulate the debate and help people make their own opinion.

This report does not give any direct answers to the above questions. Its objective is to analyse issues concerning the GMO debate in Europe and also in some aspects worldwide. It gives arguments to help the reader take position. It also gives an overview of the interests at stake. This is crucial since a vote concerning the adoption of a moratorium on the commercial use, and release of GMOs in agriculturewill take place in Switzerland in november 2005 or march 2006.

This report is also designed to inform people that have not had the opportunity to work on GMOs and to develop the skills of everybody who is interested in this area. The chapters can be completed by the reader’s own documentation and experience.This report is not therefore a static and once for all written document. It is neither an official WWF position on GMOs but a contribution to this crucial debate.

I hope you will enjoy reading it.

*Geneva, June 2005*

***Walter Vetterli***, Chair of WWF European agriculture and rural development team and Head of WWF Switzerland Alpine Programme

# Summary


**1. Economic issues**

- **Large pesticide and seed companies need GM0 market development**

The pesticide business is a mature one. The companies have a crucial need to expend GMO markets, to support pesticide use and to have new profit boosters. Most of the seed companies belong to pesticide companies also producing GMOs. In front of those constraints, there is an evident pressure from the US government and industry to expand (an acceptance of) genetically modified plants around the world. Europe based companies are not less pressuring, but they behave as followers. The global pro-biotech campaign is conducted through international trade organisations (US challenge of the EU policy at WTO), scientific networks or support of public campaigns, and also through bilateral pressures.

- **The lack of clear evidence of the economic benefits of GMOs feeds European scepticism**

In the US there is a lack of evidence of the economic benefits of GM crops for farmers after six years of commercial planting, despite industry assertions. In Spain, where GM crops have been cultivated commercially since 1998, on 25 000 ha now, benefits are still to be proven while contamination is occurring.

- **International opposition as a financial risk factor for industry**

Industry and large farming sector pressure on political and regulatory authorities as well as the lack of evident benefits for people stimulate the resistance or reticence of citizens. On a global level, many international and local environmental NGOs, consumer and farmer organisations address the political and scientific negative consequences, weaknesses, or uncertainties of GM agriculture/technology. The most important resistance can be found in Brazil, India, Australia and Western Europe.
Social, political but also economic turbulences generate an unstable business context, which is considered as an important factor of financial risk for bank analysts. The financial community is cautious with agri-biotech investments.

**2. Environment and health safety issues**

- **Reliance on pesticides: an agronomic, environmental and health problem**

The marketing of seeds genetically engineered to be resistant to a herbicide, induces the use of the herbicide from the same company. According to existing data, the claimed reduction of pesticide use with GM crops is not proven. GM agriculture remains heavily reliant the use of pesticides. The generalisation of the use of broad-spectrum, high volume herbicides can amplify the negative impacts already connected to herbicide use (weed and insect resistance (for Bt crops), toxic residues in soil, food and water). Pesticide health risks should be incorporated into the GMO health risk analysis.
These health risks are characterised by long term and crossed effects of human exposure to pollutants as well as immediate impacts like poisoning.

- **GMO environmental impacts: a threat for biodiversity**

The existence of possibly adverse impacts of GMOs on the environment and the lack of adequate information are today widely recognised.Concerns include possible escape of GM plants or transgenes into the environment, the impact of broad-spectrum herbicides used with the herbicide tolerant GM crops on the countryside ecosystems, and the impact of *Bacillus Thuringiensis* toxin produced by Bt crops on non-target species. Experts disagree on the importance and irreversibility of these impacts and on the implication of current knowledge or lack thereof on policy making.

- **Serious concerns on GMO potential health risks**

No harmful impact on human health caused by the consumption of GM food has been proved so far but some of partial, indirect evidence points to risks. The most serious concerns are related to the possible

allergenicity and toxicity of GM food (due to limited controllability of gene expression) and to the spreading of antibiotic resistance (due to horizontal transfer of genes to human intestinal bacteria). Official health risk assessment is denounced as very limited and based on selective knowledge. To date experience suggests that possible health damage would be connected to long-term and/or massive consumption of GM food (not acute harmful impacts). As in the case of pesticides, the consequences of daily exposure to low doses are a serious issue.

**3. Regulatory and political issues**

➢ **The European Commission wishes to suspend the moratorium as soon as possible**

Since 1998 there has been a moratorium on the authorisation of the release of GMOs into the environment and a de facto ban on the commercial growing of any GM crops in all EU member states except Spain. This policy has to a great extent been the result of European public mobilisation against GMOs. There are however other forces influencing the EU policy, namely pressure from the US government, US and European industry in favour of biotechnology.

As a result, the moratorium has been suspended. Four main issues had to be solved in the new legislative framework as a condition for suspending the moratorium:

- accountable authorisation procedure,
- traceability and labelling of GMOs and derived products,
- liability for possible harm related to the use of GMOs,
- co-existence of GM and non-GM agriculture.

The first two issues have been dealt with, at least on the legislative level of the EU, whereas *liability* and *co-existence still remain* unresolved and highly controversial. They are placed within the competence of the member states on account of the substantial differences between countries and regions.

➢ **Coexistence as real scale experiment will be a major focus of the mobilisation**

The lack of practical experience with the control of contamination (on a low level) makes coexistence measures a kind of real scale experiment. Some GMO opponents reject on principle any legislation that allow GMOs into Europe. Other opponents tend to accept the new traceability and labelling legislation, and try to block GMOs through consumer rejection and opposition to co-existence. For critics of GM agriculture (for political and safety reasons) any contamination, especially of organic production, is incompatible with the idea of co-existence.

At this stage, the sovereignty issue is at stake.

Member states will have to define liability and implement coexistence. But the right of member states and regions to claim to be GMO free is already a subject of political and legal conflict with the European Commission.

➢ **There are multiple stakes in the GMO controversy**

From health risks to the general questioning of the modern pro-growth orientation, the diversity of stakes is an important factor of strong and persistent public mobilisation. A key role in the mobilisation has been played by environmental and consumer organisations and farmer unions.

Public mobilisation has been able to influence governmental and commercial policy (EU moratorium, retailers' ban on stocking GM products), and the GM technology (marker genes showing resistance to antibiotics have been abandoned) this situation will persist due to the combination of uncertainty and irreversibility concerning contamination.

➢ **Towards a new moratorium in Europe?**

The current difficulties caused by the ratification of the European constitution may facilitate a de facto new moratorium: local authorities adopting their own moratorium, disagreement among member states paralysing GM variety adoption procedures and the EC having the last word with a weakened legitimacy.

# Part I. Economic dimensions

**1. Industry needs GMO market development**

The pesticide business is a mature one. The companies have a crucial need to expend GMO markets, to support pesticide use and to have new profit boosters. Most of the seed companies belong to pesticide companies also producing GMOs. To overcome the resistance of the European market, GMO industry puts pressure on developing countries and commodity providers to Europe, like Brazil to force them to adopt the GMO model.

**2. The global pro-biotech campaign**

There is an evident pressure from the US government and industry to expand (an acceptance of) genetically modified plants around the world. There is similar pressure from Europe based companies, but they behave as followers. The global pro-biotech campaign is conducted through international trade organisations (US challenge of EU policy at WTO), scientific networks or support of public campaigns, and also through bilateral pressures.

**3. High financial risk**

Industry attempts to have GMOs adopted and to facilitate GMOs free trade generate a lot of social, political but also economic turbulences. This instability is considered as an important factor of financial risk for bank analysts. The financial community is cautious with agri-biotech investments.

**4. International arenas**

The WTO is supposed to implement the principle of trade liberalisation including the trade of GM seeds and food products. The Cartagena Protocol on Biosafety came into force on September 11 2003, after its ratification by more than 60 countries. The protocol stipulates that national authorities can reject imports of genetic material if it represents a risk for human health and the environment. The WTO and Cartagena Protocol on Biosafety are driven by conflicting logics: Trade versus Precautionary Principle. The issue is about sovereignty. Legally, it is possible to consider that the Protocol should take precedence over the WTO in any dispute: because it is specific and more recent than theWTO.

**5. International opposition**

Industry and large farming sector pressures on political and regulatory authorities stimulate the resistance or reticence of citizens. On a global level, many international and local environmental NGOs, consumer and farmer organisations address the political and scientific negative consequences, weaknesses or uncertainties of GM agriculture/technology. The most important resistance can be found in Brazil, India, Australia and Western Europe.

**6. The lack of clear evidence of the economic benefits of GMOs feeds European scepticism**

In the US as well as in Spain, there is a controversial lack of evidence of the economic benefits of GM crops for farmers, despite industry, public research and administration assertions.

## Chapter 11. Seed and pesticide industry: economic issues

### i. Questions related to the item

- What is the economic and financial situation of this industry ?
- What are the consequences of this economic and financial situation ?
- What economic role can GMOs have for industry ?

### ii. Issues at stake

- Most of the seed companies belong to pesticide companies also producing GMOs.
- The pesticide business is a mature one.
- Those companies have a crucial need to expand GM markets, to support pesticide use and to have a profit booster.
- Their pressure on political and regulatory authorities stimulates resistance or reticence of citizens.
- This resistance is considered as an important factor of financial risk for bank analysts.[1]
- The financial community is cautious with agri-biotech investments.

### iii. Elements for analysis

- **The world pesticide business is declining[2]**

*The world sales*

In 2003, agrochemical sales were at US $ 26.7 billion. This corresponds to a 0.3 % decrease compared with 2002. In 2002 agrochemical sales were at US $ 27.7 billion. Accounting for inflation and currency shifts, Agrow estimated that agrochemical sales had actually fallen by 1.5% in 2002. In 2001 the market also shrank by 4.1%.

Despite this long term trend, the industry forecasts an expansion of about 0.4% per year over the next four years. This very modest forecast would depend essentially on GMO markets as the pesticide market long term trend is a declining one.

By region, in 2003, compared to 2002, pesticide sales (US $ 26.7 billion) have evolved in the following way:

- Western European agrochemical sales (24% of the total) showed a stagnation at US $ 6.3 billion;
- The North American market (29% of the total) , the world's largest, shrank by 6% to US $ 7.8 billion; this evolution relates mainly to the fall in price of glyphosate, a herbicide which was , the main beneficiary of GMO use, due to competition from generic products[2];
- Latin American agrochemical sales (16% of the total) experienced the largest increase, with sales up by 23.5 % to US $ 4.2 billion ;
- The Asia/Pacific market (22% of the total) fell by 18.3 %, in 2003, to US $5.8 billion.

By kind of products in 2003, compared to 2001:

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[1] Assouline G., Joly PB., Lemarié S., 2002 : Plant biotechnology and agricultural supply industry restructuring. In *Int.J. Biotechnology*, Vol. 4, n° 2/3, p. 194-210.
www.uipp.org
2 www.panna.org
3Kline & Company, USA, Press release, Dec 10, 2003: GM Seeds, Generic Glyphosate Taking a Bigger Bite Out of Major Crop Protection Chemical Markets.

- Fungicide sales represented 22% of the total market;
- Insecticides were 25% of the total;
- Herbicides constituted the bulk of the world pesticide sales, accounting for 50% of the total in 2003 while the proportion was 46.6% of the total market in 2002.

**Data on the most important agrochemical companies**

| Company | Total sales | | | Pesticide sales | | | Change (%)[4] in pesticide sales | | Seed sales | | | Change (%) [3] in seed sales | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 /2003 | 2003/ 2002 | 2004 | 2003 | 2002 | 2004 /2003 | 2003 /2002 |
| Monsanto * | na | 4936 | 4940 | na | 3031 | 3380 | na | -11.5 | na | 1905 | 1560 | na | +22.1 |
| Syngenta * | 7269 | 6525 | 6197 | 6030 | 5421 | 5260 | +11.2 | +3.0 | 1239 | 1004 | 974 | +23.4 | +3.1 |
| Ind. Crops | | | | | | | | | 648 | 598 | 538 | +8 | +11.1 |
| Horticult.. | | | | | | | | | 591 | 506 | 436 | +17 | +16.0 |
| Bayer ** | 29758 | 28567 | 29624 | 4957 | 4801 | 4002 | +3.2 | +20.0 | 311 | 271 | 90 | +14.8 | +200.1 |
| Dupont * | 27340 | 26996 | 24006 | 6200 *** | 5500 *** | 4500 *** | +12.7 *** | +22.2 *** | | | | | |
| Dow * | 40161 | 32632 | 37609 | 3368 *** | 3008 *** | 2717 *** | +11.9 *** | +10.7 *** | | | | | |
| Basf ** | 37537 | 33361 | 32216 | 3355 *** | 3178 *** | 2964 *** | +5.6 *** | +7.2 *** | | | | | |

(*) in US $ millions (**) in Euros millions (***) consolidated with seed business
Sources: [4], [5]

Some remarks

For pesticide and seed businesses, 2004 was a much better year than the previous ones.
- The highest growth rates are those of Dupont (+ 12.7%) and Dow (+11.9%) which present consolidated data, including mainly pesticides and seeds;
- Looking at the pesticide and seed markets, the partial data shown above indicate a rather dynamic evolution for the seed one: + 22.1 for Monsanto in 2003, + 14.8% for Bayer in 2004 , + 15% for a subsidiary of Pioneer Hi-bred (Dupont);
- In terms of structure,the Monsanto case is symptomatic: in 2002, the GM seed and trait businesses represented 31.6% of the overall sales, while in 2003 the proportion rose up to 38.6 % of a stable overall sales amount.

These companies control about 90% of the US $ 27 billion pesticide market and more than 60% of the world seed market. Monsanto markets more than 90% of GM seeds.

**The Monsanto case**

The Monsanto case is a very significant one.

The Monsanto herbicide called Roundup now represents an important part of the world herbicide market. It is the only chemical product sold by Monsanto: Monsanto is a mono-product pesticide producer. It seems to control over 90% of the market for biotech ‘traits’, the genes that transform conventional seeds into GM seeds. Those traits are licensed to most of the world’s major seed companies.

[4] without taking into account currency exchange fluctuations
4 without taking into account currency exchange fluctuations
[4] Agrow: World Crop Protection News, February 26, 2003, March 28, 2003
[5] Annual reports

In 2003, financial analysts[6] were saying that Monsanto's progress had been hampered by heavy spending, management shake-ups and the unexpected costs of trying to win GM crop world market. These analysts pointed to several problems:

- The resistance of Europe as a blocking factor, generating snowball effects on other markets.
- The heaviness and cost of the company infrastructure built for a global market.

While Monsanto devotes 80% of its US $ 500 million research and development annual spending to biotech traits, the figure for competitors is approximately 20%.

Competitors are coming out with new products which will challenge Monsanto's dominance of GM corn and cotton. Monsanto also faces declining profits from its herbicide, as its patent expired in 2000 and its price continues to drop. In 2002, Monsanto lost US $ 1.7 billion and in 2003, the net profit amounted to 68 US $ millions.

An analyst at UBS Warburg wrote about Monsanto:

> …There are a lot of risks. The market is worried about competition. The market is worried about costs. The market is worried about them getting paid for their traits. They've got a big hill to climb…[7]

Other signals have been worrying the financial community[8], such as:

- The amount of money flowing from GMO companies to US politicians as well as GMO companies' representation in US regulatory agencies. This creates a large bias potential and reduces the ability of investors to rely on safety claims made by the US Government.
- Analysts fear the enormous financial losses which could be induced by the very likely genetic contamination of human food and unsolveable insurance problems.
- Other threats to future earnings include new product and reputation risks. Several Monsanto products intended for human consumption have failed. The company had to cancel its GM wheat projects in front of the intense resistance from many US and Canadian farmers who feared a dramatic decrease of their wheat exports if GM wheat were introduced.
- Monsanto continues to face reputation problems around the world due to factors including the impression that GM foods are US products imposed on the rest of the world by the US Government and World Trade Organisation, protests in developing countries and numerous lawsuits against farmers[9].

*…In light of the issues and risks noted above, the firm may still be overvalued. Monsanto could be another disaster waiting to happen for investors. If the firm does not take steps to mitigate its substantial market risks, for example by diversifying its GE-focused strategy, further investor losses seem likely. Given available knowledge about company risks, financial analysts and asset managers may be hard pressed to explain their current positions on Monsanto…*[10]

To convince opinions, regulatory bodies, politicians, the financial community and the industry communicate on the huge technological potentialities of biotechnology for the future: production of pharmaceuticals from GMOs, and new nutritive or agronomic properties. This euphoric discourse on technology saving the world was the same 40 years ago for pesticides and 15 years ago for the current GMO generation. The same promising stories. These future generations of GMOs are not connected to the current GMO marketing allowance demands: 80% of those demands are for herbicide resistant crops.

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[6] *New York Times* - 31 May 2003 http://www.nytimes.com/2003/05/31/business/31SEED.html
Monsanto Struggles Even as It Dominates By David Barboza

[7] *New York Times* - 31 May 2003

[8] Innovest report, April 2003: Innovest Strategic Value Advisors: Monsanto Investor Risk Report.
Report commissioned by Greenpeace. www.btintenret.com/~nlpwessex

[9] As the well-known Percey Schmeiser, non-GM oil seed rape grower, contaminated by GMOs and sued by Monsanto for illegal GM seed planting.

[10] *New York Times* - 31 May 2003

## iv. Basic sources and references


- Agrow: World Crop Protection News, February 26, 2003, March 28, 2003.
- Annual reports of the companies
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- New York Times - 31 May 2003 http://www.nytimes.com/2003/05/31/business/31SEED.html Monsanto Struggles Even as It Dominates By David Barboza.
- PANUPS <panups@topica.email-publisher.com>Subject: PANUPS: Agrochemical Sales Flat in 2002 Date: Mon, 14 Apr 2003 13:45:57 –0700 www.panna.org
- www.btinternet.com/~nlpwessex/Documents/usdagmeconomics.htm

## Chapter 12. GMOs in the world: West, East, South

### i. Questions related to the item

- What are the environmental, social and political impacts of the worldwide expansion of agricultural biotechnologies?
- Can the sovereignty of national or supranational states in relation to biotechnology be assumed, and how?
- What is the potential for democratic decisions/choices related to biotechnology on a global level?

### ii. Issues at stake

- There is evident pressure from the US government and industry to expand (an acceptance of) agricultural biotechnologies around the world.
- The global pro-biotech campaign is conducted through international trade organisations (US challenge of the EU policy at WTO), scientific networks (third world scientists taking up fellowships in the US or running research centres in their countries supported by the US) or through support of public campaigns.
- The ideology related to GMO expansion (global technological solution, feeding the third world) is very similar to the "green revolution" ideology years ago.
- This pro-biotech movement is challenged and opposed, also on a global level, by a number of environmental NGOs and farmers' organisations. They address both and inseparably the political and scientific negative consequences, weaknesses, or uncertainties of GM agriculture/technology.
- The conflict over GMOs takes place worldwide. The most important opposition can be found in Brazil, Canada, India, Australia and Western Europe.

### iii. Elements for the analysis

- **Global GMO agricultural production in numbers[11]**

The global GMO area has been gradually increasing since 1996.
In a recent report ISAAA insists on a new trend: for the first time, the absolute growth in GM crops was higher in 2004 in developing countries (+ 7.2 million hectares) than in developed countries (+ 6.1 million hectares). According to ISAAA, Argentina and Brasil are included in developing countries. In 17 countries, 8.25 million farmers have been planting GM crops in 2004. Companies are doing their best to transform large countries like Brasil, India and China into driving forces of the GMO market[12].
GM crops proponents present these numbers as evidence of a steadily increasing GMO agro-industry. They point to the fact of the expanding global GMO area and to an increase in the number of states commercially growing GM crops that moved from 16 in 2002 to 17 in 2004.

Conversely, however, the numbers show a confinement of the industry to four countries, or may be two countries, the US and Argentina (planting 80% of the total GMO area).
On a broader scale, Northern America represents 65 % of the total area and Latin America 28%..

[11] Based on the information from the report "Preview: Global Status of Commercialized transgenic crops: 2002" (James 2002), which was published by the pro-GMO organisation International Service for the Acquisition of Agri-biotech Applications. Overview numbers available at: http://www.isaaa.org/kc/Bin/gstats.
[12] ISAAA, Philippines, January 2005: Worldwide Biotech Crops Experience Near Record Growth.
In www.genet-info.org/genet/2005/Jan/msg00017.html

But the main dissent is in fact related to the question of what the numbers can say about the benefits of GM crops for farmers and what is the fuel for spreading GM crops.[13]

**Worldwide GMO planted area** (*)[14]

| | 2004 | 2003 | 2002 | 2004/2003 (%) | 2003/2002 (%) |
|---|---|---|---|---|---|
| USA | 47.6 (59) | 42.8 (63) | (66) | +11 | |
| Argentina | 16.2 (20) | 13.9 (21) | (23) | +17 | |
| Canada | 5.4 (6) | 4.4 (6) | (6) | +23 | |
| Brasil (**) | 5 (6) | 3 (4) | | +67 | |
| China | 3.7 (5) | 3 (4) | (4) | +23 | |
| Paraguay | 1.2 (2) | 1st year | | | |
| Others (***) | 1.9 (3) | 0.6 (2) | (1) | + 216 | |
| Total | 81 (100) | 67.7 (100) | 58.7 (100) | + 20 | +15 |

(*) in millions of hectares (and % of the world arable area)
(**) the sowing season being October, the data correspond to the year 2004/2005 and 2004/2003
(***) Others are (in % of the total area): India (1), South Africa (1). Mexico, Spain and Philippines , Uruguay , Australia , Rumania have been planting more than 50 000 ha each in 2004.

**Main GM crops in 2003**[15]

| Crops | 2003 (in hectares) | 2003 (% of the total GM area) |
|---|---|---|
| Soybean | 41.4 | 61.1 |
| Maize / corn | 15.5 | 22.9 |
| Cotton | 7.2 | 10.7 |
| Oilseed rape/canola | 3.6 | 5.3 |
| Total | 67.7 | 100.0 |

GM crops are characterised by two traits, :

- Herbicide tolerant crops (soybean, rapeseed, cotton, maize) develop a resistance to specific herbicides. They count for 75% of the GM crop global area.
- Bt crops (maize, cotton) are modified to produce an insecticide and count for 17% of the area. They may also be used in combination in some crops (cotton, maize).

- **United States**

The US is the home country of GMO technology. The majority of biotech industry is American, and it is also the US government that provides the technology with global political support. Commercial cultivation of GM crops started there in 1996 and since that time the GMO crop area has increased. As indicated in the overview, the US counted for 66% of the GMO crop global area last year, with Roundup Ready soybean being the main crop. The US conducted 70% (6 937) of the world's 9 822 GMO crop field trials from 1986 to 1999, with Canada in the second place having conducted 8% (Uchtmann, Nelson

[13] For example cf. Watchdog refutes claims of rapid global growth in GE crops.
At: http://www.twnside.org.sg/title/5266c.htm
[14] www.isaaa.org, 2005. In Inf'OGM Bulletin January 2005, n°60
[15] Le Monde – Dossiers et Documents – n°3 – September 2004

2001). In 2003 81% of soybeans and 40% of maize planted are GM.[16] As estimated by the Sierra club, over 60% of all processed foods purchased by US consumers were manufactured with GE ingredients in 2001.[17]
Compared with the majority of other countries, GMO technology is conceived by the legislation as not posing any special environmental or health risks, and is thus regulated as any other agricultural or food production. There are currently no labelling requirements.[18]

These facts do not mean that there is no public opposition to agricultural biotechnologies in the US. It was, however, only at the end of the 90s that opposition gained in strength and visibility. For example, the Sierra Club, the largest grassroots environmental organization in the US, set up its Genetic Engineering Committee only in 1999.[19] To get an idea of the spectrum of movements concerned with the issue, it is illustrative to look at the composition of the Turning Point Coalition,[20] which started the anti-GMO campaign in 1999 by publishing an advertisement in the New York Times. It involves 11 science expert organisations, 29 food and agriculture, 45 environmental, 4 consumer, 4 animal rights, and 7 left labour organisations (Reisner 2001).
There are two recent issues that have to be mentioned. First, a report "Seeds of doubt" published by the UK based Soil Association, which is a detailed inquiry into the effects of GM crop introduction into US agriculture. In relation with the three crops cultivated in the US, the report points to the following problems:

- Herbicide tolerant (RoundupReady) soy: At least six percent lower yields, greater reliance on herbicides, new emerging weed problems, and plant health and structural problems in certain conditions;
- *Bacillus Thuringiensis* (Bt) maize: Practical constraints on growing Bt maize, lost export markets, and possible animal feed problems;
- Herbicide tolerant rape: Greater herbicide use, herbicide resistant volunteers, end of most organic rape production in Saskatchewan, lost export markets.

According to the authors, the most important problem however is the widespread contamination of the farmland and production chain, which severely threatens any possibility of non-GM production. Having found out all the difficulties, the authors wonder why US farmers adopted GM crops so easily and why they keep growing them. They indicate several reasons. At the beginning, farmers made a rather uninformed choice, which was among other factors influenced by the fact that many popular seed varieties started to be available only in the GM form. And now, a few years later, they find themselves in a kind of GM lock-in, with a shortage of good non-GM varieties, crop contamination risks, lack of access to premium GMO-free markets, and a risk of accusations of patent infringement).

According to a report made by the Center of Food Safety entitled "Monsanto vs. US Farmers", Monsanto has filled 90 lawsuits against American farmers, since 1997, which means 147 farmers and 39 small business or farm companies. According to the study, the company has set aside an annual budget of US $ 10 million and a staff of 75 experts devoted solely to investigating and prosecuting farmers for supposedly patent violation. Another aggravating circumstance is that some farmers have been sued after their fields were contaminated by pollen or seeds from someone else's genetically engineered crop[21].

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[16] According to Genetically Modified Crops in the United States (2003), a report published by Pen Initiative on Food and Biotechnology, which claims to be 'a nonprofit, nonpartisan research project whose goal is to inform the public and policymakers'. But the rhetoric of the report is implicitly pro-biotech.
[17] http://www.sierraclub.org/biotech/report.asp
[18] An initiative to introduce a special GMO legislation appeared however even within the representative political system (cf. Jones 2003).
[19] This committee runs a rather moderate campaign for regulatory reform that would ensure safety testing, labelling of GM crops, mandatory environmental impact statements for every ecosystem into which any new GMO is to be introduced, and which would address the liability issue. See http://www.sierraclub.org/biotech/report.asp for the basic information on their position.
[20] http://www.turnpoint.org
22 http://www.centerforfoodsafety.org/Monsantovsusfarmersreport.cfm

There are of course American farm organisations that support GM crop agriculture. They have recently expressed their position, for example, in relation with the new European legislation.[22] Being technologically and economically locked in GM agriculture, as indicated in the Seeds of Doubt, they are interested in defending GM crops as substantially equivalent to conventional crops. If GM crops were globally treated as equivalent, it would improve the situation of American GMO exporters and lighten the contamination issue.

The second current debate worth of note is the case of GM wheat. Monsanto applied for authorisation of GM wheat for cultivation last year, both in the US and Canada. For several years the wheat boards in both countries opposed the introduction of GM wheat. The US board finally changed its position, but the Canadian board went on with its opposition.[23] Pointing to a possible increase in herbicide use, weed resistance and contamination, it even asked Monsanto to withdraw the application voluntarily.[24] References to the negative experience with GM oilseed rape in Canada are often used in the debate.

- **Brazil**

Brazil is a very important agricultural exporter, especially of soybeans, for the global market. In 2003, it exported soybeans and derived products to the US for US $ 8.2 billion, i.e. 43.8% more than in 1997. It is a strategic country of interest for the biotech industry to introduce GM crops.
Firstly, it could bring a substantial direct profit for GM seed producers[25] and, secondly, it would cut the offer of GMO-free soybean on the global market and close the option for non-GM crop demand from Europe and Japan. And indeed, Brazilian soybean export to the EU increased from 3.1 million tonnes in 1996 to 8.9 million in 2002.[26] On the other hand, there is evidence of GMO presence in Brazilian soybean production. Campaigners from 'GM free Brazil' speak about GM contamination,[27] while Monsanto calls it black market and uses it as an argument for legalisation of GMOs in Brazil.[28]
In April 2003, the Brazilian government adopted a new labelling regime, which requires all GM products, including animal feed, with detectable genetic material, to be labelled above a 1% threshold. Due to the high contamination of the soybean harvest of 2003 it requires that all products for human or animal consumption of this harvest be labelled with "may contain GM soy".[29]
Roundup Ready soybean (Monsanto) has been approved by the Brazilian Biosafety Agency in 1998, but following Federal Court decisions, commercialising the seeds before the government issued biosafety and labelling regulations for GM crops was prohibited.
On 25 September 2003, the Brazilian President signed a provisional measure allowing the production of transgenic soybeans till the end of 2004.[30] This decision was taken after a long lasting conflict that opposed:
- within the Federal government, the Minister of Agriculture close to soybean producers and the Ministers of Environment and Rural Development, who asked for impact assessment studies before any allowance;
- large soybean producers from the Southern State of Rio Grande do Sul and small farmers, landless farmers and consumers associations, supported by environmental organisations.
Opponents to this legal decision put forward the following arguments:[31]

- There is no economic reason for taking such a decision. Brazil gains a clear advantage on the soybean world market from its non-GMO positioning.

[22] See e.g. Johnston (2003) for The American Soybean Association, or American Farm Bureau Federation press release from 02/07/2003.
[23] The battle over GM wheat. The Seedling of April 2003.
[24] Edwins (2003) in The Western Producer, or Goldberg (2003) in The Guardian
[25] One US analyst predicts profits of US $ 1 billion if Monsanto captures 50% of the Brazilian soybean market (Bell 1999: 2)
[26] EC press release of 13/05/2003
[27] The figures indicating proportion of the contaminated production differ. It may be 8% according to the campaigners GM Free Brazil (GM Free Brazil, 1, 25/06/2003), up to 30 % according to a source AS-PTA National referred in The Seedling, April 2003 (Support Brazil's anti-GM position).
[28] Judge lifts Brazilian Court Ban on Genetically Modified Seeds (Wall street Journal 13/08/2003).
[29] Cf. Governments world-wide require regulation and labelling of GMOs (Greenpeace 2003)
[30] Le Monde, 28/09/03
[31] Folha de Sao Paolo, 05/10/03

- For that specific reason, important states producing soybeans, like Parana or Santa Catarina State, are declaring their territory GM-free to keep this competitive advantage. The GMO-free positioning of Parana will cause problems to GM soybean exporters as they use Paranagua as a soybean export harbour.
- Brazilian conventional soybean yield (2.57 kg/ha), which is higher than the US average yield (2.52 kg/ha), does not justify any option in favour of GMOs.
- The enthusiasm of the Southern soybean producers for soybeans may vanish next year, as GM seeds were imported more or less illegally from Argentina until now, without paying the premium price feeding the industry royalties. If transgenic soybean is to be legalized, property rights will be negotiated between Monsanto, producers and the government. Producers expect the premium price to be 50% over the conventional seed price (56% in the US).
- No serious and reliable impact assessment studies have been carried out in the country.
- For the crop 2002/2003 which has been allowed for the Brazilian market in extremis, no serious control could be done by public administration, making labelling impossible.
- Last but not least, the broad-spectrum herbicide Round Up is not allowed by the Pesticides Assessment Committee to be applied as a post-emergence herbicide on soybean.

Early 2005, a new Provisory Measure (PM), signed by President Lula, allowed commercialisation of the harvest of transgenic soya in Brazil.

This MP put some barriers on Monsanto royalties strategy in Brasil[32]. Most of the contaminated seeds used by the farmers in Brazil have been smuggled from Argentina and then multiplied by them, so that the company can not prove that the grains used by the producers are the ones that were genetically modified by the corporation. After the signature of the MP, the company decided to negotiate with the farmers and producers in order to make the collection of its royalties possible, which should be R$ 1.20 (approximately US$ 0.40) per bag. However, a producer co-operative from Rio Grande do Sul (state from the South with the largest farming of transgenic soya in the country) took the initiative of going to Court with a lawsuit against the charges and got a favorable sentence at first instance. Monsanto had already appealed against the sentence. Now the company is threatening, in case it is not able to collect its royalties from the farmers, to charge the exporters, who would, then, impose the costs on the producers. In Spring 2005, an agreement was signed between the ministries of agriculture of Brasil, Paraguay, Argentina and Monsanto to solve this royalty issue. The payment will be done at production level, will be provisional and in form of compensation, as most of the seeds have been sold illegally[33]. A study, made by the Polaris Institute (www.polarisinstitute.org), alerted that, starting in 2004, Monsanto expects to begin collecting larger royalties from farmers via soya crushers in South America. By 2008, the royalty collection from poor farmers would reach the amazing amount of US $ 200 million. These are the real novelties that agribiotech has brought to farmers, producers and society.[34]

In March 2005, the liberation of GMOs in Brazil, becomes legal with the approval of the Biosafety Bill at the Deputies Chamber, followed by the President Luiz Inácio Lula da Silva's signature of the law. GMO imports especially from Argentina are also freed.

Despite this federal governement's pro-GMO policy , important soybean producer and exporter states, the most important being Parana, re-asserted their non-GMO policy.

- **Argentina**

Argentina is the second biggest GM crops grower. It massively adopted Roundup ready soybean (resistant to glyphosate herbicide). In 2001/02 Argentinian farmers planted 11.5 mha of GM crops, i.e. 43% of the

[32] Even before the signature of the PM, the US Embassy sent a letter to the President, asking him to reject part of the regulation that makes it difficult for Monsanto to collect royalties for its technologies. Lula refused to remove the article.

[33] Valor Econômico, 02/05/2005

[34] GM-FREE BRAZIL . Rio de Janeiro, January 26, 2005.

total farming area, 13.9 mha in 2002/03 and 16.2 in 2003/2004. Since 1996, Argentina has transformed progressively from a diversified agriculture to almost a one crop country.
Argentinean soybean is now GM. Its area has doubled. And soybean became one of the main foreign currency earners (some 30 million tons exported) . Meanwhile, between 1996 and 2002, the corn area fell from 23.8% to 20.8%, and the sunflower seed area fell from 12.6% to 5.5%.
The number of small and medium farms fell by more than 30% between 1992 and 1999, and the average farm size increased from 243 ha to 357 ha.
Finally, according to a Greenpeace report[35], 18 out of the 37 million inhabitants are now unable to meet their basic diet needs. Obviously, the reasons for this situation are not exclusively related to GM country strategy: they are social and economic. But the GM option has contributed to raise the cost of basic food.
There are several reasons given to explain this evolution. Mainly, first, the financial and economic crisis in the country have reduced farmers' access to financing and led them to plant crops considered to have low production costs and high prices. Soy is cheaper to produce than corn, according to Carlos Salvador.[36] Secondly, during Menem's presidency, the government was very open to large companies' pressures to accept and develop GMOs.
The radical shift from agricultural diversity to homogeneity makes Argentina very dependent on factors like the volatility of GM soybean international prices, US large export companies' strategy, and agronomic risks related to mono-crops (soil, disease, weather).

A report produced by the FAO has studied the cost of GM–non GM segregation in Argentina[37].
For a segregation at 0.9%, the needed investment would be US$ 40 million per ton of soybean and US$ 10.2 million for a segregation at 5%.

- **Africa**

"Feeding the world" is one of the loudest slogans of agricultural biotechnology proponents. It sums up the ideology, which appeared years ago in relation with pesticides, of technological innovation that can solve the problem of hunger and food shortage in the third world. Experience with the "green revolution" shows, however, that the problem is connected to social and political conditions rather than (purely) technological ones. Many observers alert that the invasive (bio)technology would only worsen the overall social and environmental situation.[38]
As for the African continent, the issue of GMOs gained global public attention in 2002 when several African countries hesitated to accept food aid from the US because it consisted of GM products. Whereas Swaziland and Lesotho accepted GM maize, Mozambique, Malawi and Zimbabwe insisted that it should be milled into flour, so that farmers could not plant the seeds. Zambia, with almost 3 million hungry, rejected it in any form.[39] The African states got political support from the EU to fix their level of protection against dissemination of GMOs. And later the EU also criticised the American food aid policy.

*[Food aid] should not be about trying to advance the case for GM food abroad (while staying away from the international consensus such as the Cartagena Protocol), or planting GM crops for export, or indeed finding outlets for domestic surplus, which is a regrettable charasteristic of the US food aid.*
(EC press release of 13/05/2003)

The GMO controversy in Africa started however before 2002. It was in 1998 that delegates to the UN Food and Agriculture Negotiations[40] from nearly twenty African countries issued a statement "Let Nature's Harvest Continue". It reacted directly to the Monsanto's declaration "Let the Harvest Begin" in support of genetic engineering which the African leaders were asked to sign. The statement rejected GM

[35] Greenpeace, 2002: Record harvest – record hunger: Argentinean experience.
[36] Head of the Association of Agricultural Technology Chambers, in Rise of soy makes Argentina a mainly one crop country, 18/10/2002.
[37] www.fao.org/ag/AGP/AGPS/new.htm in Inf'OGM n° 60 – January 2005.
[38] For various evidence see Voices from the South (Hickey, Mittal 2003).
[39] Zambians starve as food aid lies rejected (The Guardian 17/11/2002).
[40] UN Food and Agriculture Negotiations on the International Undertaking for Genetic Resources, June 1998.

technologies for Africa with reference to the possible destruction of biodiversity, local knowledge and a sustainable agricultural system.[41]
The GM policies of African countries differ. While Zambia rejected the GM crop food aid the last year and other countries finally accepted but milled crops, South Africa, in however small amounts so far, grows GM maize and cotton commercially and Uganda is going the same way.[42] The progress of biotech in some countries coincides with intensifying interactions between African scientists and US based research centres during the recent years. For example, the International Service for the Acquisition of Agri-biotech Applications has its African Centre in Kenya. Its director is a Kenyan scientist F. Wambugu who was the first African to take up a fellowship at Monsanto research centre in the US in the early 90s. It is also illuminating to read these sentences:

*Moving research closer to its point of application will not only speed the turnaround of useful discoveries but should also increase farmers' acceptance of innovations.*
(The Economist 21/08/2003)

*Zambia, a country that shocked the world by rejecting genetically modified food donations when the country was starving, is showing some change in the approach. Recently scientists and academics at Zambia University developed a biotechnology society to help advocate technology in the country. The Biotechnology Outreach Society of Zambia (BOSZ) will mount an aggressive awareness campaign that will involve all stakeholders to discuss issues relating to biotechnology.*
(K. Chege, 19/08/2003)[43]

- **India**

GM crops entered India on a commercial scale only in 2002, when Bt cotton of Mahyco-Monsanto (Bollgard cotton) was approved for cultivation in several southern states. The governments of four states where the cotton had been mainly grown asserted however publicly after the first year that cotton had not performed well, and asked the Genetic Engineering Approval Committee to recall the seed.[44] A similar diagnosis can be heard from different NGOs and farmer groups.[45] Criticism points to drying and falling of squares without boll formation; reduced boll formation; small sized bolls; very short staple length; very little resistance to boll worm, and requiring 2-3 sprays for control of boll worm; not resistant to dry spells; low yields; low market value; cost-benefit ratio not on par with non-Bt cotton.[46] As a result, the GEA Committee in April 2003 withheld the sanction to cultivation for the northern Indian states. Some observers are however quite sceptical that it is possible to stop GM crop introduction to India in the long term.[47]

- **China**

China is the fourth biggest producer of GM crops, with 2.1 mha of Bt cotton cultivated in 2002. The country also imports significant amounts of soybean from which a large portion is GM (from the US and Argentina). Domestic biotech research is also growing: $112 million invested in 1999, 141 new GMOs developed in 2002, from which 65 went to field trials.[48] The Government is however cautious in terms of regulation. China has special GM legislation requiring authorisation of GMO release into the environment and mandatory labelling of all GMOs, including seeds, animal feed and food products containing GMOs (since July 2003). The regulation was preceded by a discovery of Greenpeace that Nestle was selling GM

[41] Cf. Let Nature's Harvest Continue in Voices from the South (Hickey, Mittal 2003).
[42] GM Foods, Keeping the Peace in Liberia (Taire in Vanguard, 15/08/2003).
[43] http://www.lifesciencesnetwork.com/news-detail.asp?newsID=4528
[44] India rejects Bt cotton for Northern India. The Seedling, April 2003.
[45] Various references can be found in Shiva, Jafri (2003).
[46] According to Laxman Rao, the Joint Director of Agriculture, Government of Andhra Pradesh, as cited in Shiva, Jafri (2003).
[47] Bt cotton: Winning a battle, but losing the war (Nair in The Hindu Business Line, 04/08/2003).
[48] Biotech debate I: Let a thousand GM crops bloom (Karplus in International Herald Tribune 08/10/2003).

products in China, although it has a GM-free policy in Europe.[49] In March 2003 the decision was announced to keep production GM-free in the largest soybean production provinces in Northeast China. According to Lim Li Ching, 32 companies confirmed to Greenpeace in July that they did not use GM ingredient in their products, and some local companies announced their commitment to eliminate them.[50]

- **Australia**

Australia is a crucial market for biotech companies, being the world's second-biggest oil seed rape producer after Canada. Although Bt cotton has been commercially grown in Australia for six years, Bt oil seed rape ("InVigor canola") was authorised only in June 2003. The approval however is not a consensual issue in the country.
- The Network of Concerned Farmers wished to keep the GM-free status for Australia. Now, they say, the GM-free status can only be regained through grain segregation, which would add 10% to their costs.
- The majority of the federal states, Tasmania, Western Australia, South Australia and New South Wales, declared a moratorium on GM crops. The only exception is Queensland.

The issue opposes the federal government, that issued the authorisation and also supports the US in the case against the EU GM policy at the WTO, and most of the state governments and farmers.[51]

[49] Greenpeace protests against Nestle´s double standards on genetically engineered food. Greenpeace press release of 06/06/2002.
[50] Food Producers in China go GM-Free. Science in Society press release of 04/08/2003.
[51] Australian farmers fear future without GM food ban (Fickling in The Guardian 20/06/2003);
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## Chapter 13. Economic un-sustainability at farm level

### i. Questions related to the item

- For what reason are farmers persuaded to plant GM crops ?
- In the countries where GM crops have been produced, which evaluation has been done?
- What are the benefits of GM crops so far?

### ii. Issues at stake

- In the US there is a lack of evidence of the economic benefits of GM crops for farmers after six years of commercial planting, despite industry assertions.
- In Spain, where GM crops have been cultivated commercially since 1998, on 25 000 ha now, benefits are still to be proven while contamination is occurring.
- There is a lack of proven benefits of GM varieties in comparison with conventional ones.

### iii. Elements for the analysis

- **Assessment of several years of GM crop growing shows a lack of evidence of economic benefits for farmers in the US**

*USDA Report Exposes GM Crop Economics Myth*[52]

The United States Department of Agriculture (USDA) released its own extensive analysis of the economic performance of GM crops in America. This report does not represent the pro-biotech official government position.

The USDA report[53] goes so far as to conclude that "Perhaps the biggest issue raised by these results is how to explain the rapid adoption of GE crops when farm financial impacts appear to be mixed or even negative." The USDA's latest detailed analysis of national farm data reveals that GM crops have not generally delivered an economic competitive advantage to US farmers - even though that is what many farmers themselves believe. The latest USDA report reveals for the first time from an official US government source using unequivocal language, that most of the basic economic claims made for GM crops are either false or suspect.

Based on its analysis of the most widely grown GM crop, soya, the report confirms that "Using herbicide-tolerant seed did not significantly affect no-till adoption". This finding is in stark contrast to the claims of those who have attempted to promote GM crops on the back of rising economic and environmental interest in no-till crop husbandry. As the USDA report points out, the no-till acreage in America had already been steadily rising before the introduction of GM crops. That existing trend has since simply continued. In fact to some degree it has subsequently stagnated according to the USDA analysis. It has never been necessary to grow GM crops in order to carry out no-till agriculture. In fact the countries that have been expanding no-till agriculture at the fastest rate in proportion to their total arable area are in Latin America, where only Argentina grows GM crops on a substantial commercial scale (no-till was introduced on large tractor-mechanised farms in Paraguay in 1990 and, by 1997, 51% of its total

[52] Griffiths M., Aug. 2002: USDA Report Exposes GM Crop Economics Myth
www.btinternet.com/~nlpwessex/Documents/usdagmeconomics.htm
[53] The USDA report ('The Adoption of Bioengineered Crops') is available from:
http://www.ers.usda.gov/publications/aer810/

cultivated area was 'no-tilled'. The relative figures in 2000/1 are for Paraguay 52%, Argentina 32%, Brazil 21%, and the United States 16%.)
In the end the USDA report endeavours to explain why there has been such a rapid uptake of GM crops in the US, although it refers to a possible 'convenience' factor. However, a separate study funded by Iowa State University and carried out in 1998 reveals that over half of the farmers who planted herbicide-tolerant GM soya did so because they believed that it gave them higher yields compared to conventional varieties. However, when the university analysed the harvest results of the concerned farms, they found the opposite was true, despite the farmers' belief to the contrary (it is in fact now recognised that genetic modification has actually reduced the yield potential of GM soya by inadvertently disturbing other aspects of the plant's functioning). A subsequent study from the University looked in detail at the on-farm financial performance of soya crops in Iowa. It confirmed that, after taking into account the costs relating to seed, herbicides, fertiliser, all machinery operations, insurance and a land charge "there is essentially no difference in costs between the tolerant and non-tolerant fields". However, because of their higher yields, the non-GM crops made a profit for their growers, whereas the GM varieties did not. The study suggests advertising pressure as one possible reason for the rise in the use of herbicide-tolerant soybeans despite their disappointing economic performance.

Another research carried out by the University of Nebraska[54] has confirmed the poor yield performance of GM herbicide resistant soya. In particular it concluded that the low yields appear to have been caused by the genetic modification itself and not by any adverse effect from the herbicide to which it had been engineered to be resistant:
*…Yields were suppressed with GR [glyphosate resistant] soybean cultivars.... The work reported here demonstrates that 5% yield suppression was related to the gene or its insertion process and another 5% suppression was due to cultivar's genetic differential. Producers should consider the potential for 5-10% yield differentials between GR and non-GR cultivars as they evaluate the overall profitability of producing soybean…*

*Independent from administration and industry researches in the US*

Many studies[55] have been carried out by experts independent from administration and industry.

- Several reasons have been put forward to explain the weak evidence of yield benefits of GM crops. According to Benbrook (2003), none of the GM crops grown in the US have been modified to increase inherent yield potential. GM crops have been modified to make pest management simpler and/or more effective. This contributes to consolidate the reliance on pesticides as shown in chapter 3. Most herbicide resistant varieties are resistant to glyphosate, a relatively high dose herbicide; therefore the technology has not reduced herbicide use: in the US, on average, an increase of about 5% in herbicide pounds applied per acre of GM soybeans can be observed in contrast to conventional varieties.
- Introduced in 1996, Bt corn now accounts for more than 20% of the corn area. Growers have spent about US $659 million on Bt corn price premium since 1996: this investment, according to Benbrook, has only delivered $567 million in benefits (Benbrook, 2002b). This analysis seeks to understand whether farmers have succeeded in compensating the **35% jump in their seed expenditures** provoked by the introduction of the new Bt variety. Simultaneously, Bt corn market price has fallen drastically from $2.79 per bushel in 1996 to below $2.00 since 1998. Those diverging evolutions between rising production costs and declining market prices have provoked drastic losses for corn growers (more than $100 per acre since 1999). Only enormous public subsidies (about $8 billion a

[54] Agronomy Journal 93:408-412 (2001).
[55] Benbrook C., 2002a: Economic and environmental impacts of first generation genetically modified crops: Lessons from the United States. Presented at the Symposium "Transgenics in Argentina: Toward Defining a National Policy". Buenos Aires, Argentina, Dec. 5. 2002. www.iisd.org/pdf/2002tkn_gmo_imp_nov_02.pdf
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year since 1999) helped to save many growers from bankruptcy. This makes Benbrook (2002b) write: in 1996, corn growers earned $1.48 billion in profits on sales of $26.7 billion (i.e. a profit margin of 5.5%). By 2000, the total losses amounted to $7.68 billion.

- **In Europe, researches show that GM crops will be costly for all**

*A study of the Institute for Prospective Technological Studies, of the EC Joint Research Centre (Ispra, Italy)*[56]

The European Commission ordered the study on the co-existence of GM and non-GM crops in May 2000 from the Institute for Prospective Technological Studies, of the EC Joint Research Centre[57]. The study was delivered to the Commission in January 2002 with the recommendation that it should not be made public, according to Greenpeace[58]. In forwarding the study to the Commission, the Director-General of the Joint Research Centre suggested in his letter that "( ) given the sensitivity of the issue, I would suggest that the report be kept for internal use within the Commission only."

The study, based on a combination of computer modelling and expert opinion, analysed the consequences of an increase in share of GM crops. It focused on the three crops for which GM varieties were currently available: oilseed rape for seed production, maize for feed production and potatoes for consumption. The study covered several farm types, both organic and conventional farming. It also considered three different threshold levels for genetic contamination: 0,1% (analytical detection level) for all the three crops, 0.3 % for oilseed rape, and 1% for maize and potatoes.

The study states, that in oilseed rape production, the co-existence of GM and non-GM crops in the same region, even when "technically possible", would be "economically difficult" because of the additional costs and complexity of changes required in farming practices in order to avoid genetic contamination. Both organic and conventional farmers "would probably be forced to stop saving seed and instead buy certified seed", because of the increased risk of GM impurity for seeds that have been exposed to field contamination.
The study predicts that smaller farms would face relatively higher costs than larger entities, and that cultivation of GM and non-GM crops in the same farm "might be an unrealistic scenario, even for larger farms".

The main specific findings of the report were:
- Commercialisation of GM oilseed rape and maize and, to a lesser extent potatoes will increase farming costs for conventional and organic farmers in a range between 10 and 41 per cent of farm prices for oilseed rape and between 1 and 9 per cent for maize and potatoes.
- Generally, coexistence would only be possible with massive changes in farming practices, especially for conventional farmers. It would also require co-operation between farmers in a region and the willingness of all farmers concerned to participate in such co-operation. It is not clear who would implement these changes, who would be responsible for controlling their correct implementation, and who would shoulder their costs.
- Seed and crop purity from GMO at a detection level of 0,1% would be virtually impossible in most cases, i.e. all products and seeds of oilseed rape and maize would be contaminated to a certain extent with GMO.
- Coexistence of GM farming and organic farming would actually be impossible in many cases:
  The long-term impacts of GM contamination on organic farms cannot be assessed totally at the moment since they are highly dependent on the exact shaping of a farming system which intends to

[56] Date: Thu, 23 May 2002 16:48:37 -0500 Sorensen N. <nsorensen@iatp.org> : Subject: Supressed EU GMO Study Summary and Conclusions with Commentary from TWN SUNS #5120 Friday 17 May 2002. South-North development monitor SUNS [Email Edition]
[57] www.jrc.cec.eu.int/GECrops/
[58] www.greenpeace.org/~geneng/highlights/gmo/may16coexist_report.htm

minimize the unintended contamination with GM material. In cases where unintended contamination with GM material occurs every year (e. g. due to wide ranging cultivation of GM crops in a certain area), organic farms will lose their organic status and face severe problems to grow their crops according to the regulations given by the EU and the national authorities. In such a scenario it might be conceivable that it is almost impossible to grow organic crops so that the affected farms will face significant financial losses and economic problems. However, in such cases, the question of compensation payments will most probably be on the political agenda because organic farms in regions with high cultivation rates with GM crops will suffer damage to their incomes without being able to prevent contamination with GM material.
(pp. 104-105 of the JRC report)

*A study by Greenpeace and Friends of the Earth Spain on the impacts of GM corn in Spain*[59]

Spain is the only European country where GM crops are cultivated commercially on some 25 000 ha. It can be considered as the largest scale experimental field in Europe.

The study concludes that those crops are a threat for organic production, have weaker yields and are not more efficient against insect attacks.

There is no transparency in the control, assessment and allowance of GM crops in the country. In 2001, the Bt corn (Bt 176 of Syngenta) had its approval cancelled in the US. This variety has been cultivated in Spain since 1998 and got a new approval in 2003.
It seems that agro-seed-pesticide companies have overestimated the danger of the European corn borer. Data produced by the Ministry of Agriculture Working Group on Pesticides stated in April 2002 that low corn borer incidence in corn producing regions does not justify the use of GM varieties.

- In the regions where the corn borer is present, Bt corn yields are not higher, according to a study carried out by the Aragon Plant Protection Centre[60]; Syngenta and Monsanto Bt corn varieties would not be more effective than conventional varieties.
- Other studies from ITG-Agricola (Navarra) stressed no clear advantages in using Bt corn, advising farmers not to cultivate it. Yield control studies in 1998, 1999 and 2000 showed that each year Bt corn variety Compa CB was producing less or much less than a theoretical average variety (IP 100, that can be considered as the standard yield for the region) and it was often closer to the lowest yielding variety than to the highest. In 1999, the highest non-GM variety produced 25% more than the Bt one.

Five years after the introduction of GM crops in Spain, there has not been any independent economic, social and environmental assessment of the release of the GMOs. The social consequences of GMOs on agriculture and food have not been evaluated:
*…Lost markets for GM crop producers, economic damages due to contamination by GMOs, liability problems between farmers, loss of farmers' independence and of the consumer's right to choose, appearance of an atmosphere of secrecy, suspicion and fear in rural areas, amongst many others…*(p. 27)

- **Lessons learnt**

*Lessons can and need to be learnt from the current US experience*

- Partly due to European resistance to GM product imports and consumption, GM commodity market prices are unable to compensate high production costs and especially the engineered variety seed premium price. This premium price seems to be needed by the agri-biotech companies for the return

[59] Friends of the Earth and Greenpeace, Aug. 2003: The Impacts of GM corn in Spain. www.tierra.org
[60] Barriuso J. (Escuela de Ingenieros Tecnicos Agricolas de la escuela Universitaria Politecnica de Huesca), Martin J. (Centro de Proteccion vegetal de Zaragoza), Perdiguer A. (Servicio Provincial de Agricultura de Huesca). Comparativa de distintas técnicas de control contra taladros de maiz en Almudevar (Huesca). Ministerio de Agricultura , Pesca y Alimentacion, 2001

on research and development investments and for their shareholders'dividends. It represents a massive added value transfer from farming to industry.
- To compensate farms losses, GM corn production needs huge public subsidies. Those subsidies can be considered as an indirect financial support to the agri-biotech industry.
- The reliance on broad-spectrum, high dose herbicide (like glyphosate) remains total. Pesticide volumes on GM crops seem higher than for conventional productions.

*From Spain experience, different problems have emerged*

- Total lack of transparency of the administration related to the GM variety approval process, and to the location of commercial planting.
- Lack of serious multi-dimensional (environmental, economic, social…) assessment after 5 years of commercial GM productions.
- Suspicion of high level of contamination of non-GM crops.

As in the US, there is a lack of proven benefits of GM varieties in comparison with conventional ones.

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- www.jrc.cec.eu.int/GECrops/
- www.greenpeace.org/~geneng/highlights/gmo/may16coexist_report.htm
  www.biotech-info.net
- www.tierra.org

## Chapter 14. International arenas for disputes on GMOs: WTO versus Cartagena Protocol on Biosafety

### i. Questions related to the item

- What are the international disputes on GMOs?
- Who is in dispute with whom and why?
- How can the international tensions related to GMOs be solved?
- Are free trade and biosafety compatible?

### ii. Issues at stake

- The WTO is supposed to uphold the principle of trade liberalisation, including the trade of GM seeds and food products.
- The Cartagena Protocol on Biosafety stipulates that national authorities can reject the imports of genetic material if it represents a risk for human health and the environment.
- The WTO and Cartagena Protocol on Biosafety are driven by conflicting logics: Trade versus Precautionary Principle. The issue is about state sovereignty.
- Legally, it is possible to consider that the Protocol should take precedence over the WTO in any dispute: because it is specific and more recent than the WTO.
- But the debate on the precedence of treaties may depend a lot on the forum where the dispute is arbitrated…

### iii. Elements for the analysis

- **WTO disputes on GMOs and agriculture**

*EU – US legal dispute on GMOs at WTO*

- In 1999, the EU declared a moratorium on new GMOs authorization: the US threatened to lodge a complaint against it with the dispute settlement body (DSB) of the WTO.
- In January 2003, the US Trade representative described the European measures as immoral, justifying his intention of referring the matter to the DSB, for protectionism.

At the beginning of March 2003, the chairman of the US Senate Finance Committee, a senator of the farming Iowa State, complained that US $300 millions had been lost in corn sales to Europe: this unacceptable situation had to be solved by the US Government. The position defended by the US Government at the WTO is: no moratorium, no rules on traceability and labelling, considered as obstacles to free trade.[61] The measures proposed by EU commissioners and voted by the European Parliament (see chapter 31 of this report) to end the moratorium have not been considered as sufficient by the US Government. The dispute shifted from the moratorium to labelling and traceability rules, considered as illegal by the US.

The EU initial submission to the WTO dispute panel argued that its approach was necessarily "prudent and precautionary". It emphasised that the US, Canada and Argentina were challenging the right of countries to establish levels of protection against the risks of GMOs appropriate to their circumstances, and that the risks and uncertainties were complex and serious[62]. Before Cancun, several NGOs' and public authorities' initiatives opposed any attempt at imposing GMOs:

[61] George S., Europe's harvest of contamination. Le Monde Diplomatique. www.portoalegre2003.org
[62] The Guardian, February 2005: A bitter harvest.
At www.guardian.co.uk/comment/story/0,3604,1419841,00.html

- In August 2003, the Tuscany Region (Italy) published a Manifesto on the Future of Food[63], resulting from the International Commission on the Future of Food that met in late 2002 and early 2003 in Tuscany. This was a joint initiative of the President of the Region of Tuscany and Vandana Shiva. The manifesto is intended as a synthesis of the work and ideas of organizations and individuals around the world actively seeking to reverse the present industrialization and globalisation of food systems. It is conceived as a catalyst to unify and strengthen the movement toward sustainable agriculture, food sovereignty, biodiversity and agricultural diversity.
- Also, in August 2003, several NGOs met during the Biodevastation Conference in St Louis, Missouri to announce the citizens' GMO challenge to the WTO dispute. They[64] presented this challenge as a catalyst for intervening in the WTO dispute, as a global solidarity network of citizens, an accelerated movement to keep the food system and ecosystems GMO free and to defend the principle of the free choice of food.

In Cancun, September 2003, at the WTO Ministerial Conference, the GMO case was not a topic of acute tension. In fact, outside this legal dispute in the WTO arena, bilateral pressures and sanctions are strong from the pro-biotech US Government and its industry on countries such as Brazil or Tanzania, considered as reticent to GMOs.

Since the announcement by the EU Commission of the de facto moratorium lift, the commission has shifted its defence in the WTO case in a way that may suggest a direct link with its new policy on GMO approvals. According to some US reactions, the commission now wants the dispute to be ruled by removing any big strategic issue, because GMO approvals have started. In other words, it has caved in to US pressure and is rearranging the pieces[65].

**An example of what may become a routine[66]**

On the 15th of April 2005, the EU imposed an emergency ban on imports of US animal feeds unless they were proven to be free of illegal GM maize. This ban on gluten feed and brewers' grains followed a delayed admission by Syngenta that about 1000 tons of US maize derived from its unlicensed Bt10 GM seeds had 'inadvertently' entered the European food chain over the past four years.

The EU adopted the ban after the US and Syngenta failed to provide information enabling a safety assessment of Bt10 or testing of food and feed imports for the illegal maize. Under the ban, which follows the discovery of illegal GM rice from China in Britain and other EU countries, US feeds will be allowed into the EU only if an accredited laboratory has produced an analytical report proving that they have not been contaminated by Bt0. The US condemned the ban , insisting there were no hazards to health, safety or the environment from Bt10.

*EU – US converging global economic interests on food and agriculture*

In Cancun, many conflicting issues opposed the EU and US to the G22, a group of developing countries and the Cairns group (which includes important agri-export countries[67]). On food and agriculture, the EU and US expressed their converging interests and policies. This convergence may have been facilitated by the strategic change of the European Commission related to GMOs. Positions polarised on three

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[63] The International Commission on the Future of Food and Agriculture, 2003: Manifesto on the Future of Food.San Rossore, Italy. July 15 2003.
[64] Especially Brian Tokar, Mae-wan Ho, Vandana Shiva. gmochallenge@yahoo.com
[65] The Guardian, February 2005: A bitter harvest.
At www.guardian.co.uk/comment/story/0,3604,1419841,00.html

67 The Guardian, April 16, 2005: Illegal GM maize fear sparks EU ban on US animal feeds.
At www.guardian.co.uk/intenational/story/0,,1461012,00.html
[67] Australia, Canada, Brazil, Argentina and New Zealand systematically urge for an opening of agricultural markets to allow imports.

problems: internal subsidies in practice in the EU and US, access to internal markets and support to export[68]. The unresolved tensions around those problems have probably been a major cause of blockage in Cancun.

But they were not the only ones. Others were:
- the Singapore topics such as investment, competition, transparency of public markets,
- access to markets for non-agricultural products,
- cotton, an emblematic problem put on the Cancun agenda and opposing poor countries like Mali, Burkina Faso, Benin or Chad to the US which pays yearly subsidies of US $3 billions to its producers[69].

On those issues, the general impression was that developed countries were asking many more concessions from developing countries than what they were ready to concede especially on agriculture. In this global bargaining, agriculture was perceived as a test case for assessing the intentions of the developed countries[70]. The lack of transparency, much pressure, the lack of real deliberations and the lack of resources of small developing countries have also been considered as factors contributing to the Cancun blockage.

- **Cartagena Protocol on Biosafety[71]: Key provisions**

The treaty, known as the Cartagena Protocol on Biosafety was agreed upon by more than 130 nations in January 2000 but could not take effect until formally ratified by 50 nations. The 50th, Palau, gave its endorsement in June 2003, so the protocol entered into effect on September 11, 2003[72]. Since then, some 15 more countries have ratified the Convention. The United States reluctantly agreed to sign the treaty in 2000 after intense negotiations but did not ratify it. While the European Community has ratified the Protocol, many European countries did not do so till September 2003 (see table below).

The treaty seeks to protect biological diversity from the potential risks posed by modified living organisms resulting from modern biotechnology. It allows countries to ban imports of genetically engineered seeds, microbes, animals or crops that they deem a threat to their environments, taking also into account risks to human health[73] . It requires international shipments of genetically engineered grains to be labelled.
- It establishes an advance informed agreement (AIA) procedure for ensuring that countries are provided with the necessary information to make informed decisions before agreeing to the import of such organisms into their territory. Once the importing country is informed, it has 270 days to decide whether or not to allow the shipment to proceed[74]. After confrontation between potential importers and exporters, there has been a compromise where the AIA only applies to the first import of any GMO intended for direct release into the environment, and under which the majority of GMOs were actually excluded from the scope of the AIA. Although GMOs for food, feed and processing are covered by the protocol, they are covered by a weaker procedure than the AIA. The procedure used for these commodities places the onus on importing countries to make the effort to find out about the potential shipments of GMOs, rather than obliging the exporter to first obtain the importing country's explicit consent[75].
- The Protocol contains reference to a precautionary approach and reaffirms the precaution language in Principle 15 of the Rio Declaration on Environment and Development.

[68] Le Monde 16/09/03
[69] No easy answers for how to proceed after Cancun. In www.twnside.org.sg/title/5427a.htm
[70] DAS B.L., 2003: Salvaging WTO from Cancun Collapse. In www.twnside.org.sg/title/twninfo78.htm
[71] http://www.biodiv.org/biosafety/ratification.asp
[72] Pollack A., 2003: Trade Pact on Gene-Altered Goods to Take Effect in 90 Days. *New York Times*, June 14, 2003 http://www.nytimes.com/2003/06/14/business/14TRAD.html
[73] Cartagena Protocol on biosafety : article 16. In www.biodiv.org
[74] Cartagena Protocol on biosafety : articles 7-10. In www.biodiv.org
[75] www.greenpeace.org

- The Protocol also establishes a website called Biosafety Clearing House to facilitate the exchange of information on modified living organisms and to assist countries in the implementation of the protocol[76]. It is administered by the Secretariat to the Convention on Biological Diversity.
- Although socio-economic considerations are not an explicit requirement of the risk assessment procedures in the Biosafety Protocol, countries have the right to consider socio-economic impacts when evaluating potential imports of genetically engineered organisms. An example can be to take into account the value of biological diversity to indigenous and local communities when implementing domestic regulatory measures for GMOs[77].
- An importing country can demand that the exporter carry out and bear the cost of any further risk assessments that are needed to help the importing country to make a decision[78].

The protocol has been the object of many negotiations throughout the last 5 years, showing how intense the conflict of interests among countries has been and still is. To achieve an international compromise, the many exemptions and ambiguities have probably weakened the text. This concerns, for instance, GMOs which are supposed to be potential pharmaceuticals for humans, partly escaping the protocol under the pressure of industrialised countries, the notion of contained use of GMOs, the regulation of trans-boundary movement of GMOs[79]…

Obviously this treaty will work as an important resource used by states and any other actors in international disputes over the use of GMOs in agriculture and food.

*Potential conflicts between Cartagena Protocol and WTO*

Recognizing a potential conflict with WTO rules, the framers of the biosafety treaty were careful to state that it neither supersedes nor is subordinate to other agreements. It is easy to imagine that the issue of treaties subordination is a complex one.

What does the Protocol say[80]?

Under international law, the interpretation of treaties is governed by the Vienna Convention on the Law of Treaties. The rule is that a later agreement supersedes an earlier one, and an agreement on a specific subject prevails over a general one. Since the Biosafety Protocol comes after the trade agreements and deals specifically with biosafety, in a conflict of laws, the Protocol has to be given priority.

The following text has been added to the preamble[81]:
*…Recognising that trade and environment agreements should be mutually supportive with a view to achieving sustainable development, Emphasising that this protocol shall not be interpreted as implying a change in the rights and obligations of a Party under any existing international agreements, Understanding that the above recital is not intended to subordinate this Protocol to other international agreements...*

This language relegated to the preamble carries far less weight than a substantive provision. The language of preambles in international agreements, however, sets the framework for their interpretation. The effect appears to be a return to the general international law of interpretation. However, this position is still vulnerable, as there are specific provisions in the Protocol that also refer to other international obligations. Article 2(4) on the right of Parties to take more protective domestic biosafety action qualifies this right - such action has to be 'in accordance with its other obligations under international law'. The

[76] Cartagena Protocol on Biosafety: About the Protocol. In www.biodiv.org/biosafety/background.asp?print=1
[77] Cartagena Protocal on Biosafety. Article 26. In www.biodiv.org
[78] Cartagena Protocol on biosafety : article 15 (2et 3). In www.biodiv.org
[79] The core issues in the Biosafety Protocol: an analysis. In www.twnside.org.sg/title/core.htm
[80] Lin L.L., 2000: The core issues in the Biosafety protocol : An analysis. Third World Resurgence, n° 114/115, Feb/March 2000. In www.twnside.org (see annex)
[81] Cartagena Protocol on biosafety : Preamble. In www.biodiv.org

provision on socio-economic considerations (Article 26) also makes reference to the other international obligations of Parties.

According to Greenpeace[82], the differences between the WTO and the Protocol are so significant that a mutually supportive relationship seems extremely unlikely.

- Under the WTO, for example, the onus is on the importing country to provide proof that a GMO is not safe if it wishes to block an import, and the importing country will be subject to punitive sanctions if it cannot provide this proof.
- Under the Protocol, the onus is on exporting countries to provide the evidence that a GMO is safe and importing countries are required to take all measures necessary to prevent a GMO from having any adverse effect.

In the end, a lot will depend on the forum where any dispute is arbitrated. The WTO need not be the only forum where biosafety disputes are settled, as the CBD itself provides for a dispute resolution procedure, which is also applicable to the Protocol. Therefore, concerned countries should, as a matter of priority, explore ways and means of defending the integrity of the Protocol in its implementation stages.

[82] Relationship between the Biosafety Protocol and the WTO. In www.greenpeace.org

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- www.wto.org


**Ratification of the Cartagena Protocol by European countries**

(**Note: rtf** = Ratification **acs** = Accession **acp** = Acceptance **apv** = Approval)

| | **Country** | **Dates Signature** | **Ratification** | | **Entry into force** |
|---|---|---|---|---|---|
| 1 | Azerbaijan | | 1 April 2005 | acs | 30 June 2005 |
| 2 | Democratic Republic of the Congo | | 23 March 2005 | acs | 21 June 2005 |
| 3 | Eritrea | | 10 March 2005 | acs | 8 June 2005 |
| 4 | Benin | 24 May 2000 | 2 March 2005 | rtf | 31 May 2005 |
| 5 | Zimbabwe | 4 June 2001 | 25 February 2005 | rtf | 26 May 2005 |
| 6 | New Zealand | 24 May 2000 | 24 February 2005 | rtf | 25 May 2005 |
| 7 | Namibia | 24 May 2000 | 10 February 2005 | rtf | 11 May 2005 |
| 8 | Albania | | 8 February 2005 | acs | 9 May 2005 |
| 9 | Indonesia | 24 May 2000 | 3 December 2004 | rtf | 3 March 2005 |
| 10 | Guatemala | | 28 October 2004 | acs | 26 January 2005 |
| 11 | Niger | 24 May 2000 | 30 September 2004 | rtf | 29 December 2004 |
| 12 | Portugal | 24 May 2000 | 30 September 2004 | acp | 29 December 2004 |
| 13 | Algeria | 25 May 2000 | 5 August 2004 | rtf | 3 November 2004 |
| 14 | Lao People's Democratic Republic | | 3 August 2004 | acs | 1 November 2004 |
| 15 | Solomon Islands | | 28 July 2004 | acs | 26 October 2004 |
| 16 | Rwanda | 24 May 2000 | 22 July 2004 | rtf | 20 October 2004 |
| 17 | Dominica | | 13 July 2004 | acs | 11 October 2004 |
| 18 | Finland | 24 May 2000 | 9 July 2004 | rtf | 7 October 2004 |
| 19 | Togo | 24 May 2000 | 2 July 2004 | rtf | 30 September 2004 |
| 20 | Gambia | 24 May 2000 | 9 June 2004 | rtf | 7 September 2004 |
| 21 | Greece | 24 May 2000 | 21 May 2004 | rtf | 19 August 2004 |
| 22 | Seychelles | 23 Jan. 2001 | 13 May 2004 | rtf | 11 August 2004 |
| 23 | Armenia | | 30 April 2004 | acs | 29 July 2004 |
| 24 | Sri Lanka | 24 May 2000 | 28 April 2004 | rtf | 26 July 2004 |
| 25 | Zambia | | 27 April 2004 | acs | 25 July 2004 |
| 26 | Kiribati | 7 Sept. 2000 | 20 April 2004 | rtf | 19 July 2004 |
| 27 | Belgium | 24 May 2000 | 15 April 2004 | rtf | 14 July 2004 |
| 28 | Peru | 24 May 2000 | 14 April 2004 | rtf | 13 July 2004 |
| 29 | Syrian Arab Republic | | 1 April 2004 | acs | 30 June 2004 |

| | | | | | |
|---|---|---|---|---|---|
| 30 | Estonia | 6 Sept. 2000 | 24 March 2004 | rtf | 22 June 2004 |
| 31 | Italy | 24 May 2000 | 24 March 2004 | rtf | 22 June 2004 |
| 32 | Paraguay | 3 May 2001 | 10 March 2004 | rtf | 8 June 2004 |
| 33 | Latvia | | 13 February 2004 | acs | 13 May 2004 |
| 34 | Belize | | 12 February 2004 | acs | 12 May 2004 |
| 35 | Tajikistan | | 12 February 2004 | acs | 12 May 2004 |
| 36 | Bangladesh | 24 May 2000 | 5 February 2004 | rtf | 5 May 2004 |
| 37 | Grenada | 24 May 2000 | 5 February 2004 | rtf | 5 May 2004 |
| 38 | Viet Nam | | 21 January 2004 | acs | 20 April 2004 |
| 39 | Bahamas | 24 May 2000 | 15 January 2004 | rtf | 14 April 2004 |
| 40 | Hungary | 24 May 2000 | 13 January 2004 | rtf | 12 April 2004 |
| 41 | Egypt | 20 Dec. 2000 | 23 December 2003 | rtf | 21 March 2004 |
| 42 | Poland | 24 May 2000 | 10 December 2003 | rtf | 9 March 2004 |
| 43 | Cyprus | | 5 December 2003 | acs | 4 March 2004 |
| 44 | Brazil | | 24 November 2003 | acs | 22 February 2004 |
| 45 | Madagascar | 14 Sept. 2000 | 24 November 2003 | rtf | 22 February 2004 |
| 46 | Slovakia | 24 May 2000 | 24 November 2003 | rtf | 22 February 2004 |
| 47 | Japan | | 21 November 2003 | acs | 19 February 2004 |
| 48 | Germany | 24 May 2000 | 20 November 2003 | rtf | 18 February 2004 |
| 49 | Iran (Islamic Republic of) | 23 April 2001 | 20 November 2003 | rtf | 18 February 2004 |
| 50 | United Kingdom of Great Britain and Northern Ireland | 24 May 2000 | 19 November 2003 | rtf | 17 February 2004 |
| 51 | Ireland | 24 May 2000 | 14 November 2003 | rtf | 12 February 2004 |
| 52 | Jordan | 11 Oct. 2000 | 11 November 2003 | rtf | 9 February 2004 |
| 53 | Lithuania | 24 May 2000 | 7 November 2003 | rtf | 5 February 2004 |
| 54 | Turkey | 24 May 2000 | 24 October 2003 | rtf | 24 January 2004 |
| 55 | Ethiopia | 24 May 2000 | 9 October 2003 | rtf | 7 January 2004 |
| 56 | Senegal | 31 Oct. 2000 | 8 October 2003 | rtf | 6 January 2004 |
| 57 | El Salvador | 24 May 2000 | 26 September 2003 | rtf | 25 December 2003 |
| 58 | Tonga | | 18 September 2003 | acs | 17 December 2003 |
| 59 | Cambodia | | 17 September 2003 | acs | 16 December 2003 |
| 60 | Antigua and Barbuda | 24 May 2000 | 10 September 2003 | rtf | 9 December 2003 |
| 61 | Malaysia | 24 May 2000 | 3 September 2003 | rtf | 2 December 2003 |
| 62 | Saint Vincent and the Grenadines | | 27 August 2003 | acs | 25 November 2003 |
| 63 | South Africa | | 14 August 2003 | acs | 12 November 2003 |
| 64 | Burkina Faso | 24 May 2000 | 4 August 2003 | rtf | 2 November 2003 |
| 65 | Democratic People's Republic of Korea | 20 April 2001 | 29 July 2003 | rtf | 27 October 2003 |
| 66 | Mongolia | | 22 July 2003 | acs | 20 October 2003 |
| 67 | Nigeria | 24 May 2000 | 15 July 2003 | rtf | 13 October 2003 |
| 68 | Romania | 11 Oct. 2000 | 30 June 2003 | rtf | 28 September 2003 |
| 69 | Austria | 24 May 2000 | 27 August 2002 | rtf | 11 September 2003 |
| 70 | Barbados | | 6 September 2002 | acs | 11 September 2003 |
| 71 | Belarus | | 26 August 2002 | acs | 11 September 2003 |
| 72 | Bhutan | | 26 August 2002 | acs | 11 September 2003 |
| 73 | Bolivia | 24 May 2000 | 22 April 2002 | rtf | 11 September 2003 |
| 74 | Botswana | 1 June 2001 | 11 June 2002 | rtf | 11 September 2003 |
| 75 | Bulgaria | 24 May 2000 | 13 October 2000 | rtf | 11 September 2003 |
| 76 | Cameroon | 9 Feb. 2001 | 20 February 2003 | rtf | 11 September 2003 |
| 77 | Colombia | 24 May 2000 | 20 May 2003 | rtf | 11 September 2003 |
| 78 | Croatia | 8 Sept. 2000 | 29 August 2002 | rtf | 11 September 2003 |
| 79 | Cuba | 24 May 2000 | 17 September 2002 | rtf | 11 September 2003 |
| 80 | Czech Republic | 24 May 2000 | 8 October 2001 | rtf | 11 September 2003 |
| 81 | Denmark [1] | 24 May 2000 | 27 August 2002 | rtf | 11 September 2003 |
| 82 | Djibouti | | 8 April 2002 | acs | 11 September 2003 |
| 83 | Ecuador | 24 May 2000 | 30 January 2003 | rtf | 11 September 2003 |
| 84 | European Community [2] | 24 May 2000 | 27 August 2002 | apv | 11 September 2003 |
| 85 | Fiji | 2 May 2001 | 5 June 2001 | rtf | 11 September 2003 |
| 86 | France | 24 May 2000 | 7 April 2003 | apv | 11 September 2003 |

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|---|---|---|---|---|---|
| 87 | Ghana | | 30 May 2003 | acs | 11 September 2003 |
| 88 | India | 23 Jan. 2001 | 17 January 2003 | rtf | 11 September 2003 |
| 89 | Kenya | 15 May 2000 | 24 January 2002 | rtf | 11 September 2003 |
| 90 | Lesotho | | 20 September 2001 | acs | 11 September 2003 |
| 91 | Liberia | | 15 February 2002 | acs | 11 September 2003 |
| 92 | Luxembourg | 11 July 2000 | 28 August 2002 | rtf | 11 September 2003 |
| 93 | Maldives | | 2 September 2002 | acs | 11 September 2003 |
| 94 | Mali | 4 April 2001 | 28 August 2002 | rtf | 11 September 2003 |
| 95 | Marshall Islands | | 27 January 2003 | acs | 11 September 2003 |
| 96 | Mauritius | | 11 April 2002 | acs | 11 September 2003 |
| 97 | Mexico | 24 May 2000 | 27 August 2002 | rtf | 11 September 2003 |
| 98 | Mozambique | 24 May 2000 | 21 October 2002 | rtf | 11 September 2003 |
| 99 | Nauru | | 12 November 2001 | acs | 11 September 2003 |
| 100 | Netherlands | 24 May 2000 | 8 January 2002 | acp | 11 September 2003 |
| 101 | Nicaragua | 26 May 2000 | 28 August 2002 | rtf | 11 September 2003 |
| 102 | Niue | | 8 July 2002 | acs | 11 September 2003 |
| 103 | Norway | 24 May 2000 | 10 May 2001 | rtf | 11 September 2003 |
| 104 | Oman | | 11 April 2003 | acs | 11 September 2003 |
| 105 | Palau | 29 May 2001 | 13 June 2003 | rtf | 11 September 2003 |
| 106 | Panama | 11 May 2001 | 1 May 2002 | rtf | 11 September 2003 |
| 107 | Republic of Moldova | 14 Feb. 2001 | 4 March 2003 | rtf | 11 September 2003 |
| 108 | Saint Kitts and Nevis | | 23 May 2001 | acs | 11 September 2003 |
| 109 | Samoa | 24 May 2000 | 30 May 2002 | rtf | 11 September 2003 |
| 110 | Slovenia | 24 May 2000 | 20 November 2002 | rtf | 11 September 2003 |
| 111 | Spain | 24 May 2000 | 16 January 2002 | rtf | 11 September 2003 |
| 112 | Sweden | 24 May 2000 | 8 August 2002 | rtf | 11 September 2003 |
| 113 | Switzerland | 24 May 2000 | 26 March 2002 | rtf | 11 September 2003 |
| 114 | Trinidad and Tobago | | 5 October 2000 | acs | 11 September 2003 |
| 115 | Tunisia | 19 April 2001 | 22 January 2003 | rtf | 11 September 2003 |
| 116 | Uganda | 24 May 2000 | 30 November 2001 | rtf | 11 September 2003 |
| 117 | Ukraine | | 6 December 2002 | acs | 11 September 2003 |
| 118 | United Republic of Tanzania | | 24 April 2003 | acs | 11 September 2003 |
| 119 | Venezuela | 24 May 2000 | 13 May 2002 | rtf | 11 September 2003 |
| 120 | Afghanistan | | | | |
| 121 | Andorra | | | | |
| 122 | Angola | | | | |
| 123 | Argentina | 24 May 2000 | | | |
| 124 | Australia | | | | |
| 125 | Bahrain | | | | |
| 126 | Bosnia and Herzegovina | | | | |
| 127 | Brunei Darussalam | | | | |
| 128 | Burundi | | | | |
| 129 | Canada | 19 April 2001 | | | |
| 130 | Cape Verde | | | | |
| 131 | Central African Republic | 24 May 2000 | | | |
| 132 | Chad | 24 May 2000 | | | |
| 133 | Chile | 24 May 2000 | | | |
| 134 | China | 8 August 2000 | | | |
| 135 | Comoros | | | | |
| 136 | Congo | 21 Nov. 2000 | | | |
| 137 | Cook Islands | 21 May 2001 | | | |
| 138 | Costa Rica | 24 May 2000 | | | |
| 139 | Côte d'Ivoire | | | | |
| 140 | Dominican Republic | | | | |
| 141 | Equatorial Guinea | | | | |
| 142 | Gabon | | | | |
| 143 | Georgia | | | | |
| 144 | Guinea | 24 May 2000 | | | |
| 145 | Guinea-Bissau | | | | |
| 146 | Guyana | | | | |

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|---|---|---|
| 147 | Haiti | 24 May 2000 |
| 148 | Holy See | |
| 149 | Honduras | 24 May 2000 |
| 150 | Iceland | 1 June 2001 |
| 151 | Iraq | |
| 152 | Israel | |
| 153 | Jamaica | 4 June 2001 |
| 154 | Kazakhstan | |
| 155 | Kuwait | |
| 156 | Kyrgyzstan | |
| 157 | Lebanon | |
| 158 | Libyan Arab Jamahiriya | |
| 159 | Liechtenstein | |
| 160 | Malawi | 24 May 2000 |
| 161 | Malta | |
| 162 | Mauritania | |
| 163 | Micronesia (Federated States of) | |
| 164 | Monaco | 24 May 2000 |
| 165 | Morocco | 25 May 2000 |
| 166 | Myanmar | 11 May 2001 |
| 167 | Nepal | 2 March 2001 |
| 168 | Pakistan | 4 June 2001 |
| 169 | Papua New Guinea | |
| 170 | Philippines | 24 May 2000 |
| 171 | Qatar | |
| 172 | Republic of Korea | 6 Sept. 2000 |
| 173 | Russian Federation | |
| 174 | Saint Lucia | |
| 175 | San Marino | |
| 176 | Sao Tome and Principe | |
| 177 | Saudi Arabia | |
| 178 | Serbia and Montenegro | |
| 179 | Sierra Leone | |
| 180 | Singapore | |
| 181 | Somalia | |
| 182 | Sudan | |
| 183 | Suriname | |
| 184 | Swaziland | |
| 185 | Thailand | |
| 186 | The Former Yugoslav Republic of Macedonia | 26 July 2000 |
| 187 | Timor-Leste | |
| 188 | Turkmenistan | |
| 189 | Tuvalu | |
| 190 | United Arab Emirates | |
| 191 | United States of America | |
| 192 | Uruguay | 1 June 2001 |
| 193 | Uzbekistan | |
| 194 | Vanuatu | |
| 195 | Yemen | |

Source: [83]

[83] www.biodiv.org/biosafety/signinglist.aspx?sts=rtf&ord=dt

# Part II. Environment and health safety dimensions

**1. Reliance on pesticides: an agronomic and environmental problem**

The marketing of seeds genetically engineered to be resistant to a herbicide, induces the use of the herbicide from the same company. According to existing data, the claimed reduction of pesticide use with GM crops is not proven. GM agriculture remains heavily reliant on pesticide use. The generalisation of the use of those broad-spectrum, high volume herbicides can amplify the negative impacts already connected to herbicide use (weed and insect resistance (for Bt crops), toxic residues in soil, food and water). Such a process, already observable in the US, forces farmers to over-use the specific pesticide or to mix this pesticide with others. According to existing data, assessment and controversy on benefits, the claimed reduction of pesticide use induced by GMOs is not proven. GM agriculture remains heavily reliant on pesticides.

Those issues are very controversial and debated as experts disagree. In the US debate, the closeness of the positions of public administration (USDA especially) and industry is an object of criticism from academic and NGOs experts.

**2. Pesticide health risks**

The pesticide health risks should be incorporated into the GMOs health risk analysis. Those health risks are characterised by long term and crossed effects of human exposure to pollutants as well as immediate impacts like poisoning.

**3. GMOs environmental impacts: a threat for biodiversity**

The existence of impacts, possibly adverse impacts, of GMOs on the environment is today widely recognised, and so is the lack of relevant knowledge. Concerns are connected mainly to the possible escape of GM plants or just transgenes into the environment, the impacts of broad-spectrum herbicides used with the herbicide tolerant GM crops on the countryside ecosystems, and the impacts of the *Bacillus Thuringiensis* toxin produced by Bt crops on no-target species. There is a controversy (experts disagree) on the seriousness and irreversibility of the impacts and on the implications of the current knowledge and the lack of knowledge for policy-making.

**4. Health risk assessment in question**

Official health safety evaluations of commercial GM crops work on the assumption of 'substantial equivalence' of GM and non-GM food in most of the cases. This allows for a limited health safety assessment. Those procedures are strongly criticised by different experts emphasizing the limited scope of evaluation, selectivity of knowledge taken into account, and the fact that it is mostly the biotech firms themselves that carry out the assessments.

**5. Serious concerns on GMOs potential health risks**

No GM food related harmful impact on human health has been proved so far but there is some partial and indirect evidence pointing to risks. The most serious concerns are related to the possible allergenicity and toxicity of GM food (as a result of limited controllability of gene expression) and to the spreading of antibiotic resistance (as a result of horizontal transfer of genes to human gut bacteria). To date experience suggests that possible health damage would be connected to long-term and/or massive consumption of GM food (not acute detrimental impacts). As for pesticides, the consequences of daily low dose exposures are a serious issue.

## Chapter 21. Pesticide environmental contamination

i. **Questions related to the item**

- Which interactions between GMOs and pesticides ?
- Does the use of GMOs decrease or increase pesticide use ?
- What are the impacts of pesticides on the environment ?

**ii. Issues at stake**

- The marketing by a company of herbicide resistant seeds induces the use of the herbicide from the same company.
- The generalisation of the use of one herbicide can generate the same kind of consequences observed so far with weed and insect resistance (for Bt crops).
- Such a process, already observable in the US, forces farmers to over-use the specific pesticide or to mix this pesticide with others.
- This on-going process impacts yields and costs of such crops.
- Those issues are very controversial and debated, as experts disagree. In the US debate, the closeness of the positions of public administration (USDA especially) and industry is an object of criticism from university and NGOs experts.

**iii. Elements for the analysis**

- **Consensus on the harmfulness of pesticides**

Public administrations, industry, NGOs and some farmers' organisations agree on the risks of pesticides for environment and health.

Some data show health and environment impacts :

- Worldwide data[84] record some 500000 cases of pesticide poisoning and 5000 deaths from this cause annually.
- In the US alone, there are 110000 cases of pesticide poisoning and 10000 cases of pesticide-induced cancers.
- In the US agriculture fields, 70 millions of birds are killed each year by pesticides.
- 35% of the foods sold in US supermarkets have detectable pesticides residues .
- In the EU, a study of the Food and Veterinary Office of the European Commission (04/05/2002) shows that 35% of European food samples have pesticide residues, with 4% exceeding allowed thresholds[85].
- In France, a recent study[86] of the IFEN, the National Institute of Environment (19/02/2003), reports that pesticides are present in 90% of the rivers and 58% of underground waters : in surface waters, 148 different pesticides are found on a total of 320 researched ones and 62 in underground waters on a total of 292 researched ones. Triazine herbicides are the most represented among the residues. When glyphosate is searched, residues are found. But also banned molecules like lindan, dinoterb or dionoserb can be found in underground waters. In seacoasts and estuaries, the situation is considered as worrying especially for triazine herbicides.

[84] Raven P., 2003 : The environmental challenge. At the Natural History Museum, London, 22nd May 2003
[85] www.agrisalon.com/06-actu/article-5998.php
[86] www.agrisalon.com/06-actu/article-9435.php

On a more general level, many studies[87] have characterised the impacts of pesticides on the environment :

- Those substances may have a direct lethal impact on fauna and flora populations.
- Their presence in the ecosystems (water, soil, air, plants) at sub-lethal levels may affect the reproduction conditions of fauna and flora species.
- The systematic use of pesticides has induced a strong pressure of genetic selection of targeted weeds, fungi and insects by pesticides. This growing resistance to chemical products has been a permanent problem for agrochemical companies and also an opportunity for launching supposedly more efficient products.

- **Is glyphosate safe for the environment[88]?**

- In the agricultural environment, glyphosate is toxic to some beneficial soil organisms, beneficial arthropod predators, and increases the susceptibility of crops to diseases.
- Sub-lethal doses of glyphosate from spray drift damages wildflower communities and can affect some species up to 20 metres away from the sprayer.
- The use of glyphosate in arable areas may cause dieback in hedgerow trees.
- The Danish environment ministry has announced[89] unprecedented restrictions on glyphosate, the country's and Europe's most widely used herbicide. The action follows publication of data showing its presence in groundwater, from which Denmark obtains most of its drinking water. Although concentrations in drinking water did not exceed permissible limits, it was "worrying" that unacceptable quantities of glyphosate and its breakdown product AMPA might build up via drainage in the uppermost levels of groundwater. From 15 September, autumn spraying of glyphosate will be banned on sites "where leaching is extensive because of heavy rain". There are a number of exceptions to the new restrictions, which are subject to revision after an interim consultation period.

- **And so what with GMOs?**

As a result of those observations on the harmfulness of pesticides , P. Raven writes[90]:
*…It is obvious that agriculture in Europe and throughout the world is neither being managed sustainably nor productively. In order to meet human needs adequately and safely, agricultural practices need to be improved everywhere. Certainly the use of Integrated Pest Management and organic agriculture are useful parts of our striving towards the creation of productive, sustainable agricultural systems, but the application of modern plant breeding methods through GM technology clearly have significant contributions to make also...*

In abstracto, this assertion may be reasonable. Why could not GM technology contribute to better agriculture systems? The answer to this question has to take into account the way firms have been mobilising GM technology to produce new products. Two GM technologies account for nearly all areas planted with GM crop varieties worldwide: plants engineered to tolerate applications of broad spectrum herbicides, especially glyphosate and crops engineered to express the natural bioinsecticide, Bacillus Thuringiensis, or Bt. Herbicide-tolerant crops account for 2/3 of the US and world crop areas, Bt transgenic varieties for the remaining third[91].

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[87] Assouline G., 1994 : Impacts sur l'environnement des nouvelles techniques de protection des plantes [Impacts on environment of new plant protection techniques]. Study commissioned by the French Ministry of Environment and European DG XI-Environment. QAP Décision. 230 pages.
- Colborn T., 1992: Listening to the lakes: faltering Great lakes wildlife populations point the way to human health hazards. In *Pesticides and You*, June 1992. NCAMP, Washington, DC.
- Hollomon D., 1993: Pesticide Resistance. In *Chemistry and Industry*, 15 Nov. 1993.
- Moriaty F., 1983: Ecotoxicology: the study of pollutants in ecosystems. Academic Press, London.

[88] Pesticides News No. 41, September 1998, Pesticide Action Network UK.

[89] Press release: http://www.mim.dk/nyheder/presse/Dep/040603_glyphosat.htm

[90] P. Raven is the director of the Missouri Botanical Garden in St Louis (MO, USA). St Louis is also Monsanto headquarters location.

[91] Benbrook C., 2003: GMOs, Pesticide Use and Alternatives: Lessons from the US experience. Presented at the Conference on GMOs and Agriculture, Paris, France, June 20. 2003. www.biotech-info.net/lessons_learned.pdf

De facto, can those concrete marketable products contribute to a more sustainable and safer agriculture?

To get elements of information on such issues, we have to look at what is happening in the US, one of the rare countries to have developed GM crops massively and initiated some assessment on the efficiency of GM crops.

The debate and dissent are intense among experts. Pest-resistant crops such as Bt corn and Bt cotton have been promoted as a means to reduce the spraying of pesticides, while herbicide-tolerant crops such as Roundup ready soybeans are said to reduce the application of herbicides. But on such claims, there is a total lack of evidence.

*Large reductions of chemical spraying have been claimed to result from the introduction of these transgenic varieties.*

- A USDA report on reduction in pesticide use associated with GM crops indicates that several methods of analysis show a decline in pesticide use attributable to Bt cotton[92]. A report prepared by the USDA's economic research service also concludes that pesticide use has declined because of Bt corn[93]; the same report concludes that herbicide-tolerant cotton varieties have not played any role.
- But the US EPA's benefits assessment for Bt corn notes that "the potential benefits were anticipated to be yield increase rather than reduced pesticide costs or reduced pesticide use'[94]. In this report, analysts are rather cautious by writing that several factors affect the amount of pesticide that is sprayed, it is difficult to support a claim that the introduction of Bt corn varieties is responsible for all of the change in pesticide use. It states that total insecticide use on corn has not declined , despite the reduction in use of certain insecticides that were often used against the European corn borer (ECB).

*Other analysts are much less euphoric concerning the impacts of GMOs on pesticide use*

According to C. Benbrook[95], herbicide-tolerant technology was designed to allow greater reliance on herbicides, not to decrease herbicide use. The technology works by allowing broad-spectrum herbicides (mostly glyphosate) to be applied on crops with a relatively high dose, at times and in ways that were not possible before.

- On average, an increase of about 5% could be observed in herbicide pounds per acre of GM soybeans in contrast to conventional varieties; but this increase has been compensated by the price competition on herbicides which contributed to reduce the cost of glyphosate use per acre. The use of Roundup (glyphosate) on soybean areas has increased from 20% of the total area to 62% of the total area since the introduction of Roundup Ready soybeans, while the percentage of soybean areas treated with most other herbicides has declined. Dr Benbrook[96] estimates that the widespread cultivation of the GE soya beans could lead farmers to spray an additional 20 million pounds of herbicides on their crops. This researcher also states that university research trials suggest that Monsanto's GE soya yields 5-10% less than similar conventional soya varieties.
- The planting of about 25% of US corn area has reduced insecticide use by about 2% of the area treated from its peak. According to Benbrook (2001), 30% more herbicides are used on Roundup ready corn than on conventional corn.

[92] www.ers.usda.gov/publications/agoutlook/aug2000/ao273fr.pdf
[93] www.ers.usda.gov/Emphases/Harmony/issues/genengcrops/genengcrops.htm
[94] www.epa.gov/scipoly/sap/2000/october/brad5_benefits_corn.pdf
[95] Benbrook C., 2003: GMOs, Pesticide Use and Alternatives: Lessons from the US experience. Presented at the Conference on GMOs and Agriculture , Paris, France, June 20, 2003. www.biotech-info.net/lessons_learned.pdf
[96] Benbrook C., 2001: Troubled Times Amid Commercial Success for Roundup Ready Soybeans, www.biotech-info.net/troubledtimes.html.

- Bt cotton shows very contradictory results. Some reports say that it has reduced insecticide use in several states (USDA, Benbrook). Other works conclude that the extensive cultivation of GM cotton has brought no appreciable reduction in the use of insecticides and herbicides[97].

- **A déjà vu problem: Weed growing resistance**

The world's most widely grown genetically engineered crops - soybeans, cotton and corn developed to be impervious to glyphosate - are facing a new problem in their continued long-term use. The herbicide is beginning to lose its effectiveness in controlling weeds. In the last few years, weeds resistant to the herbicide have emerged in US states such as Delaware, Maryland, California, western Tennessee and at the edges of the Corn Belt in Ohio and Indiana[98]. But the resistance could spread, rendering Roundup herbicide less useful. That would be a problem for farmers because glyphosate is by far the most widely used weed-killing chemical in the world.

- The problem was first noticed by farmers in Delaware with a weed called mare's-tail, or horseweed[99]. The Roundup-resistant mare's-tail has also been found in cotton and soybean fields in western Tennessee and some neighbouring states like Kentucky.
- Water hemp, a weed that is abundant in the Corn Belt, is becoming harder to kill with glyphosate. And resistant ryegrass has appeared in almond orchards in Northern California and in many wheat fields in Australia.
- For the Roundup-resistant mare's-tail, Monsanto advises farmers to use another herbicide along with Roundup. But weed specialists say it might be hard to find good replacements, in part because the very success of Roundup has cut profits from other herbicides, causing farm chemical companies to reduce investments in developing new ones.
- It might be hard to get farmers to reduce their use of Roundup herbicide and Roundup Ready crops unless the resistance became severe.

In the US, the government has no resistance management rules for Roundup Ready crops.

- **Resistance to Bt[100]**

The multiplication of Bt engineered seeds may induce a growing resistance of insects to Bt, as it has already happened with insecticides. As a consequence, a very useful biological insecticide considered as harmless will be lost for farmers.

- Resistance to the biological insecticide Bt is already a reality in some areas like Hawaï.
- Bt engineered crops induce a much longer exposure of insects to Bt ([101]for a whole season) while Bt external application has a fast degradation. Long exposure provokes a genetic selection of insects which have time to develop resistance to Bt on several generations.
- In 1992, GRAIN noticed that insects developing resistance to different Bt toxin types were discovered.

In the US, EPA has set up a new regulation on Bt crops. When farmers plant transgenic corn, containing an insect-resistance gene known as BT, the government requires a portion of the fields to be planted with non-BT crops in order to slow the development of insects resistant to the toxin produced by the BT gene.

[97] Thalmann Ph., Küng V., 2000: Transgenic Cotton: Are there benefits for Conservation? Report for Oehen B., Bärlocher C., WWF International. www.panda.org/livingwaters

[98] Pollack A., 2003: Widely used crop herbicide is losing weed resistance. The New York Times, January 14. 2003.

[99] www.ipm.iastate.edu/ipm/icm/2003/3-17-2003/glyphosate.html

[100] Assouline G., 2000: Prise de décision en univers incertain, controverse et effets à long terme sur l'environnement et la santé d'innovations technologiques: le cas de la protection des plantes [Decision making in uncertain context, controversy and long term effects on environment and health of technological innovations: the case of plant protection]. In Theys J. (ed.): L'environnement au XXIe siècle: visions du futur [The environment in the XXIst century: visions of the future]. GERMES, Paris.

[101] Seedling, 1995: Engineered Bt from pest to market control. GRAIN, Barcelona, Spain.

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- Pollack A., 2003: Widely used crop herbicide is losing weed resistance. The New York Times, January 14, 2003.
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- www.ers.usda.gov/publications/agoutlook/aug2000/ao273fr.pdf
- www.ers.usda.gov/Emphases/Harmony/issues/genengcrops/genengcrops.htm
- www.epa.gov/scipoly/sap/2000/october/brad5_benefits_corn.pdf
- www.ipm.iastate.edu/ipm/icm/2003/3-17-2003/glyphosate.html
- www.min.dk/nyheder/presse/Dep/040603_glyphosat.htm

## Chapter 22. Pesticide human health risks

i. **Questions related to the item**

- What has been said and written on human health risks related to pesticides?
- Are those risks modified or reduced by GM seeds?

**ii. Issues at stake**

- According to existing data, assessment and controversy on benefits, the claimed reduction of pesticide use induced by GMOs is not proven
- GM agriculture will remain heavily reliant on pesticide use
- The pesticide health risks should be incorporated into the GMOs health risk analysis
- Those health risks are characterised by long term and crossed effects of human exposure to pollutants as well as immediate impacts like poisoning

**iii. Elements for the analysis**

- **Pesticides are harmful for human health**

The synthesis of the research carried out by international public research institutes, NGOs, risk evaluation and regulatory bodies shows that:

- Chronic risks of pesticides on human health go much beyond the cancer risk (especially breast cancer)[102] which is one of the major pillars of the US pesticide regulation: reproduction and hormonal problems[103,104], trans-generational exposure, leukaemia more frequent among farmer population…[105]
- This important issue of exposure to chemicals reveals the capacity of chemical molecules to imitate hormones in living beings. One effect can be the malfunctioning of the endocrine system which regulates hormonal activity[106].
- The interdependence is strong between the presence of pesticides in the environment and the impacts on human health: a major vector is food, through the absorption of water and food products containing pollutant residues.
- Some categories of population are more exposed than others to pesticide health risks: children, farmers[107], chemical industry workers.
- Risk evaluation procedures which are used before allowing a pesticide are the object of much criticism:

[102] International Agency for Research on Cancer, IARC:
. (1986): IARC Monographs on the evaluation of the carcinogenic risk of chemicals to humans. Some halogenated hydrocarbons and pesticide exposures. Volume n° 41, Lyon (France).
. (1991: IARC Monographs on the evaluation of the carcinogenic risk of chemicals to humans. Occupational exposures in insecticide application and some pesticides. Volume n° 53, Lyon (France).
[103] Colborn T., 1992: Listening to the lakes: faltering Great lakes wildlife populations point the way to human health hazards. In *Pesticides and You*, June 1992. NCAMP, Washington, DC.
[104] Wingspread Statement Consensus, 1991: Chemically induced alterations in sexual development: the wildlife / human connection. Wingspread Seminar, July 26-28. 1991, Wisconsin, USA.
[105] C&EN [Chemical and Engineering News], 1993: Concerns broaden over Chlorine and Chlorinated Hydrocarbons. In C&EN, April 19, 1993
[106] Colborn T., Dumanoski D., Myers JP, 1996: Our stolen futures. Penguin Books, New York.
www.ourstolenfuture.org/Basics/chemlist.htm
Repetto R., Baliga G., 1996: Pesticide and the Immune System, the Public Health Risks. WRI, Washington, DC
[107] The French daily newspaper Le Monde (June 4. 1994) was referring to researches carried out in the US as well as France on leukaemia risks induced by the exposure to pesticides of some categories of population such as farmers. Farmers present a risk of having a very specific leukaemia, which is twice the level of risk for other people.

. the procedures mainly assess the molecule of the pesticide and not the commercial formulation of the molecule which contains very toxic inert ingredients (important in the case of Roundup herbicide);
. the metabolites produced by the degradation of the molecule in the environment are not assessed;
. only very recently, toxicological tests have been broadened to the long-term hormonal and endocrine impacts of exposure to pesticides;
. ecotoxicological tests do not take into account the diversity of the population exposed;
. they do not assess the risks related to the crossed effects of multiple ways (air, water, food…) of exposure to multiple pesticides as is usually the case.

- **The Roundup case: an interesting example**

Most of the marketed or marketable GM crops are engineered to be treated with the herbicide Roundup containing the glyphosate molecule. It is a broad-spectrum herbicide which can eliminate any plant (weeds or crops). Its patent came over in 2000. By putting on the market patented GM Roundup tolerant seeds, Monsanto sells the seed and the chemical, with a contract forcing farmers to buy Monsanto herbicide. So the marketing of Roundup Ready seeds pushes the marketing of this herbicide. This strategy is fundamental for Monsanto: in 2002, the herbicide represented 66% of the Monsanto Company total sales.

*Some punctual data*

- In Ecuador, in December 2002, farmers sued public administration for not taking any measure to protect the population against the herbicide (Roundup, Cosmoflux) applications used on coca production on the Columbian border (Putumayo State). The administrative Court considered the State as guilty:

*…there is no doubt on the catastrophic consequences resulting from glyphosate applications on plants, animals and humans: children died, considerable number of diseases, plants ands crops destroyed, unusable extensive area of arable land, contamination of water and air…*[108]

- In Brazil, the herbicide Roundup has been considered as the main intoxication source between 1996 and 2000, with 11,2% of the total of cases according to a master thesis written at the faculty of medicine of the University of Campinas (Unicamp). IDEC, a consumer organisation in Brazil, concludes[109] from that study that, if Roundup Ready crops are accepted in Brazil, they will result in an increasing number of acute intoxications and a major volume of these herbicide residues in the environment. IDEC points out the high toxicity of the surfactant (inert ingredient) POEA[110] mixed with glyphosate to make the product more efficient in the penetration of the plant.

*Toxicological analysis*

A comparative analysis[111] carried out in 1994 examined the toxicological data provided by different regulatory bodies in the world concerning the herbicide molecule glyphosate and its commercial products.

Acute and chronic toxicity

- Final products containing glyphosate provoke eyes and skin irritation. It also causes a range of acute symptoms including recurrent eczema, respiratory problems, elevated blood pressure, allergic reactions.

[108] Comité Interinstitucional sobre Fumigaciones, CIF, Quito, January 24, 2003.
www.viaalterna.com.co/planco_5feb3.htm
[109] www.idec.org.br/paginas/emacao.asp?id=429

[111] Assouline G., 1994 : Impacts sur l'environnement des nouvelles techniques de protection des plantes [Impacts on the environment of new plant protection techniques]. Study commissioned by the French Ministry of Environment and European DG XI-Environment. QAP Décision. 230 pages.

- In California, glyphosate based pesticides are considered as causing the most frequent professional diseases and accidents among agricultural workers (eyes and skin).
- Weak probability of carcinogenicity of the molecule.
- The molecule provokes diarrhoea, weight losses, nose irritation and death in pregnant females of rat and rabbit groups treated with high doses.
- DNA damage has been observed in laboratory experiments in mice organs and tissue.
- Laboratory tests on rabbits have shown that glyphosate causes long lasting, harmful effects on semen quality and sperm counts[112].

*Commercial products*

If the toxicity of the glyphosate molecule is considered as weak by regulatory bodies, conclusions are different when assessing the commercial products containing the molecule and inert ingredients like surfactants aiming at facilitating the penetration of the molecule. One of the ingredients of the formulation , POEA, is an inert ingredient and is not listed in the composition of the final product. Japanese researchers have investigated[113] the cases of 56 poisonings with Roundup (mainly suicides or attempts, 9 lethal ones). The average absorbed volume was 200 ml. One of their hypotheses was that POEA was responsible for the acute toxicity of the Roundup. POEA surfactant present in Roundup formulations contains 1,4-Dioxane. IARC[114] and the US National Cancer Institute have classified 1,4-Dioxane as carcinogenic for animals.

[112] Pesticides News No. 41, September 1998, Pesticide Action Network, UK.
[113] Cox D., 1991: Glyphosate. In Journal of Pesticide Reform. Summer 1991. Eugene, Oregon, USA.
[114] International Agency for Research on Cancer, 1987: IARC Monographs on the Evaluation of Carcinogenic Risks for Humans. Supplement 7.

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## Chapter 23. GMOs and biodiversity

**i. Questions related to the item**

- What are the impacts of GMOs on the environment?
- What are the policy implications of the lack of knowledge?

**ii. Issues at stake**

- The existence of impacts, possibly adverse impacts, of GMOs on the environment is today widely recognised, as well as a lack of relevant knowledge.
- The impacts are connected mainly to the possible escape of GM plants or just transgenes into the environment, and to on-field interacting of GM crops with non-target species.
- There is a controversy on the seriousness and irreversibility of the impacts and on the implications of the current knowledge and lack of knowledge for policy-making.

iii. **Elements for the analysis**

- **Growing concerns and a lack of knowledge**

Awareness about the possible adverse impacts of an introduction of GMOs into the environment has been increasing significantly over the last years. An obligatory long-term monitoring has been for example incorporated into the new EU legislation (Directive 2001/18/EC, and traceability and labelling regulation). It is surely a result of the permanent attention paid to environmental impacts in campaigns against GMOs, but mainly of growing empirical evidence. Indeed, with more practical experience about GMOs' interaction in the environment (commercial growing in the US and Canada, large scale field trials in the UK, empirical research), environmental concerns have been strengthening not diminishing.

- **Possible environmental interactions and impacts of GMOs**

These hazards can be related to the on-field impact of GM crops on other organisms, the spreading of GM plants into the environment, or to the spreading of the very transgenes, through hybridisation and horizontal gene transfer to other varieties or species, and their further interactions in the environment.
The limitation of knowledge is widely recognised. It however implies two very different political positions.
- The first one is shared mainly by GMO proponents, and it is also the framework for regulatory assessment. It is clearly represented in the UK science review:
*Most of the possible negative impacts of GM crops on biodiversity are likely to be* reversible*, so small-scale field trials to test for impacts on relevant ecosystems are* unlikely to pose any long-term environmental risks*. After a crop has been approved for commercial use, the monitoring systems required for GM crops grown in the EU provide a valuable mechanism to collect ecologically relevant data. This will be useful* to enhance our understanding *of the impacts of GM pest-resistant crops on non-target species* (pp. 14-15, our emphasis ).

*Most of the environmental issues raised by growing currently available* GM crops do not differ qualitatively from conventional crops*. In both cases, the GM and conventional contexts, we are limited in our ability to predict changes within complex systems* (p. 17, our emphasis).

The keywords are reversibility, no long-term risks, growing understanding through trials, usage and monitoring, comparability/similarity of GMOs and non-GMOs.

- There is however a second, and contrasting, interpretation of the lack of knowledge. It implies a political position that insists on irreversibility, new uncertainties, and a lack of (social, political, scientific) reasons to undergo the risks associated with the release of GMOs into the environment (be it for commercial or

experimental purposes). This opinion is shared not only by experts from NGOs opposing GM crops but by ordinary citizens. For example the final report of the recent UK public debate reads as follows:[115]
*…People fear that GM crops could be a threat to the environment, wildlife and biodiversity. They argue that over time GM crops need more pesticides not less because of the development of resistance "superbugs" and "superweeds". They refer to the potential contamination of native wildlife species, and a danger of extinction of weeds and insects, which might change the balance of nature. People suggest that GM crops are a further stage in the industrialization of agriculture, which in their view is already a catastrophe for the global environment.* (GM Nation? A finding of public debate, p.20)

It is important to note the explicit comparison between pre-GM and GM agriculture with a very different interpretation from the one of official regulatory assessment (described above). Here GM technology is conceived as intensification of a harmful development that started much earlier. Similarities between GM and conventional agriculture cannot justify GMOs. They, on the contrary, should make us more aware of the problems of current agriculture and its impacts on the environment.

**The major impacts identified**

*The issue of pests*

- The herbicide tolerance of GM crops can be transferred to other plants. It happens due to hybridisation of GM herbicide-tolerant crops with their wild counterparts or horizontal transfer of transgenes to weeds. It makes the weeds less controllable. The transfer of genetic material is widely documented.
- In Europe, oil seed rape is an especially sensitive plant in this respect. It has wild relatives in Europe through which transgenes can be carried further into the countryside, with a risk of creating so called superweeds. A nationwide survey has been published in the UK at the beginning of October 2003, which studied the hybridisation of commercially farmed non-GM oil seed rape. Results show that hybridisation is significant.[116]
- Oil seed rape has light pollen, which can transfer over long distances. To date experience shows that there is no "safe" distance to prevent crosspollination.
- It was argued that, in case of herbicide tolerance developed by weeds, different herbicides could be used. Cases of "gene stacking" have been however documented in Canada, when multiple herbicide tolerance occurred in weeds due to the accumulation of resistance from different GM crops.
- One fifth of globally cultivated GM crops have been engineered to produce Bt toxin (especially maize and cotton). It is naturally produced by the soil bacteria *Bacillus thuringiensis*, and it has been used for pest control for more than 50 years. If used in conventional or organic agriculture it is repeatedly but discretely sprayed over the plants, but the toxin is produced continually in GM Bt-crops. This means that insects are exposed permanently and are more likely to develop resistance. A natural biological resource of pest control is thus devaluated.

*Replacing native species*

- The introduction of a transgene may result in the selective advantage of GMOs in a specific environment, and invasion of the surrounding vegetation. This becomes a potential problem mainly in the case of plants with GM tolerance to specific environmental conditions (salt-tolerance, drought-tolerance). It is an urgent issue in regions where the genetic diversity of specific plants is located (like maize in Mexico, soybean in China). In these regions the expansion of modified genomes can result in a significant reduction in genetic diversity.
- In 2001 I. Chapella and D. Quist published their findings of GM material in Mexican maize, in spite of the fact that cultivation of GM maize is not authorised in Mexico. It points to the high uncontrollability of gene flow.

[115] For more detailed explanation of the event see chapter 32. of this report
[116] GM crops could create hybrids (Brown in The Guardian 10/10/2003)

*Harming non-target species*

- An overuse of herbicides and Bt toxins can harm non-target insects and soil bacteria. One of the first laboratory experiments (only in 1999!) which pointed to an insufficient environmental risk assessment of GM crops was related to the possible harmful impact of Bt toxin on the monarch butterfly.
- Total herbicides used with GM crops kill pests very effectively. This may result in the disappearing of various weeds and insects biologically significant in food chains, and can indirectly impact different species in the countryside, like birds, and reduce biodiversity.

*The most systematic experimental research into the impacts is based on the UK three-year farm-scale trials.*

Farm-scale field trials with four GM crops, spring and winter oil seed rape, sugar beet and maize, took place in the UK between 1999 and 2002[117] The experiment was to test the hypothesis that the impact of growing GM crops on the abundance and variety of farmland plants and creatures is not different from that of conventional varieties. Seventy fields across the country were selected each year, representing the diversity of soil types, environmental conditions and crop management strategies. Each field was divided between conventional and GM varieties of the same crop. Farmers were told to cultivate the conventional crops in the usual way and to treat GM crops with broad-spectrum herbicides according to the instructions given by the industry. The researchers monitored the plants and animals (butterflies, bees, ground beetles, springtails, true bugs, spiders) in the fields, around the ploughed edges of the fields, before, during and after the crops. Each field was visited 15 to 20 times a year.

The results published on October 16, 2003 were widely interpreted as showing significant harmful effects of growing GM varieties in the cases of spring oil seed rape and sugar beet.

- In both cases the amount of weed seeds was substantially higher in conventional fields, up to six times, providing food for birds like skylarks.

- The results were uniform across the country, giving Professor Chris Pollock, chairman of the scientific panel, confidence that the results would be the same all over Europe[118]- There were fewer bees and butterflies on the GM fields.

*The case of maize is more complicated.*

The results showed better performance of GM crops in relation to biodiversity but are to a great extent invalidated by a recent ban in the EU on atrazine, a herbicide that was used with the conventional maize in the trials. Some say that the trials need to be completely repeated.

*The results for winter oil seed rape have been published by the Royal Society, in March 2005*[119].

The main findings of the trials led to the following:

- fewer important plants (broadleaf weeds on which birds rely heavily) for insects and birds,

- an increase in grass weeds which farmers may have to tackle with more herbicides, which would further damage wildlife,
-the main damaging factor for the wildlife is the herbicide sprayed on GM crops. The use of the patented glufosinate–ammonium weedkiller contributes to have one third fewer weeds for birds to eat at the end of

[117] For the full report of the trials see The Farm Scale Evaluations of spring-sown genetically modified crops. A themed issue from Philosophical Transactions: Biological Sciences. Series B, volume 358, issue 1439. November 2003. At: http://www.pubs.royalsoc.ac.uk/phil_bio/news/fse_toc.html. For crop by crop, species by species summary see Birds and the bees: how wildlife suffered (Vidal in The Guardian 17/10/2003)
[118] Two GM crops face ban for damaging wildlife (Brown and Vidal in The Guardian 17/10/2003)
[119] Damning verdict on GM crop (Brown and Gow in the Guardian 22/03/2005).
At www.guardian.co.uk/uk_news/story/0,,1442915,00html

the season, than in a conventional crop. Two years later there were still 25% fewer seeds even though the weedkiller had not been applied again.
Those results have been considered as particularly significant because winter-grown oil seed rape occupies 330 000 hectares of British fields and is the largest single crop and the one from which farmers make more money.
Bayer Crop Sciences , which owns the patent on the GM oil seed rape being tested said afterwards that it was not going ahead with the application to grow the crop in Europe and was seeking permission to import it into the EU for use in food and animal feed. The EC has refused to allow Bayer to alter its joint application (to grow and to import). A decision is likely to be taken this year[120].

For many commentators the results of the trials provide sufficient ground not to allow commercial cultivation in the UK and should have implication for the EU policy.[121]

*Genetic instability*

- Some scientists argue that the very technique of genetic modification enhances horizontal transfer of genes and recombination (Ho, Lim 2003: 31-32, 40-47). This leads potentially to the creation of new micro-organisms and viruses, with unknown interactions in the environment.[122]

[120] Friends of the Earth, Press release, 21/03/2005: GM crop trial blow to biotech industry.
[121] Case not proven (The Guardian 17/10/2003); Outright ban, caution or green light? All sides draw comfort from report (Vidal in The Guardian 17/10/2003)
[122] For other empirical examples and extensive literature references related to environmental impacts see for example Ho, Lim 2003; Kruzsewska 2001: 42-50

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## 24. Potential GM related human health risks

### i. Questions related to the item

- Do knowledge and evidence point to the existence of health risks?
- What are the possible risks then?
- Do knowledge and evidence point to the non-existence of health risks?
- What is the basis of an official risk assessment and what is consequently its informative value?

### ii. Issues at stake

- Official health safety evaluations of commercial GM crops work on the assumption of a 'substantial equivalence' of GM and non-GM food in most of the cases. This allows for limited safety assessment.
- Official assessments are strongly criticised by different experts pointing to the limited scope of evaluation, selectivity of knowledge taken into account and the fact that it is mostly the biotech firms themselves that carry out the assessments.
- No GM food related harmful impact on human health has been proved so far but there is a certain amount of partial and indirect evidence pointing to risks.
- The most serious concerns are related to the possible allergenicity and toxicity of GM food (as a result of limited controllability of (trans)gene expression) and to the spreading of antibiotic resistance (as a result of horizontal transfer of genes to human gut bacteria).
- To date experience suggests that possible health damage will be connected to long-term and/or massive consumption of GM food (not acute detrimental impacts).

### iii. Elements for the analysis

- **An official risk assessment and its critics**

The only consensus between different experts is that there has been so far no strong evidence of health damages related to the consumption of GMO or GM-derived products. There are two common arguments from GM proponents. The first starts with an assumption of no principal risk related to GM technology. A case-by-case risk assessment system (even stricter than in the case of other foodstuff) thus effectively eliminates possible harmful products. The second argument stresses the fact that GM products have been consumed for several years in the US and other countries without an observation of any detrimental effects on the consumers' health. Even though an expert could hardly be found today who would declare an equation between no evidence of harm and guarantee of absolute safety, GM food is consequently treated as substantially equivalent to its non-GM food counterparts, i.e. without special risks and need for further testing.

One can never guarantee absolute safety, but the GM foods that have been through the process are as safe, if not safer, than conventional alternatives, says Janet Bainbridge, the chair person of the UK government's advisory committee on GM foods (in Sample 2003).

No evidence of harm is however interpreted quite differently by other experts.[123] They point to a lack of experiments and knowledge, the poor quality of the risk assessment, which is based on a selective body of knowledge and carried out mostly by the biotech industry, and a lack of long-term effects monitoring and epidemiological studies in countries where GMOs have been consumed.[124]

Official positions have however been changing recently. For example, the concept of substantial equivalence was excluded from the EU legislation in the new traceability and labelling regulations, and

[123] A prominent group of experts opposing GMOs were gathered in the Independent Science Panel. An overview report The Case for a GM-Free Sustainable world (Ho, Lim 2003) was published recently in reaction to the UK Science review commissioned by the Government in connection with the UK public debate on GMOs. A leading figure of the Panel is Mae-Wan Ho who also founded The Institute of Science in Society (at: http://www.i-sis.org.uk).

[124] An extensive overview of the controversies and gaps in knowledge that should supposedly back official claims about "no GM related risks" can be found in de Visser, Nijhuis, van Elsas and Dueck (2000).

the recent UK science review admitted the possibility of unknown risks and a lack of inquiry into health risks.
To date worldwide there have been no verifiable untoward toxic or nutritionally deleterious effects resulting from the cultivation and consumption of products from GM crops. However, the absence of readily observable adverse effects does not mean that these can be completely ruled out and there has been no epidemiological monitoring of those consuming GM foods.
(UK science review, final report, p.10)

- **Potential health risks: partial evidence**

As a result of the above described conditions, possible risks are elaborated and published nearly exclusively by GM critical experts. They are partially based on non-peer reviewed papers, as the critical knowledge often questions or crosses the borders of the established paradigm and can thus hardly find its way to reviewed journals.

*The case of Arpad Pusztai*[125]

The most famous paper on the health safety of GM food was published by two UK scientists, Arpad Pusztai (Rowett Research Institute in Aberdeen) and Stanley Ewen (Aberdeen University) in the Lancet in 1999. They presented experimental results and claimed that feeding rats on GM potatoes damaged their stomach linings and caused an increased production of cells in bowel linings. It thus suggested the possible detrimental effects of intensive GM food consumption, which may be "general to all GM food" (Ho and Lim 2003: vi). Interestingly, Arpad Pusztai lost his job as a result of the publication, for he reportedly bypassed some internal publication related rules of the institute, and the case provoked much controversy in the scientific community (e.g. there was a petition to support Puzstai) .[126]

GM major health risks are related to two phenomena. The first is the complexity of the gene expression process. Genes are not mechanically read in cells but rather 'interpreted' in specific conditions. This brings in a degree of unavoidable unpredictability. The second phenomenon is gene flow. Fragments of genetic information can transfer to other organisms not only vertically (from parents to children) but also horizontally (between different organisms). These are naturally occurring phenomena, but there are indications that the very technique of genetic modification enhances instability and a tendency for recombination and horizontal gene transfer (Ho, Lim 2003: 7-8).

*Allergenicity and nutritional/toxicological impacts*

A great majority of GMOs have so far been approved with reference to 'substantial equivalence'. The principle says that, if a new food product does not substantially differ from its existing food counterpart, it does not need to undergo strict and long-lasting allergenicity and nutritional/toxicological tests. There is no unequivocal test to define substantial equivalence. Companies can therefore claim that the GMO is substantially equivalent to the respective non-GMO except for the transgene product. This brings them a double benefit as it allows them to carry the risk assessment on an isolated transgene product only and at the same time to ask for patent protection. However, as noted above, genes are expressed in complicated interactive processes in a cell, which cannot be taken into account by the limited risk assessment.
There has been so far no acute health problem related to the consumption of GM food. However, according to Meacher (2003), food-derived illnesses are believed by the official US Centres for Disease Control to have doubled over the past seven years. And there are many reports of a rise in allergies - a 50 per cent increase in soya allergies has been reported in the UK since imports of GM soybean began. But there is no proved link to GM food consumption - due to lack of investigation and also due to the complexity of factors that may influence human health.

[125] When fed to rats it affected their kidneys and blood counts. So what might it do to humans? We think we should be told. G. Lean in The Independent 22/05/2005.
At:http://news.indepêndent.co.uk/world/science_technology/story.jsp?story=640402
[126] For an overview of other relevant studies and partial evidence, see Pusztai (2003).

Potential allergic risks are related to the risk of cross reactivity with existing allergens, the modification of the allergenicity of the transgenic protein induced by a modified metabolism in the host, the modified allergenicity of the proteins of the transgenic plants, a potential neo-allergenicity of the transgenic protein and the risk of dissemination through pollens, including a respiratory sensitization then a cross food allergy[127].

*Antibiotic resistance and other gene flow related risks*

Antibiotic resistance marker genes have been widely used in commercial GM crops. A 2002 study commissioned by the UK Food Standards Agency showed that the transgenes can make their way into human gut bacteria (a possibility which was before rejected by a majority of scientists). A spreading of antibiotic resistance would of course have very serious effects on human health. Also, other transgenic constructs can be incorporated to bacteria on the same principle, which could alter the bacteria balance in the gut.

In addition to the natural possibility of a horizontal gene transfer, there is a suspicion that a gene of cauliflower mosaic virus, widely used as a promoter in transgene constructs of commercial GM crops, is especially unstable and prone to horizontal gene transfer and recombination. This could result in gene mutations due to random insertion, cancer, reactivation of dormant viruses and generation of new viruses (cf. Ho, Lin 2003: 33-36).

- **Indirect impacts**

The above listed risks are directly linked to GM food consumption but there are other relevant, though more indirect, impacts.

*Higher herbicide and herbicide residues exposure*

As described in chapter 21 of this report, GM agriculture triggers an increased use of herbicides. People living near GM crops fields as well as consumers become thus more exposed to herbicides and their residues. There are two common herbicides used with GM plants, glyphosate and glufosinate ammonium, which are both reported to have a harmful impact on human health.[128] In addition to more negative impacts related to increased use (in comparison with conventional production), there may be a special GM related risk in case of glufosinate ammonium. The chemical reaction in GM crops that causes the (glufosinate ammonium based) herbicide tolerances can be partly reconverted in the gut of warm-blooded animals, i.e. a regeneration of the original toxic herbicide to a certain degree (cf. Ho, Lim 2003: 27-28).

According to the latest report of The Institute of Science in Society, plane spraying in Argentina causes skin and eye irritations and a recent field research (personal communications by local people and medical doctors) suggests that there is a great increase in the incidence of cancer within populations surrounding RR soya fields (Joensen, Ho 2003).

*A mono-crop consumption*

With increased poverty and GM reorientation of the agriculture, GM soya became a principal component of the daily diet in Argentina, alternating milk and meat products. The government launched a campaign Soja Solidaridad (Soya Solidarity) to promote the consumption. There is however a substantial amount of scientific evidence showing that an unbalanced diet based on soya can have nutritionally damaging effects. Too much soya (be it GM or non-GM) can inhibit the absorption of calcium, iron, zinc and vitamin B12, and according to Joensen and Ho (2003), doctors in Argentina are already seeing such symptoms.

[127] Moneret-Vautrin A., 2002: The allergic risk of transgenic foods: strategy for prevention. In Bull. Acad. Med. 2002; 186: 1391-1400.

[128] Glyphosate: balance disorder, vertigo, muscle paralysis, spontaneous abortion, etc; glufosinate ammonium: disturbances of metabolism (cf. Ho, Lim 2003: 27-30).

As shown in many parts of this report, GM agriculture tends to homogenise production and consumption due to its economic and technological nature. The Argentinian case warns precisely against this mono-crop orientation, which GMO proponents often suggest as an ideal solution for feeding the world.

Rather than an acute detrimental impact of GM food, to-date experience suggests possible risks connected to long-term and/or massive consumption. More invisible and unequivocal does not of course mean less serious and dramatic. Importantly, however, these impacts are (1) difficult to prove; (2) it is difficult to make someone accountable/responsible ; and (3) they are difficult to control and revert.

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# Part III. Regulatory and political dimensions

**1. The European Commission questioning of the moratorium**

Since 1998 there has been a moratorium on the authorisation of new GMOs for release into the environment and a de facto ban on the commercial growing of any GM crops in all EU member states except Spain. This policy has to a great extent been a result of the European public mobilisation against GMOs. There are however other forces influencing the EU policy, namely pro-biotech pressure from the US government, from the US and European industry on hesitating public authorities. As a result the moratorium was lifted in April 2004 with the adoption of two regulations on traceability and labelling.

**2. Four main issues had to be solved in the reconstructed legislative framework as a condition for lifting the moratorium**

- Accountable authorisation procedure
- Traceability and labelling of GMOs and derived products
- Liability for possible harms related to the use of GMOs
- Co-existence of GM and non-GM agriculture

The first two issues have been dealt with , on the legislative level of the EU, whereas ***liability*** and ***co-existence*** still remain unresolved, highly controversial. They are put under the member states' competence with a reference to substantial differences between countries and regions.

**3. There are multiple stakes in the GMO controversy**

From health risks to the general questioning of modern pro-growth orientation, the diversity of stakes is an important factor of strong and persistent public mobilisation. A key role in the mobilisation has been played by environmental and consumers' organisations and farmers' unions. The public mobilisation was able to influence governmental and trading policy (the EU moratorium, retailers' ban on stocking GM products), and GM technology (suppression of antibiotic resistance marker genes).

**4. Unequal mobilisation**

Public mobilisation takes place to a certain extent in most countries in Western Europe, whereas Central and Eastern European (CEE) countries behave as followers. Eastern countries have a GM moratorium policy but it is a result of pre-accession harmonisation of legislation and political conformity rather than of public mobilisation.

**5. Co-existence as a real scale experiment will be a major focus of the mobilisation**

There is a general agreement about unavoidable GM contamination at some level if GM crops are cultivated on a commercial scale in a region. The lack of practical experience concerning the control of contamination (at a low level) makes co-existence measures a kind of real scale experiment.
Some GMO opponents reject in principle any legislation that could open the way to Europe for GMOs. Other opponents tend to accept the new traceability and labelling legislation, and try to block GMOs through consumer rejection and opposition to co-existence. For critics of GM agriculture (for political and safety reasons), any contamination, especially of organic production, is incompatible with the idea of co-existence. The complexity of the issue is due to the combination of uncertainty and irreversibility related to contamination. These high stakes are not counter-balanced by any persuasive benefits.

**6. Towards a new moratorium in Europe?**

The current political context due to the adoption process of the Constitution may facilitate a de facto new moratorium: local authorities deciding on their own moratorium, disagreement among member states paralysing GM variety adoption procedures and the EC having the last word with a weakened legitimacy.

## Chapter 31. Current EU regulatory process related to GMOs: from the moratorium till today

### i. Questions related to the item

- What sovereignty of European member states and regions in relation to GMOs?
- What freedom of choice can be guaranteed for consumers and farmers by the emerging reconstructed EU legislation?
- What can happen after the moratorium is lifted?

### ii. Issues at stake

- Since 1998 there has been a moratorium on the authorisation of new GMOs for release into the environment and a de facto ban on the commercial growing of any GM crops in all EU member states except Spain. This policy has to a great extent been a result of the European public mobilisation against GMOs.
- There are however other forces influencing the EU policy, namely pro-biotech pressure from the US government and industry. As a result the moratorium is about to be lifted.
- Four main issues had to be solved in the reconstructed legislative framework as a condition for lifting the moratorium: accountable authorisation procedure, traceability and labelling of GMOs and derived products, liability for possible harms related to the use of GMOs, co-existence of GM and non-GM agriculture. In April 2004, the adoption of two regulations concerning traceability and labelling meant that the moratorium could be lifted.
- Liability and coexistence still remain unresolved, highly controversial, and put under the member states' competence.
- Some GMO opponents reject in principle any legislation that could open the way to Europe for GMOs. Other opponents tend to accept the new traceability and labelling legislation, and they try to block GMOs through consumer rejection and opposition to coexistence.
- This new step, in a difficult political context due to the adoption process of the Constitution treaty, may generate a *de facto* new moratorium under different forms: local authorities imposing their moratorium, disagrement among member states paralysing the GM variety adoption procedures.

### iii. Elements for the analysis

- **Around the moratorium: a call for a new legislative framework**

The first special EU legislation related to GMOs appeared at the beginning of the 90's. It responded to a wide-ranging GMO risk debate and to pressure to overcome a democratic deficit in the EU (Levidow et al. 1996).

The two relevant directives were:
- Directive 90/119/EEC on the contained use of genetically modified micro-organisms
- Directive 90/220/EEC on the deliberate release into the environment of genetically modified organisms

The contained use of GMOs has not been the object of any strong controversy, and the Directive was only slightly amended in 1994 and 1998. On the contrary, the deliberate release into the environment was to a varying extent controversial during all the 90s. Public mobilisation against GMOs in agriculture and food reach its peak in 1996/97 with the first shipments of GM soybean from the US. The campaign finally resulted in a moratorium on the authorisation of new GMOs declared by the Council of Ministers of the environment in 1999. The establishment of a stricter and more precautionary regulatory framework was set as a main condition for lifting the moratorium. Except for an accountable authorisation procedure, this framework should resolve the issues of traceability and labelling of GMOs in the food chain, of liability for potential harms related to the use of GMOs, and of coexistence between various types of agricultural production.

Before the imposition of the moratorium, 18 plants were approved for release into the environment under Directive 90/220/EEC, including three different varieties of maize for commercial cultivation (the only crop authorised for this use in the EU). As the moratorium does not work retroactively, these plants could on principle be kept in use in accordance with the authorisation. In fact, however, only one European country, Spain, currently grows GM maize.

The legislative process focused on the establishment of the new regulatory framework, to justify the lifting of the moratorium has recently been quite intensive. Most of its elements have been in force since 2004. Before discussing its respective parts in the following paragraphs, two features of the legal construction are worthy of note.

- First, different pieces of legislation relate to different policy levels. The authorisation process for GM food and feed to be placed on the market is regulated directly by EU regulation and its results (possibly positive authorisation decisions) are binding for all member states. On the other hand, coexistence and related liability, i.e. potentially highly controversial and contested issues, are to be regulated by individual member states, with only guidelines published by the Commission.
- Secondly, the Commission strongly insists on the discrete functions and meanings of different pieces of the legislation. Authorisation is related to health and environment risks and guarantees their absence. Traceability and labelling ensure consumer choice and ethical concerns. Coexistence measures are related to economic issues. None has any connection to health and environmental risks, as stated by the Commission. For example: Co-existence is not about environmental or health risks because only GM crops that have been authorised as safe for the environment and for human health can be cultivated in the EU /…/ Co-existence is concerned with the potential economic loss through the admixture of non-GM crops that could lower their value… (EC press release of 23/07/2003).

The regulatory framework is thus based on a sharp distinction between objective, risks managed by experts (on the level of the EU or individual member states) and subjective consumers concerns. They are politically and economically relevant, and should thus be accommodated, but they are carefully distinguished from the "real" risks of the technology.

- **Authorisation procedure for the release into the environment**

The current legislation regulating the authorisation process is Directive 2001/18/EC of the European Parliament and of the Council on the deliberate release into the environment of genetically modified organisms, which repeals Council Directive 90/220/EEC. It came into force on 17 October 2001 as the first element of the reconstructed legislative framework.

*There are two kinds of use of GMOs regulated by the directive.*

The first is the release into the environment of GMOs for any other purpose than for commercialising them, which mainly covers open field trials In this case, the authorisation is valid only on the territory of the member state concerned, and the European Commission and other member states are in fact only informed about the on-going process and its results.
The second use is commercialising GMOs, which means "making them available to third parties, whether in return for payment or free of charge". It thus covers the commercial cultivation and marketing of GMOs. It is important to note, however, that the directive relates only to "organisms", i.e. to biological entities capable of replication or transfer of genetic material and does not deal with the marketing of products derived from GMOs without living DNA, for example refined oil produced from GM soybeans.[129] The authorisation in the case of commercialisation also happens in/via one member state but an approval is binding for the whole EU. Its application needs a positive assessment from the competent authorities of each member state. Possible dissent is managed at the EU level.[130] Furthermore, the

[129] It means that the scope is the same as in the case of the Cartagena Protocol on Biodiversity.
[130] The Commission asks for the opinion of its Scientific Committees. If the opinion is positive, the Regulatory Committee, composed of representatives of member states, will decide the case. If the Regulatory Committee does

directive includes two so called Safeguard clauses : one, the art. 23, 2001/18 directive allows a member state to provisionally restrict or prohibit an authorised GMO on its territory. It has been invoked 9 times by Austria, France, Germany, Luxembourg, Greece, UK. The second one, art. 12 of 258/97 regulation has been used by Italy. The reasons and justifications for these actions are then investigated on the EU level and have to be defended.
The directive should have been adopted by member states by 17 October 2002.[131] However, it did not happen in the majority of the member states, and in July 2003 the Commission decided to refer them to the European Court of Justice. By July 11 member states did not comply with the European directive.[132] This delay shows the ambiguous position of the majority of member states. They do not openly challenge the EC efforts focused on withdrawing obstacles to the opening of the European markets but, on the other hand, they try to avoid a confrontation with the wide public opposition in their countries, which can be expected to strengthen with the ending of the moratorium. This clear lack of consensus is a serious issue for the new EU Commission in 2005. More and more countries abstain in Europe's GMO votes, reducing the chance of agreement, while a small group votes in favour and a counter-group always votes against. The result is that no decision is taken and it is incumbent on the Commission to approve new GMOs, months later. So it seems that the new EC plans to press ahead with new approvals for the cultivation of GMOs, in spite of a legal loophole in EU legislation concerning co-existence.

- **Traceability and labelling**

Traceability and labelling were two other issues to be dealt with as a condition for lifting the moratorium. Two related regulations were adopted by the Parliament on 2 July 2003, and then approved by the Council of Agriculture Ministers at the end of the month. They came into force in April 2004.

These regulations are:
- Regulation of the European Parliament and of the Council on the traceability and labelling of GMOs and products derived from GMOs, which amends Directive 2011/18/EC
- Regulation of the European Parliament and of the Council on GM food and feed
The two regulations together set rules for the authorisation, traceability and labelling of GM food and feed.[133]

*Main changes compared with the previous requirements*

- Traceability and labelling are required not only for GMOs but also for products derived from GMOs but no longer containing living DNA. The only difference is that GMOs have to be transmitted with unique identifiers of the specific modification,[134] whereas, in the case of a derived product, it is only unspecified information stating that the product is of GM origin.[135] Products produced with the help of GMOs, such as meat from animals fed on GM feed, will not be traced and labelled.
- The same rules apply to GM food and feed.
- The threshold for adventitious or technically unavoidable presence of GMOs in a non-GM product is 0.9% for GMOs authorised in the EU and 0.5% for GMOs that are not authorised in the EU but have nevertheless been assessed as risk-free. Below the threshold labelling is not required.

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not give a favourable opinion, the decision will shift to the Council of ministers. They decide on a qualified majority or reject the case.
[131] There are three basic forms of EU legislation. 'Regulations' become part of the member states' legislation automatically. 'Directives' have to be adopted by each member state and incorporated into its legislative framework. There is a certain time limit (usually two years) for a member state to act after the directive comes into force at the EU level. 'Decisions' are similar to regulations but may not apply to all member states. The de facto moratorium on GMOs is an example of a decision.
[132] Genetically Modified Organisms: Commission takes Court action against eleven Member States. 15/07/2003. http://www.eu.nl/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/03/1007|0|RAPID&lg=EN
[133] Until the regulations come into force, GM food is regulated within the frame of Regulation (EC) 258/97 on Novel Foods and Novel Food Ingredients.
[134] Cf. Article 4 of the regulation on traceability and labelling.
[135] Cf. Article 5 of the regulation on traceability and labelling.

The Commission presents these regulations as a measure that "will consolidate a trustworthy and safe approach to GMOs, GM food and GM feed" (EC press release of 22/07/2003). At the same time, as admitted even in the explanatory memorandum of the GM food and feed regulation, there is no analytical method for controlling the truthfulness of the information provided on labels. Testing methods are based on the detection of modified genetic material, and they will not be able to ascertain the GM origin of the products no longer containing the genetic material. To a certain extent, the labelling has therefore to be based on trust in the traceability system.

**Public participation in the regulatory scheme**

The GM food and feed regulation and the 2001/18/EC directive both involve a procedure of public consultation. It seems to be an imprescriptible measure with regard to the Commission's effort to restore the trustworthiness of the regulatory system. At certain stages of the authorisation procedure, the public may comment on the application or on the opinion of competent authorities or the Commission on the application. On principle, it is a gate for counter-expertise and public concerns of different nature to enter the process. On principle - in both senses of the word: firstly, the handling of the consultation procedure in practice (at the EU level or in a respective member state) will determine whether objections from the public will be seriously taken into account and will have a chance to influence anything. Secondly, a counter-expertise may find other more effective ways to influence GMO policy, for example via consumer rejection - it may however be in conflict with the manner in which the Commission wanted to channel and interpret the whole framework (contrasting objective risks and subjective preferences as described above).

- **Liability**

*The issue of liability, or responsibility is still unclear, unresolved and very controversial.*

First, in the guidelines on the coexistence of GM and non-GM agriculture issued by the Commission in July 2003, the issue of liability is delegated to member states to be dealt with within the frame of their civil liability laws.

Secondly, there is an on-going relevant debate on the proposal for a European Parliament and Council directive on environmental liability. The initial proposal of the Commission did not cover the field of GMOs as it proposed that all activities which are allowed in the applicable legislation or are not considered harmful according to the scientific and technical knowledge of the time were to be excluded from the scope of the regulation.[136]After the first reading (14.5.2003), the Parliament voted to extend the scope of the regulation so that it would encompass activities related to GMOs. Further discussions on the proposal are to take place later this year.

Thirdly, with the exception of environmental liability, the question of health damage related liability has not however been explicitly addressed so far by the Commission .
In many countries, insurance companies have expressed the impossibility to ensure any responsibility in case of damages, for different reasons: either there is no proven risk, so no reason to ensure, or the risk is so sure that it could be extremely costly for insurance companies to cover it. In Germany for instance, German seed companies desisted to assume themselves the responsibility of possible damages, as they can be be covered by their insurance regime[137].

[136] In May 2003, Commissioner Wallström stated in the parliamentary debate that "regarding GMOs…it was too early to determine the outcome of the debate on "co-existence" and that he would therefore prefer environmental liability to be dealt with in due time through an international convention" (European Parliament, Daily notebook 13-05-2003).
[137] Inf'OGM n° 55 – July 2004. At http://www.infogm.org/article.php3?id_article=1628

- **What happens with the end of the moratorium ?**

*The position of NGOs*

A great deal of the opposition against GMOs has so far been channelled through criticism of (insufficient) existing legislation and insistence on the moratorium. With the new legislative framework , the justification for a new moratorium emerges. Let us see the comments of some actors on the legislative framework.

*Reactions on the GMO traceability and labelling regulations*

Geert Ritsema, GMO Campaign Coordinator of Friends of the Earth Europe, said:

*…This new legislation is a welcome step in the right direction and will allow countries to take action to protect our food and farming from genetic pollution. It will also give consumers and farmers more information so that they can choose whether or not to take part in the biotech industry's massive GM experiment. But there are still gaping holes in the legislation, particularly over liability. The EU must make biotech companies fully liable for their actions before any GM food or crop is approved…*
(Friends of the Earth press release of 02/07/2003)
*… the European Parliament today adopted the world's strictest and most comprehensive rules on the labelling of GMOs. Greenpeace praised the move, which is a practical example of EU resistance towards the intensified global campaign by the US Government and the genetic engineering industry to ease or abolish GMO legislation. The new EU rules allow consumers to exercise their right to reject GMO food. All food and animal feed containing or derived from GMOs will have to be clearly labelled, making it possible for farmers, food producers and consumers to continue to avoid using or eating them. /…/ While the new rules are a significant step forward, Greenpeace regrets that loopholes remain in the legislation, most importantly regarding dairy and meat products from animals fed with GMOs, which still do not need to be labelled.*
(Greenpeace press release of 02/07/2003)

The two big NGOs campaigning against GMOs at the European level welcome on principle the new legislation with only minor objections. In spite of the fact that it de jure allows the commercial use of GMOs, Greenpeace interprets it explicitly as a means to de facto block GMOs in European agriculture and food. Indeed, British food retailers, for example, after the labelling regulation was voted in the European Parliament in July, announced that they would not stock even labelled GM food if their customers did not want it.[138]

The relative support of the European traceability and labelling legislation gives an image of constructive opposition, and at the same time it provides a basis for critical position against the US. The NGOs, on the other hand, are ready to take a very critical position concerning the issue of co-existence and related EU legislative measures.[139]

There is, however, a different, principally critical, reaction to the EU legislative initiative too. "Les OGM en liberté! Décision scandaleuse des parlementaires européens! Les parlementaires européens viennent d'ouvrir la voie, par un vote irresponsable, à la levée du moratoire qui depuis 99 'protège' les territoires européens de l'invasion des OGM [GMOs free! Scandalous decision of MEPs! The MEPs have opened the way, through an irresponsible vote, to the lifting of the moratorium that have 'protected' the European territories against an invasion of GMOs since 1999]," a press release of Confédération paysanne exclaims. Thus, we can notice two contradictory public interpretations of the new legislation by its opponents.

[138] Richard Ali, director of food policy at the British Retail Consortium, said: "Our position remains unchanged. We are neutral on GM technology. But we provide what customers demand and they do not want GM food." (Morris in The Guardian 16/07/2003)
[139] See 3.2. of this report

*The position of GMO proponents*

In comparison with the opponents of GMOs, the actors interested in the marketing of GMOs in Europe did not welcome the traceability and labelling legislation.

*…While BIO recognizes and appreciates the EU efforts to create a functional regulatory system, our customers among the farming and food producing communities tell us the new traceability and labelling standards are impractical. Impartial observers can see they are not scientifically defensible. We are concerned that these new rules may not, in fact, enable European consumers to enjoy the opportunity to choose foods derived from crops improved through biotechnology*. (Biotechnology Industry Organization Statement on European Union Vote on Biotech Foods, 02/07/2003)

*…The American Farm Bureau Federation today expressed concern about the European Union's new rule requiring biotech products to be traced through production and processing and labelled as containing genetically modified organisms (GMOs). AFBF also called on the Bush administration to continue to aggressively prosecute the case it filed last month in the World Trade Organization against the EU's de facto ban on biotech imports*.
(American Farm Bureau Federation press release from 02/07/2003)

At the same time, 20 notifications received by the Commission under Directive 2001/18/EC have been waiting for the end of the moratorium. There are different varieties of maize, oilseed rape, sugar beet and potato to be approved for cultivation.

*The effect of the end of the moratorium and the new legislation in force is not clear.*

The legislation is designed as a means to allow GMO introduction into Europe. It cannot, however, determine the following development. In the currently tense and conflicting situation, different actors try to use it for blocking or promoting GMOs.

The end of the 1998 moratorium did not allow to solve the political dissent among member states and between member states and the EC. The new EC announced its intention to fight legally against the GMO-free regions and to propose a regulatory initiative on coexistence[140].
This new step, in a difficult political context due to the constitutional treaty adoption process, may generate a new de facto moratorium under different forms:
- local authorities imposing their own moratorium,
- disagrement among member states paralysing the GM variety adoption procedure.

Much will depend on internal factors:
- results of the EU debate on coexistence and many decentralised GM-free initiatives
- enforcement of the traceability and labelling system in practice,
- in the current context of the constitutional treaty adoption process, the highly sensitive debate on the content of national and regional sovereignty, with the European Union. On this issue, one could perceive a very acute contradiction between:
  . the European Commission new governance rhetoric insisting on stakeholders'initiatives and decentralised capacity to self-govern,
  . and the de facto impossibility of implementation as soon as the issues are considered as sensitive or strategic;

as well as external factors:
- the development of the US-EU WTO process and the intense pressure of GM producers on European traceability policy,
- the possible mobilisation of the Cartagena Biosafety Protocol by the main actors.

[140] Denys S., Jacob L., 2005: Towards a new moratorium? Inf'OGM, n° 63, April 2005.

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## Chapter 32. Mobilisation and public debate in some European countries

### i. Questions related to the item

- How can (concerned) citizens be more than mere voters ( represented by elected politicians), ignorant lay persons ( educated by experts) and passive consumers ( protected by regulatory bodies)?
- What are the effects of formal participatory procedures (e.g. consensus conferences) through which governments try to channel public mobilisation?

### ii. Issues at stake

- There are multiple and various stakes in the GMO controversy: from health risks to the general questioning of modern pro-growth orientation. Diversity is an important factor for strong and persistent public mobilisation.
- A key role in this mobilisation has been played by environmental and consumer NGOs and farmer unions.
- Another important fuel for mobilisation is publicly visible expert disagreement and previous experience with the suspicious role of official expertise in other cases (BSE). Expert knowledge cannot play a role of uncontested objectivity that calms down a controversy .
- Public mobilisation was able to influence governmental and trading policy (the EU moratorium, retailers' ban on stocking GM products) and GM technology (suppression of antibiotic resistance marker genes).
- Public mobilisation is, to a certain extent, present in most West European countries, whereas Central and East European (CEE) countries behave as followers. They have a GMO moratorium policy but it is a result of pre-accession harmonisation of legislation and political conformity rather than of public mobilisation.
- In Romania and Bulgaria, GM crops have been grown for commercial purposes for several years in a rather uncontrolled way. They are a potential source of contamination for the Balkan region.

### iii. Elements for the analysis

- **General characteristic of the debate(s)**

The strength of GM agriculture and food controversy, at least in some West European countries and at the level of EU governance, is constituted by a multiplicity and diversity of stakes, ranging from (counter)expert disputes about the health and environmental risks of technology, ethical concerns, to questions of democratic governance related to (new) technologies, of the global influence of big corporations, or the very political questioning of the pro-growth orientation of modern societies. It is connected to other environmental problems and food-related crisis and in some contexts it is even a kind of icon.

The debate about biotechnology emerged in some European countries, for example Denmark, already in the 80s. However, visible and noisy mobilisation took place only in 1996/97, when the first shipment of GM soybeans arrived in Europe from the US. The European campaign of Greenpeace played a crucial role. Most importantly, the mobilisation resulted in the moratorium on the authorisation of new GMOs into the EU, in a de facto ban on the commercial cultivation of already approved GM maize in most of the countries, and in a GMO-free policy for most food retailers. The following should be noted : first, public mobilisation was able to influence governmental and trading policy of both the EU and member states. Secondly, in spite of the reasonable feeling that many actors, including a majority of governments, strive to ensure the success of biotechnology, it is also a fact that GMOs today are not the same as ten years ago. They are labelled. Soon, the inclusion of antibiotic resistant marker genes will be prohibited. Authorisations are more cautiously given due to the permanent scrutiny of various public actors. But their usage is far from being taken for granted.

According to Gaskell et al. study of July 2003 based on the analysis of five Eurobarometer surveys between 1991-2002, "an improvement of climate of opinion for agri-food biotechnologies has occurred in more or less all the EU member states since 1999" (p.3).[141] The authors ascribe the change to the EU moratorium, which has taken the heat out of the controversy, to a more transparent regulatory framework defined in Directive 2001/18/EC, and to lower media attention to agricultural biotechnologies. This has, however, changed considerably in the recent months as the Commission's effort to lift the EU moratorium aroused public attention and mobilisation again, especially in the UK and France.

- **GMOs in the EU countries**

Before the moratorium was imposed, 18 GMOs were approved in the EU, some of them only for import and processing (soybean), others for breeding activities (swede rape).

The only GM crop approved for commercial cultivation is GM maize (in several varieties). Spain has been the only country growing it in recent years.[142] The experimental release of GMOs has, however, been going on in the majority of countries in recent years - in spite of the fact that field trials must face resistance and occasional destructive actions (e.g. Confédération Paysanne in France, Greenpeace in the UK). Austria, Luxembourg, France, Greece, Germany and the UK invoked Article 23, the so-called safeguard clause, of Directive 2001/18 /EEC to impose a temporary ban on the commercialisation of GM maize and rape products on their territory. The claims were examined by the EU Scientific Committee of Plants, which in all cases concluded that the information submitted by member states did not justify their bans, but they were never politically overturned.[143]

As for the use of GMOs in food, a variety of soybean and a variety of maize, as well as several products derived from GMOs have been authorised under the Regulation on novel foods.[144]

Thanks to public pressure on retailers, however, GM products should not appear on store shelves, as a majority of retailers subscribed to a GMO-free policy. The case of Italy is interesting in this context : Italy tried to ban GM products legally, invoking the safeguard clause in the new food regulation concerning food products derived from GM maize. The regulation allows a "simplified procedure" for trading GM-derived food products that no longer contain living (reproducible) genetic material. With this simplified procedure no special assessment has to be carried out. Such food products can be qualified as "substantially equivalent" and do not need to be labelled. In 2000 Italy suspended the use of "substantially equivalent" food products derived from GM maize (e.g. flour), with a reference to findings of transgenic protein residues in them. The European Court recently ruled (09/09/2003) that this is not a sufficient reason and it could be justified only by "demonstration of the existence of a risk to health."[145] Interestingly, the ruling appears at a time when "simplified procedure" is being left out of the EU legislation. The new traceability and labelling regulations do not include it any more, as it "has been very controversial in the Community in recent years and there is consensus at the international level… that it is not a safety assessment itself."[146]

[141] Note the sympathetic language! Eurobarometer is perceived as a rather pro-biotech survey. The language of the report, the authors of which were involved in the drafting of the survey questionnaires, can only confirm the assumption. It nevertheless could have some relative informative value, as it compares a series of surveys with the same bias. Or have they become more "experienced" in survey design recently?
[142] Gene crops in the European Union (Reuters, 3.6.2003.)
[143] Cf. Questions and answers on the regulation of GMOs in the EU.
[144] So far this has been the EU norm regulating the use of GMO and products of GM origin in food. The agenda will, however, be transferred under the new traceability and labelling legislation after it comes into force.
[145] Judgment of the Court in Case C-236/01 Monsanto Italia SpA and Others v. Presidenza del Consiglio dei Ministri. At: http://www.curia.eu.int/en/actu/communiques/cp03/aff/cp0367en.htm
[146] Proposal for Regulation of GM food and feed, p. 7.

*United Kingdom*[147]

The UK government recently launched a public debate on GMOs, which, together with the results of three-year large-scale field trials, should provide a basis for a governmental decision related to the cultivation of GMOs in the country, and publicly legitimise the decision. It included three strands: science review, economic evaluation of GM crops by a governmental strategy unit and nation-wide public debate. It was aimed at overcoming public distrust in GM-related expertise and political decision-making. The design (selection of experts to the expert panel, public dimension) should have allowed for uncontested objective facts and political stances to emerge as results. However the contrary actually happened.

- Even before the debate started, it had been criticised as a mere tool to legitimise governmental pro-biotech position.[148]
- Official experts were denounced for being selected on account of their pro-GM bias. Reports on attempts to intimidate the few who expressed criticism appeared in the media.[149]
- An independent science panel issued a counter-expert report pointing at relevant (but often non-peer reviewed) knowledge that was not taken into account by the official experts and explicitly denouncing the official report.[150]
- The results of the scientific review were interpreted differently in the public sphere, in spite of the very cautious style of the report, which, in some media (The Independent, The Guardian), was considered as unfavourable to GM crops.[151]

The UK debate experience shows that there is no way back from expert and public opposition. No "methodology", scientific (e.g. peer reviewing) or political (e.g. formalised public debates), is persuasive any more to establish uncontested objectivity and reduce dissent.
It was the very mobilisation of various social actors (NGOs, scientists, journalists…) which destabilised the Government-led building of scientific objectivity and political consensus, and turned it to support opposite aims.

*France*

The GMO controversy in France is characteristic for its very heterogeneous actors, issues and stakes. The coalition currently organising the campaign includes five main actors. First, Confédération paysanne, the second farmers' union representing small and medium size farms with discourse on sustainability of "agriculture paysanne" (family farming). A charismatic spokesperson José Bové aroused great public and media attention in relation to field trials destructions and the legal processes which ensued. He has also linked the issue to the anti-globalisation movement. Secondly, ATTAC, a grass-root movement focused on denouncing the negative effects of globalisation. Third, organic farming associations which mobilise mainly against the contamination of organic production. Finally, Inf'OGM, which runs a web page and mailing list to debate, inform and publish, and The Foundation of Leopold Meyer that co-funds many activities, including the World Social Forum.

The first peak of mobilisation took place in 1998 when the government organised a citizen conference. It was strongly criticised as a mere tool of consolidating public opposition and legitimising a decision already taken. As a result, it only amplified the opposition. Currently, the major fuel for anti-GMO mobilisation is experts' disagreement and pressure to allow open field experiments, and governments' consent to end the EU moratorium.

[147] The following paragraphs do not provide the reader with any overview information about respective countries, but rather point to interesting events and aspects with more general relevance.
[148] Some observations and proposals on the 2002-2003 Public Dialogue on possible commercialization of GM crops in the UK. 04/11/2002.
[149] The GM plot: Scientist tried to sabotage work of top academic who is a sceptic (McCarthy in The Independent 26/08/03). Or, Probe into 'bullying' of GM panel scientists (Townsend in The Guardian 24/08/03).
[150] http://www.i-isis.org
[151] Scientists stress uncertainties of GM crops (Brown in The Guardian 22/8/03).

**The open field experiment debate in France[152]**

In November 2001, the French ministers of agriculture and environment in relation with those of Research and Health asked four institutions[153] to organise a "public debate" on GMOs and field experiments, to pilot it and write the synthesis.
The debate took place in February 2002.

For two days, 36 experts were asked to intervene in front of 230 personalities (from research, firms, associations, agriculture, administration, local authorities…), 120 lay people (students, gymnasium pupils, citizens of the citizen conference of June 1998).
Six discussion groups were organised:
Three on field experiments
. Do we have to go from confined experiments to open field experiments and why?
. How are those field experiments carried out, what are the results?
. Who decides and who controls field experiments?
Three focused on more general issues related to GM plants
. What are the benefits and inconveniences of GM plants in terms of health and environment?
. What are the socio-economic consequences of GM plants research?
. What are the expectations of society? Which citizen participation? Which democratic regulation?
Each group involved six experts, and the debate was moderated by a journalist.
A debate on the debate has developed, criticising:
- the form of the public debate , mainly an exchange between experts but no citizen involvement,
- the legitimisation goal of this exercise, right before the field experiment allowance.
Some recommendations of the synthesis report written by the four institutions are:
. to take into account citizens' expectations and associate those citizens to decisions;
. to inform participants to debates of what politicians will do with the conclusions of those debates;
. to define what could the "socially acceptable" character of GMP be;
. to have a democratic control of experiment conditions and dissemination of GMP;
. to reinforce local mayors' authority;
. to improve the functioning of scientific expertise committees;
. to better benefit from confined experiments before starting field experiments;
. to try to control contamination;
. to avoid the dispersion of experiments;
. to have a broader distance between experiments and conventional crops;
. to better protect organic and conventional farming;
. to define a responsibility regime: civic responsibility, administrative responsibility.
The passage from confined to open air experiments is part of a research process which is considered as an intrusion into the social space, as consumers do not see any evident benefit from GM plants.

- **GMOs in Central and Eastern European countries, i.e. EU candidate countries**

*In the process of harmonisation of their legislative systems with the EU, candidate CEE countries adopted the EU regulatory model for GMOs.* [154]

These countries were also advised by the Commission not to approve GMOs that are not authorised in the EU, as it will generate potential conflicts when they enter the EU. In spite of rather low public and/or NGOs' attention to the issue, the situation should be similar regarding legislation and actual use of GMOs to that in other European countries. On the other hand, there is still a significant lack of technical facilities and competence (e.g. reference laboratories) in most of the CEE countries to ensure enforcement of the laws. For example, the tests on food products in most countries showed that foods containing GMOs were sold without appropriate labelling. The most consolidated policies seem to be in the

[152] Babusiaux, Le Deault, Sicard, Testard (2002)
[153] National Council of Food, Parliamentary Office of Technology Assessment, the National Consultative Ethic Committee and the French Commission for Sustainable Development
[154] Overview information on CEE and extensive case studies on some of the countries can be found at: http://www.anped.org

countries ready to join the EU in 2004, whereas the development in Romania and Bulgaria is significantly less controlled. These are also the only countries growing GMOs commercially.

It is interesting to note that the Commission reportedly believes that the accession of new CEE states will help to unblock GMOs in the EU, as these countries will behave more "pragmatically" because they are not so wealthy as the rest of the EU.[155]

*Czech republic*

GMOs are rather an apolitical and publicly uncontroversial issue in the Czech republic. The GMO legislation has been adopted in a disciplined way and with low public attention at the end of the 90s. There are several interesting points to note. First, accession to the EU plays a key role in shaping GM policy. When pro-biotech experts with high influence at the Ministry of Environment (ME) proposed a US version of regulation in the mid 90s, it was rejected as politically unfeasible. Similarly, the pre-accession status implies a de facto moratorium on the commercial use of GMOs that are not approved in the EU. For example, GM wheat was rejected for experimental trials in 2001 with direct reference to the EU preference. Secondly, as a result, the issue became a technocratic problem of transposition of the EU legislation. It did not get any significant public visibility.[156] The genetic campaign of Greenpeace, the only one of its kind in the country, has a very limited impact, and has not so far succeeded in connecting GMO questioning to any important public problem. This is due to the relatively urban character of the country and lack of strong farmer movement (not to speak about *political* farmer movement), and minor political and social position of environmental NGOs in the public sphere.[157] Thirdly, the status of science and expertise in general remains rather strong and uncontested. There has been no big scandal related to the use of official expertise in political decision-making so far, and it was only very recently that this kind of arguments appeared in the campaigns of environmental organisations. The pro-biotech experts are therefore quite close to public administration ( Ministry of Environment) and they are well organised and linked to external actors (industry, EU funds).[158]

*Romania*

The country does not belong to the first wave of the EU accession and it seems to be under more significant US influence (not only in the case of GMOs) than other CEE countries. It has been growing RR soybean since 1999, and Monsanto claimed that 30 000ha, i.e. nearly half of the whole Romanian soybean production, was genetically modified in 2000. In spite of the EU-like legislation on authorisation and labelling which was recently introduced, there is a lack of control and the GM policy is not transparent. According to ANPED, there is no public awareness about GMOs and nobody can answer with certainty what is actually grown in Romania. Different GM varieties of potatoes, soybean, sugar beet and maize may be grown either commercially or experimentally; but without any substantial control and monitoring. Romania is thus a potential contamination source for the whole Balkan region. The question is how this country can ever be integrated into the EU regulatory system (aspiration to accession in 2007) with a history of nearly uncontrolled use of GMO for several years.[159]

[155] Mentioned by J.Turna, a Slovakian biotech scientist, in his lecture on GMOs in Ceske Budejovice, 7.10.2003.
[156] Which is not specific to GMOs but rather a general pattern of Czech politics.
[157] It is interesting to observe that even though the opposition to communist regime drew upon environmental critics at the end of the 80s, the "economic development" discourse prevailed quickly and strongly at the beginning of the 90s.
[158] Similar policy patterns can be found also in other EU candidate countries, for example Latvia (cf. Tisenkopfs, Kalninš 2003).
[159] A less acute but similar situation can be found in Bulgaria, where GM maize varieties not approved in the EU have been grown since the late nineties (cf. Schweiger 2003: 12).

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## Chapter 33. GM and non-GM crops problematic coexistence and risks on agricultural production systems

### i. Questions related to the item

- What is coexistence?
- To what extent is control of contamination possible and at what costs?
- At what level (EU or member states) should coexistence and liability measures be developed, managed and ensured?
- Who will bear the higher production costs of organic farming if GM agriculture is introduced?
- How can the right to remain a GM-free zone be exercised ?

### ii. Issues at stake

- There is a general agreement about unavoidable GMO contamination at some level if GM crops are cultivated on a commercial scale in a region.
- For those accepting GM agriculture as one option among others, contamination is not in contradiction with coexistence. Ensuring coexistence means to guarantee an acceptable maximum level of GM contamination.
- For critics of GM agriculture (for political and safety reasons) any contamination, especially of organic production, is incompatible with the idea of coexistence.
- There is no practical experience concerning the control of contamination (on a low level). Co-existence measures would thus be an experiment in itself.
- The urgency of the issue is constituted by the combination of uncertainty and irreversibility related to contamination.
- These high stakes are not counter-balanced by any persuasive benefits. In the short and medium term, GM productions would not contribute to sustainable agricultural and rural development in Europe. On the contrary, it could undermine sustainability building.
- The pressure for coexistence from the Commission evoked strong opposition in many EU regions and localities, which reacted by declaring themselves GM-free zones. The struggle about practical arrangement continues.

### iii. Elements for the analysis

- **What is the meaning of the concept of coexistence?**

The concept of coexistence was introduced by the European Commission as a reaction to concerns about the impacts of GM agriculture on conventional and organic farming in Europe. The concept of coexistence as proposed by the Commission does not question the introduction of GM agriculture into Europe. Quite the opposite: it reckons it will happen. The inquiry does not start with the question "Is coexistence possible?" but "Which coexistence is possible?" "What changes do we need to ensure coexistence?"

*The issue of coexistence refers to the ability of farmers to provide consumers with a choice between conventional, organic and GM products that comply with European labelling and purity standards (press release of the Commission of 23/07/2003).*

GM agriculture is taken for granted. The explicit questions are what measures and changes of practice. But, rather implicitly, there is also a question of what changes in labelling and purity standards - as these are the other variables in the defining sentence. This strategy can be found in the Commission's actions: unavoidable contamination was anticipated in the setting of thresholds for labelling requirements, and later seed purity thresholds are to be derived from the same anticipation.

Social actors who initially expressed concern consider, on the contrary, that purity standards are essential and not subject to discussion, and they question the very introduction of GM agriculture. In addition, with

time, the concerns have become less of a theoretical nature, and could increasingly draw from the US and Canadian experience, which shows that the impacts are significant and multiple. Consequently, the Commission's proposition became a subject of contestation rather than a tool for reaching consensus and acceptance.

- **Research and empirical evidence related to the issue of contamination and coexistence**

*Scenario for coexistence of genetically modified, conventional and organic crops in European agriculture (May 2002)*

The European Commission ordered the study on the coexistence of GM and non-GM crops in May 2000 from the Institute for Prospective Technological Studies of the EU Joint Research Centre; this study was to be used as a starting and reference point for the EU coexistence policy. The report consists in fact of three case studies on maize, oilseed rape and potatoes, and is based on computer modelling and expert opinions which take into account farming experience with the plants.

The report is based on the assumption that there are four main sources of contamination: seed impurities, cross-pollination, volunteers (seeds remaining in the soil after harvest and producing new plants in successive years) and harvest-storage practices, with different importance for specific crops and farm types (e.g. volunteers are most important as a source of contamination for organic rape seed farms, whereas seed impurities and cross-pollination affect maize production) and it studies contamination between different varieties of the same crop. The report thus takes into account contamination factors and mechanisms known for non-GM crops and does not consider contamination related to possible specificities of GM crops.

The most important findings of the report are the following:
- Estimated levels of GM contamination[160] do not change dramatically between the two scenarios of 10% or 50% GM crop share in a region. It means that the questioning of coexistence becomes highly relevant even in relation to a limited introduction of GMOs.
- Reduction of contamination to less than 1% (around the labelling threshold) possible in all cases but with significant changes in agricultural practices in some of the cases. In some cases, cooperation between neighbouring farms would be needed to minimise contamination and, in other cases, cooperation on a regional level would be necessary.
- Reduction of contamination to less than 0.1% (current detection limit, i.e. also organic production limit) extremely difficult in all three cases, even with significant changes in current practices (perhaps only some farm types producing seed of oil seed rape could reach it).
From a political point of view, it is interesting to mention that, according to Greenpeace, the Commission tried to keep the study secret, as the results were quite unfavourable.[161]

*UK public dialogue on GMOs (July 2003)*

The issue of coexistence was one of the key points in the recent UK science review.[162]

The authors admitted difficulties related to coexistence and redefined the problem as being essentially political. Contamination management, in any case, requires significant changes in farming practices.
*…The levels at which gene flow can be maintained for different crop varieties are significantly determining whether co-existence of different types of agriculture is feasible. However, political decisions may ultimately affect whether co-existence is practical, in particular what thresholds are set for maximum GM presence in non-GM crops (and their products), whether conventional or organic. For some crops, maintaining thresholds of gene flow may be relatively straightforward, by employing*

[160] The paper, as well as other Commission papers, uses expressions such as "adventitious presence of GM crops" or "admixture".
[161] At: http://www.greenpeace.org/~geneng/highlights/gmo/may16coexist_report.htm
[162] GM science review: First report. At: http://www.gmsciencedebate.org.uk

*separation distances and, more importantly, by reducing gene flow through seed. However, in other cases, it may be difficult, if not impossible, to grow certain crops or use some existing farming practices (e.g. using farm-saved oilseed rape on farms where both GM and non-GM varieties are grown.* (p.18)

The emphasis on difficulties with detection is noteworthy.
*…GM crops that have been approved for commercial release can be detected but unapproved GMOs present difficulties. Gene flow may be detected if commonly used transgenic DNA is present, but the actual source of the GM presence will be difficult, maybe impossible, to identify…*(p.18).
The latter point has important implications for the issue of liability, because what can the framework for liability be if detection is on principle problematic and unreliable?

Even more radical is the counter-expert report of the Independent Science Panel, which emerged in reaction to the official GM science review initiative.[163]

Regarding coexistence it claims, with reference to Mexican and Canadian evidence, that extensive transgenic contamination is unavoidable. "Contamination is generally acknowledged to be unavoidable, hence there can be no co-existence of transgenic and non-transgenic crops" (p. vi, emphasis original). The efficiency of separation distances and other possible measures are much more controversial than official experts are willing to admit today.

*Organic maize contamination in Spain*

As a consequence of the commercial cultivation, however limited, of GM maize in Spain, the first cases of contamination of organic crops were observed in northern Spain according to the Friends of the Earth Europe and Greenpeace press release of 26/08/03. Consequently, the products lost their organic certification.

*Contaminated conventional maize in Italy (2003)*

Over 100 farmers in northern Italy ( farming roughly 400 hectares) have discovered that the seeds they bought and sown as non-GE maize were in fact already contaminated by GE maize even before they planted it. According to the Greenpeace press release of 01/07/03, the seeds were reportedly sold by Pioneer Seeds which is also a sales agent of Monsanto GM seed in many countries. Greenpeace called for full investigation of the case,suspecting that it could be a deliberate policy of Monsanto to contaminate conventional seeds.

*GM oil seed rape and maize trials in UK (October 2003)*

According to research published by the UK Department of Environment, Food and Rural Affairs at the beginning of October:[164]
- Oil seed rape pollen was documented to be transferred by bees over a distance of 26 km. Scientists conclude that 100% purity cannot be achieved by geographical separation.
- In contrast, the study shows that a 24.5 m separation distance should be enough to keep the contamination below 0.9% in the case of GM maize, and a 80 m distance would be necessary for a 0.3% limit.
- Due to GM volunteers in the field, a contamination above 0.9% limit. The break could be reduced to 5 years only by rigorous weedkiller spraying.

*Sugar beet in France (July 2003)*

A recent study by Jean-Francois Arnaud (Lille University, France) on the interactions between three separate varieties of beet, has shown that, contrary to expectations, it is not pollen dispersal but

[163] Ho, Lim (2003)
[164] Scientists uncover risks in GM oilseed rape (Brown in The Guardian 14/10/2003), or News - Curb on GM crop trials after insect pollution (Uhlig in The Daily Telegraph 14/10/2003).

"accidental seed flow" (e.g. seeds spread in the soil caught on vehicle wheels) which accounts for most of the gene contamination. If validated it would have major implications for co-existence measures.[165]

*The US and Canada after six years of commercial cultivation*

There are many cases of contamination in the two countries. They have been related to different stages of the crop/food production process.

- The biggest contamination crises in the US started in 2000 in relation with StarLink (Aventis), a GM maize variety not approved for human consumption because it contained a Cry9C protein with possible allergic reactions in some people. StarLink was found not only in many different food products but also in other maize crop varieties.[166] The incident cost Aventis nearly $1 billion. In spite of the fact that over 300 maize products were withdrawn, StarLink contamination is still occurring in low numbers.[167]
- The issue of contamination is even more acute in the case of pharmacrops where a crop is engineered to produce pharmaceutical traits. This happened with GM maize developed by ProdiGene to produce pig vaccine which contaminated maize and soybean food crops in Iowa and Nebraska.[168]

According to the report *Seeds of doubt*, good non-GM varieties have become hard to buy, and all non-GM farmers have problems to get uncontaminated seeds and run a high risk of crop contamination in their fields. Due to a lack of segregation, the whole food processing and distribution system has become vulnerable to contamination incidents (like the one of StarLink).[169]

Significant contamination of oilseed rape production is reported in Canada.[170]

- It caused the loss of nearly the whole oilseed rape organic production in the province of Saskatchewan.[171] This experience plays an important role in the resistance of many farmers' organisations against introduction of GM wheat on the territory.
- Well-known is the case of Percy Schmeiser, a non-GMO farmer who was accused, among other things, by Monsanto of sowing its Roundup Ready canola in 1998 illegally. He asserted that he had never sown Monsanto seeds and described the situation, on the contrary, as result of Monsanto contaminating his fields with RR canola, and sued Monsanto for that. More generally, the legal controversy also raised the question of the farmers' rights to save and re-sow patented seeds. Courts of several instances ruled against Schmeiser. The case is still going on. An important report was published by the Canadian Biotechnology Advisory Committee in 2002 saying that the Patent Act should be amended so that farmers have a right to save and sow seeds from patented plants such as GM crops. At the moment more than one thousand farmers from Saskatchewan are suing Monsanto in cases similar to Schmeiser.[172] The case points to a wide range of conceivable liability arrangements in relation to GMOs.
- One extreme is the precedent of the successful accusation of farmers on whose fields GM material is detected from illegal growing of GM crops - which would make the growing of non-GM crops rather unbearable in regions with GM production. According to *Seeds of Doubt*, this effect is already partly real in the US, as one motive for *not being* a non-GMO farmer stems from the fear of patent infringement accusations.

[165] New fears over GM cross-breeding (The Guardian 17/07/03).
[166] Friends of the Earth. 2001. GMO contamination around the world.
[167] StarLink corn still shows up (Clayton 2003).
[168] Innovest (2003).
[169] Seeds of doubt (2002: 5).
[170] e.g. Contamination in Canada sounds warning to UK (Goldenberg in The Guardian 18/08/2003).
[171] Seeds of doubt (2002: 5).
[172] More details in Smith (2003), or Mae-Wan Ho (2003), or at: http://percyschmeiser.com

- The other extreme is the case of seed producers made liable for the whole trajectory and interactions of GM seeds which would probably become rather unbearable for the agri-biotech industry.[173]

The case also emphasizes the key role which courts may play in the GMO controversy.

These are important places where the actual meaning of the legislative norms is negotiated, with major impact on the distribution of costs and benefits between GM seed producers, GM and non-GM crop farmers, food producers and consumers.

*GM material found in Mexican maize (2001)*

In November 2001, Ignacio Chapella and David Quist published in Nature their discovery of GM material in Mexican maize, in spite of the fact that cultivation of GM maize was prohibited in Mexico. The results pointed to possible high uncontrollability of gene flow, be it for natural or social factors. The urgency of the case also stemmed from the fact that Mexico is a site of maize gene diversity. The article was later withdrawn by Nature, the first such case in the history of the publication, with the explanation that it was not publication scientifically rigorous. According to the authors and some other observers, it was the result of pressure from the industry to which the findings were unfavourable.[174] The case became a lesson revealing the politics of biotech science. All science is happening in societal context, and even scientific publications, the sacred cows of scientific objectivity, do not escape external (political or industrial) influences.

**EU measures on co-existence**

The so called co-existence is the biggest controversy in relation with the potential introduction of GM crops introduction into European agriculture on a commercial scale. For the Commission, a regulatory frame for coexistence was a condition for lifting the EU moratorium. On 23 July 2003, the Commission published "Recommendation on guidelines for the development of national strategies and best practices to ensure the coexistence of genetically modified crops with conventional and organic farming". It is intended as a basis for the member states to develop their own measures. Let us look at some of the key characteristics of the recommendation and of the concept of coexistence inscribed into it.

*Status of the recommendation*

The link of the paper to practical co-existence measures is in fact quite indirect. It is a "recommendation on guidelines for the development of national strategies and best practices…" The paper justifies this by reference to subsidiarity and explains in 1.4 :
*…The conditions under which European farmers work are extremely diverse. Farm and field sizes, production systems, crops rotations and cropping patterns, as well as national conditions, vary enormously across Europe. This variability needs to be taken into account when devising, implementing, monitoring and coordinating co-existence measures. The measures that are applied must be specific to the farm structures, farming systems, cropping patterns and natural conditions in a region.…* (1.4.)

The argument itself makes sense but the same can be said in relation with the authorisation and cultivation of GM crops.

There is, therefore, a contradiction between the EU-wide binding authorisation procedure and its outcomes, and the members' state-limited co-existence and related responsibility measures. There is also a tension between EU-wide thresholds and the task of achieving consensus on co-existence which is delegated to member states. The case by case/country by country regulatory pattern is very similar to the one applied in the past in relation to the (non-)regulation of pesticides.

[173] Liabilities and externalities are always collectively distributed, even in cases of more controllable technologies and products than GMOs. In the case of GMOs, however, relevant groups of farmers, consumers etc. refuse and resist becoming shareholders. No good reason for and many reasons against.
[174] Corporate Phantoms (Monbiot in The Guardian 29/05/02).

It is also interesting to note, in this context, that the recommendation often refers to cooperation among farmers as an important means to achieve co-existence but never mentions the diversity of farmers' sociality across Europe, of social conditions in a region to paraphrase the quotation from 1.4. above.

*Symmetry between forms of agriculture*

*…the possibility of adventitious (unintended) presence of genetically modified (GM) crops in non-GM crops, and vice versa, raises the question as to how producer choice for the different production types can be ensured. On principle, farmers should be able to cultivate the types of agricultural crops they choose - be it GM crops, conventional or organic crops. None of these forms of agriculture should be excluded in the EU* (1.1.).

Throughout the document, an interaction between GM and non-GM agriculture is conceived as symmetrical - as if contamination of different types of production had equivalent effects. The question why GM agriculture should be included in the EU is thus reversed to the question of why it should be excluded.

These formulations do not equate.

- The first one expresses what could be called a political precautionary principle (Do we have good reasons to introduce a new technology?).
- The other one reflects a simplistic idea of progress (Is there a reason not to implement a new technology?).

*It is weakened only in the clause that "during the phase of introduction of a new production type in the region, operators (farmers) who introduce the new production type should bear the responsibility of implementing the farm management measures necessary to limit gene flow" (2.1.7., emphasis mine).* However, bearing the responsibility does not necessarily mean bearing all (direct and indirect) costs.

*No substantial position concerning liability related to contamination*

*The liability rules are discussed in 2.1.9. but without reference to any substantial principle. "Member states are advised to examine their civil liability laws to find out whether the existing national laws offer sufficient and equal possibilities in this regard." No reference or connection is made to a EU level initiative concerning environmental liability.*[175]

*Thresholds as maximum but also minimum contamination levels*

Member states' co-existence measures could be so strict that they made GM agriculture de facto impossible. The commission recommendation obviously tries to prevent such usage of co-existence measures.

*…Measures for co-existence should be efficient and cost-effective, and proportionate. They shall not go beyond what is necessary in order to ensure that adventitious traces of GMOs stay below the tolerance threshold set out in Community legislation. They should avoid any unnecessary burden for farmers, seed producers, cooperatives and other actors associated with any production type.* (2.1.4.)

*Strict distinction between economic aspects, and health and environmental aspects*

*…It is important to make a clear distinction between the economic aspects of co-existence and the environmental and health aspects dealt with under Directive 2001/18/EC* (1.2.).

The urgency of the GMO case lies in the diversity of aspects and concerns at stake.

It allows for a wide mobilisation and coalition of diverse actors. Who is a stakeholder, and what is at stake? A discussion group on coexistence organised by the EC in April 2003 involved "a range of stakeholders, representing the farming sector, industry, NGOs, consumers and other players" (1.3.); at the

[175] Discussed in 31. of this report.

same time, however, the recommendation keeps the stakes and effects to be taken into account quite restricted. Opponents to the introduction of GMOs to Europe, who tend to use co-existence as a blocking issue, try, on the contrary, to broaden the debate and link it to other issues.[176]

- **Positions of member states**

In May 2003, before the guidelines were officially published, the positions of member states differed substantially as to whether the lifting of the moratorium should be conditioned by the finalised regulation of coexistence and whether the "guidelines format" is sufficient for lifting the moratorium. The strictest position was held by Austria, Belgium and Portugal that insisted on EU legislation concerning co-existence before the moratorium had been questioned by EC. Some other countries, including the UK, Spain, Ireland, Finland, the Netherlands, pushed for the fast lifting of the moratorium regardless of the issue of co-existence.[177] The position of the UK, for example, should however have changed in reaction to the results of the public debate and large scale field trials published in 2003 and 2005. But it did not change. In Italy, a law, adopted in January 2005, delegates decision-making about concrete measures to regions. The new rules require all 20 regions to have formulated their own individual coexistence plans by 31 Dec. 2005, following guidelines drawn up by organic, conventional farming and biotech experts. GMO farmers who contaminate other crops through negligence or non-adherence to the co-existence plans may face fines of between 2500 and 25000 Euros, according to the Italian law. Regions will be allowed to declare themselves "GM-free". Farmers who violate GM-free areas could face a prison sentence[178].

Coexistence recent institutional arrangements in some EU countries

| Countries | Date | Institutional arrangements | Remarks |
|---|---|---|---|
| Denmark | May 2005 | Law | Liability and compensation within the 0.9% contamination threshold and a specific distance. |
| Germany | Nov. 2004 | Law | No threshold. Separation distances are specified. Any damage conflict should be legally (court) solved. Information on GM crops made accessible |
| Italy | Jan. 2005 | Law | Gives competence to regions. Regions have to get compulsory coexistence plans. Possibility to be GM – free. |
| Netherlands | Nov. 2004 | Agreement between farmers and industry | Compensation fund created. Separation distances specified. Information on GM crops not easily accessible. |

Sources:[179]

Some reactions

Criticising the Dutch policy option, the EU Group of the International Federation of Organic Agriculture Movements (IFOAM) declares:
*It is essential that all member states guarantee through their national coexistence rules that the GM-free farming sector and organic farming are able to produce GMO free crops to supply the mainly non-GM food market in Europe, in support of the clear wishes of European consumers to continue eating non-GM food. However, it is known that if GM crops are introduced in any country, it is inevitable that there will be some cases of GM contamination of non-GM crops. This fact introduces major new costs and risks to food production in Europe through the new need to segregate crops, test and reject contaminated food. To allocate this new cost, it is clear that the "polluter pays principle" must be applied to GM crops so*

[176] Cf. *Considerations regarding the co-existence of GMO, non-GMO and organic farming* (Greenpeace 2003)
[177] According to Greenpeace report from Agricultural Council of 26/05/03.
[178] IFOAM EU Group, Italian coexistence law (email, 31/01/2005).
[179] According to:
- Grain at www.grain.org
- Stockelova T., 2005: Coexistence between GM a,nd non-GM crops: contested political geographies of Europe.4th Annual IAS-STS Conference "Critical Issues in Science and Technology Studies" . 28 February - 1 March 2005, Graz, Austria.

*that those who are seeking to gain financially from their commercialisation do not pass the risk and costs of GM contamination onto non-GM agriculture and thus citizens at large.*
*Therefore this part of the Dutch agreement presented today by the government is completely unacceptable. The public supports organic farming but organic food already costs more because of higher production costs. By asking for a contribution from organic farmers to the compensation fund and thereby imposing part of the costs of GM contamination on the organic and conventional non-GM sector, the introduction of GMOs will increase the costs of normal food and make organic food even more inaccessible for many people. This proposal clearly violates the polluter pays principle which is established in European policy making, and instead introduces the unreasonable concept that the polluted sector pays.* [180]

- **GMO-free zones**

The publication of the co-existence recommendation triggered and/or intensified attempts by many European regions and municipalities to declare themselves GMO-free zones. If GM crops were introduced in a region, GM contamination would be unavoidable at some level, consequences uncertain, contamination management expensive. As a result, the question emerges in many places in Europe : why should we introduce GM crops at all?

**GMO-free regions in Europe**

| Country | Remarks |
|---|---|
| Austria | 8 out of the 9 provinces reject GMOs |
| France | 15 out of 21 regions, 5 counties and more than 1300 municipalities declared themselves GMO-free. They do not have the administrative authority to decide. |
| Hungary | 26 municipalities declared themselves GMO-free |
| Italy | In 2005, 15 Italian regions held the status. More than 1800 towns and villages declared themselves GMO-free, corresponding to 80% of the territory. |
| Poland | 6 regions GMO-free. 50% of the population living in GMO-free declared areas. |
| UK | 44 regions adopted anti-GMO resolutions |
| Europe | In February 2005, some 100 European regions and 3500 sub-regional areas (like municipalities) declared temselves GMO-free. |

Source:[181]

Some regions in some countries have the administrative authority to declare themselves GMO-free, because of the national political frame: Austria, Italy, Poland. In France, regions use their political authority to do so, but usually administrative courts question their GMO-free option.

A short focus on Poland[182]
In Poland, the Mazowieckie Province (with capital Warsaw), with a population of over five million, has become the sixth province in Poland whose local authorities have adopted a resolution declaring themselves a GMO-Free Zone. Earlier, similar decisions were taken by the boards of Podkarpackie (with capital Rzeszow), Malopolska (with capital Krakow), Podlaskie (with capital Bialystok), Lubelskie (with capital Lublin) and Kajawsko-Pomorskie (with capital Torun). Further, strong declarations of intent against GMOs have been made by the main farmer organisation in Donaslaskie. Together with single communities from different parts of Poland, almost half the Polish population are now living in an area where local authorities have established GMO-Free Zones. Another four provinces are currently taking steps in this direction.This situation is claimed by the International Coalition to Protect the Polish Countryside, (ICPPC) to be the result of its campaign "Stop GMOs in Poland' for a GMO- Free Poland. The next phase of the campaign is to reach a complete ban on the planting of GM crops and the sale of GM seeds.

[180] IFOAM EU Group criticizes Dutch GMO coexistence agreement for making non-GM food producers pay for GMO contamination damage. International Federation of Organic Agriculture Movements - EU Regional Group, Belgium 2 Nov 2004.
[181] Gentech news 108, 03/02/2005.
[182] ICPPC, 2005 at: www.gmo.icppc.pl

After the first declarations of GMO-free zones, the European Commission invested considerably in showing its strong opposition to any attempts of the kind. As a reaction to the widespread pressure and rejection by many European regions and possibly also to the results of the UK public debate, the Commission has finally changed its position. The Agricultural Commissioner Franz Fischler declared on September 29. 2003 that *the co-operation among farmers in a region and their exchange of information and experiences will be of particular importance. For instance, I would support the idea of farmers joining on a voluntary basis to create zones of GMO-free production or bio-regions*.[183]

The announcement was welcomed, for example by Michel Meacher, the former UK Environment Minister now strongly associated to GMO opposition, as a "significant shift" and "considerable advance" in official thinking.[184] On the other hand, the Commission only assumes what it could not block anyway - the voluntary agreements between farmers to create GMO-free zones. Does the voluntary basis of GMO-free zones suffice? There are at least three reasons why it does not. First, it conceals the fact that the adoption of GM agriculture is in many respects - e.g. influence of multinational corporations, general agricultural orientation - not (only) a decision for separate regions but for the whole of Europe. Secondly, it enables the Commission to escape from its responsibility to guarantee the right to GMO-free zones, which became an issue because of the Commission's decision to accept GMOs on principle. Thirdly, GMO-free zones not covered by any legally binding agreeements (and this is exactly what the Commission keeps trying to oppose) are especially sensitive to the strategic breaking of such agreements and contamination actions.[185]

In any case, however, this recent shift in the position of the Commission showed that public mobilisation and resistance are able to influence policy-making.

- **Positions of NGOs**

Contrary to the reactions on labelling and traceability rules, which were positive in the case of some of the major NGOs,[186] the coexistence recommendation aroused only critical reactions. "Brussels bureaucrats have decided to protect the interests of the biotechnology industry rather than the organic food producers. They could just as easily have introduced a zero threshold for organic food but have ignored this option," said Dr Sue Mayer, Director of GeneWatch UK.[187] In a press release of 3.3.2003, Greenpeace[188], Friends of the Earth and the European Environmental Bureau demanded "hard" European legislation on co-existence, zero tolerance for contamination of organic production and unequivocal liability of GMO growers.[189]

The first new European Commission debate on the future of GM crops and food (22/03/2005) have been an opportunity for a network of NGOs in UK to seek advice from Paul Lasok, a leading European lawyer, specialised in EU law, on the EC Recommendation on the growing of GM alongside non-GM and organic crops (coexistence)[190].

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[183] Outcome of Agriculture/Fisheries Council of September 29. 2003.
[184] Farmers can set up GM-free zones (Carrell in The Independent on Sunday 12/10/2003).
[185] There is a suspicion that some contamination events in Europe (see the case of Italy described above) were deliberate actions the biotech industry.
[186] See 31. of this report.
[187] GeneWatch UK, press release of 23/08/03.
[188] The position of Greenpeace with elaborate arguments can be found in the report "Considerations regarding the coxistence of GMO, non-GMO and organic farming" (Greenpeace 2003), which opens with the statement that the paper "does not preclude at this stage of knowledge and discussion that sustainable and effective coexistence between genetically modified crops and conventional and organic agriculture will be feasible." The NGOs also actively support European regions to establish GMO-free zones.
[189] Coexistence of GM and non-GM agriculture: the EU Commission dodges its responsibility.
[190] EUROPEAN GM CROP CO-EXISTENCE RECOMMENDATIONS LEGALLY FLAWED. By Paul Lasok QC. Advice on the EC Recommendation on the growing of GM crops alongside non-GM and organic crops (coexistence) to Which? (the UK consumers' association), Friends of the Earth, The Soil Association, Greenpeace, the Five Year Freeze Campaign and GeneWatch UK. March 2005.

The legal opinion[191] , presented to the EC Commissioners for Agriculture, Environment and Consumers condemns the EC position as "*fundamentally flawed*" and criticizes the UK Government for following this approach, which has no basis in community legislation and is legally incorrect. The opinion concludes:
*…the Recommendation is based on a fundamental misunderstanding of the relevant legal provisions, and risks advising Member States to adopt coexistence measures that are incompatible with the aims of the legislation or which would result in preventing, in practice, the use of the "organic" label and the reliance on the GM labelling exemption.*

According to Paul Lasok, the approaches are wrong in law. In particular:
a. The labelling thresholds (0.9%) are 'legally irrelevant' to deciding how to implement co-existence measures .
b. The objectives of coexistence must not be restricted to 'economic issues'. Member States must take into consideration the aims of protecting human health and the environment when adopting any coexistence measures.
c. Any coexistence measures based on the labelling threshold of 0.9% would make it extremely difficult for operators to avoid labelling their products as containing GMOs even when their products are below the 0.9% threshold.
d. The Organic Regulation provides that, in order to be labelled or referred to as organic, a product must not contain GMOs in any quantity. If coexistence measures were to operate to a "baseline norm" (such as the 0.9% labelling thresholds), there is a very real risk that the "organic" label could become defunct.

Friends of the Earth's GMO campaigner commented:
This legal opinion destroys the European Commission's position on the coexistence of GM crop and non-GM crops. Countries around Europe are already adopting laws to control contamination from GM crops, but they are being misguided by flawed advice. There is a growing movement for GMO-free areas in Europe, and consumer demand for GMO-free food remains as strong as ever. The Commission must now abandon its misleading guidance and replace it with tough, EU-wide laws that will truly protect our choice in favour of GMO-free food, our health and the environment against the threat of GM crops.

- **Insurance companies**

Important signals came from insurance companies in reaction to coexistence. According to an inquiry carried out by the UK based agricultural campaigning group Farm, none of the five main British insurance underwriters[192] would insure farmers growing GM crops, or non-GM farmers seeking to protect their business from GM contamination. The companies refer to a lack of knowledge about health and environmental consequences and social resistance against GMOs, and they feel unable to insure farmers against potentially huge compensation payouts if concerns prove realistic. They place GM crops in the same category as thalidomide, asbestos and terrorism.[193]
*…In particular, no indemnity will be provided in respect of liability arising from the spread or the threat of spread of genetically modified organism characteristics into the environment or any change to the environment arising from research into, testing of, or production of genetically modified organisms* (NFU Mutual as quoted in The Guardian, emphasis mine)[194].

The quotation reminds us of an important point that insurance and liability do not become relevant only with coexistence but are relevant at this moment, in relation to research and testing. But liability terms are undefined, and the development takes place in the shade of state authority.

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[191] Advice - In the matter of coexistence, traceability and labelling of GMOs. K.P.E. Lasok QC and Rebecca Haynes, Monkton Chambers, 21 January 2005 available at 11am Monday 21st March on http://www.foe.co.uk/campaigns/real_food/resource/media.html
[192] Agricultural Insurance Underwriters Agency, Rural Insurance Group, BIB Underwriters Limited, Farm Web and NFU Mutual.
[193] Insurers 'would not cover' GM farmers (The Guardian 07/10/2003).
[194] Insurers refuse to cover GM farmers. Leading companies liken risk to thalidomide and terrorism (Brown in The Guardian of 08/10/2003).

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# Conclusion

# Which future for European agriculture?

- **Towards a broader perspective**

Let us choose the following hypothesis: the sustainable future of European agriculture will aim at regenerating rural communities.

For such a purpose, agricultural and rural development[195] could be based on:
- national or regional self-sufficiency: this may eliminate the huge EU surpluses exported at present on the world market (through dumping subsidies) and also reduce transportation distances and impacts on climate change,
- quality and territory-anchored food productions: this may contribute to improving farming practices in a more environment friendly and healthy way, but it can also stimulate local or regional collective initiatives,
- redefinition of farming societal functions: not only oriented to food production but also participating in society new relation with environment and nature,
- the necessary re-negotiation with food processors and retailers: farmers need to get the adequate level of added value,
- fair trade with developing countries for food imports.
- Obviously such a hypothesis will impose the transformation not just the reform of the Common Agricultural Policy (CAP). But as our subject here is not CAP, we shall not get into this complex issue.

- **The point is now to see if GM crops may contribute to the sustainable future of European agriculture**

Can the introduction of GM crops make conventional agriculture economically more viable?
- no clear economic benefits for farmers,
- clear risk of contamination on non- GM crops,
- lack of responsibility regime between farmers and between farmers and the industry,
- uncertainty on GM product market prices.

Can the introduction of GM crops make conventional agriculture more environment friendly?
- clear risk of environmental contamination,
- no evidence on reduction in the use of pesticides

Can GM agriculture contribute to rural regenerating?
- economic and social risks for quality food production systems,
- risk of accentuated land and farm concentration.

Can GM products contribute to better and healthier food supply?
- no evidence of contribution to food quality and uncertainty on health-related risks.

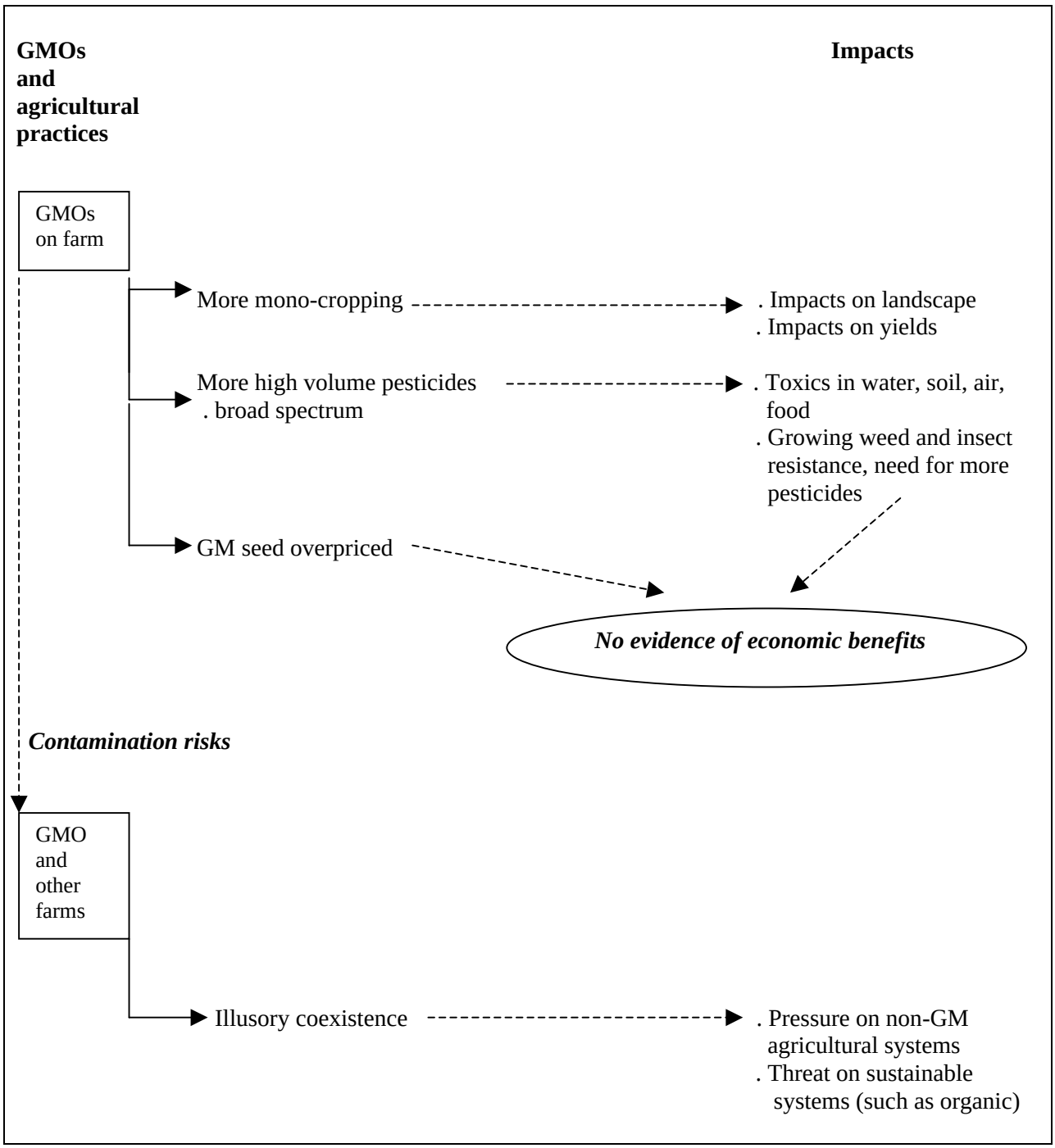
In the short and medium term, GM productions would not contribute to sustainable agricultural and rural development in Europe.

On the contrary it could undermine sustainability building.

[195] Lucas C., Hart M., Hines C., 2002: Look to the Local: a better agriculture is possible. A discussion document. The Greens at the European Parliament and the Small and Family Farms Alliance.

**Integrating the different dimensions**

**Scheme 1. Economic and environmental dimensions**



**Scheme 2. Economic and political dimensions**