The socio-economic effects of GMOs

Hidden costs for the food chain

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Introduction

In Europe, the authorisation process for genetically modified (GM) crops is based on the assessment of risks for health and the environment. Evidence from the food industry and farming experiences worldwide, however, shows that the cultivation and trade of GM crops has far-reaching impacts which are not covered by the EU's legal framework for genetically modified organisms.

Conventional and organic farmers, bee keepers, seed developers, as well as the whole food production chain, are constantly threatened by GMO contamination. Yet, co-existence regulations cover contamination in the farming sector in only half of EU countries. Even in those, the protection offered to farmers is weak and partial. In the food sector, contamination is not covered by any national regulations. Instead, European policy relies on the assumption that the non-GM stakeholders in the food industry will pay for all measures to secure their GM-free status.

This briefing will focus on the real costs of the production of GM crops.

1. Economic effects of GM cultivation for the food chain

The EU's research programme on co-existence and traceability (Co-Extra) estimates that "additional costs can increase to 13% of total product turnover".[1] But this does not reflect the full reality. Data on the overall economic effects of GM crops is still limited. Most economic calculations are based on models and not on concrete empirical evidence. They usually neglect key factors such as the economic burden of co-existence measures, avoidance and segregation costs for the food industry. The negative effects of contamination incidents and the relations between farmers and other stages of the food production chain are covered insufficiently, or not at all.[2] Some of these factors are discussed below.

EU law says that where there are even minor GMO traces in a product, it must be labelled as GM (unless it is accidental)[3] – and yet the European Commission is keen to get rid of this protection for citizens, preferring 0.9% as a minimum threshold.[4]

The socio-economic effects of GMOs

European food producers comply with the rule that even minor traces must be labelled. According to Co-Extra:

"From interviews conducted with European and third countries companies involved in commodity supply chains, it can be stated that a vast majority of stakeholders, if not all, are using a practical threshold which is lower than the labelling threshold (generally from 1/3rd to 1/10th of the labelling threshold, more generally 0.1% of DNA based unit GMO content)."[5]

Models that use the 0.9% threshold therefore systematically underestimate the real economic burden of GM crop cultivation.

1.1 Contamination incidents

Contamination incidents make up a major part of the costs of GM crops. As of January 2011, there were more than 300 reported cases of contamination incidents worldwide.[8] Some of these cases have resulted in major worldwide trade disruptions and have cost farmers, food processors and supermarkets billions of dollars, with many liability cases still pending. However, the lack of liability rules in the EU means there is no clear right to compensation. In almost all contamination incidents to date, governments have taken measures against market distortion and paid for control and testing whilst the GM industry has paid only a minor percentage of the total damage.

Starlink Aventis' GM maize StarLink was approved for animal feed only, but because of insufficient segregation between food and feed streams in the US commodity handling systems, in 2000 the GM maize was detected in food products such as taco shells and corn bread.[9] StarLink was only planted on 0.4% of the USA maize crop area in 2000, but about 10% of all US foods containing corn meal were contaminated.[10] There is still no exact data about the total economic effects of the StarLink case, but costs for the food industry are considered to have been around $1 billion.[11] In addition, the US government bore indirect costs of $172 to $776 million through the USDA's Loan Deficiency Payments Program, which offers producers short-term loans and direct payments if the price of a commodity falls below the loan rate.[12] Further costs to Aventis arose from a class action by farmers (settled for $110 million)[13] and the repurchase of StarLink maize (another $110 million).[14]

LL601 rice In 2006, Riceland Foods, the US' largest rice cooperative, detected trace amounts of GM rice of unknown origin. Months later, Louisiana State University announced the detection of GM contamination in foundation seeds of long grain rice. Bayer CropScience acknowledged that an unapproved variety of herbicide tolerant genetically modified rice Liberty Link 601 (LL601) was the cause of the contamination.[15] LL601 had been grown by Bayer's predecessor Aventis in small scale field trials in the US many years earlier. By Autumn 2006, LL601 was found in shipments of imported rice in 24 countries worldwide. Costs incurred globally as a result of LL601 rice contamination are estimated to range from $741 million to $1.285 billion.[16]

What are the socio-economic effects of GMO cultivation?

The term "socio-economic" is undefined to a high degree. In most cases, the definitions comprise a broad range of economic, social and ethical aspects, e.g.

- effects on food, feed and commodity prices,
- ethical considerations,
- sustainability issues,
- the risks of the extinction of traditional varieties,
- corporate control of seeds and property rights on land (tenure),
- cultural losses (like specific branches of the food industry),
- effects on income and employment (including seasonal aspects and on job quality),
- effects on farms and farming communities, including size and protection of the farm family and labourers,
- requirements for education, information, vocational and continuing training,
- effects on the health, safety and dignity of farm families and labourers (e.g. in relation to pesticide spraying),
- social acceptance and well-being,
- operating costs (inputs, labour, economics of scale etc.) and competitiveness (income, profitability, viability),
- impact on investment and access to finance.[6,7]

These estimates do not cover all costs, however. For example, the payment of compensatory legal claims to the over 8,000 plaintiffs who have sued Bayer is estimated at about $1 billion.[17] In 2006 European supermarkets recalled rice products but didn't sue Bayer, meaning the recall costs are indirectly covered by the consumers. Additional costs for testing have been paid by regional authorities, meaning the taxpayer.

Triffid flax Canada is the world's biggest producer and exporter of flax and around 70% of its 900,000 tonne annual harvest is exported to Europe. In 2001, a GM flax seed called CDC Triffid (technical name FP967) was delisted from the official register of varieties amidst concerns about the loss of export markets due to contamination. Triffid was never grown commercially. However, in Autumn 2009, traces of Triffid flax were found in European shipments of Canadian flax.

The total economic cost is unknown but damage to the industry has been huge - prices dropped dramatically and are still low as a consequence of the contamination. The average price for 2008 was C$583 (€430) per tonne.[18] In 2009, at the height of the Triffid crisis, prices had dropped to an average of C$376 (€280) per tonne and remained low in 2010 at C$407 (€300) per tonne.[19] The contamination has cost the Canadian government millions of dollars including C$1.9 million (€1.5 million) for the development of sampling and testing methods and C$3 million (€2.2 million) to rid the supply system of any remaining genetically modified flax.[20]

1.2 Seed breeding and multiplication

Seed purity is of fundamental importance for securing GM-free food production. If seed is contaminated with GMOs, the cost of securing GM-free production in all the following steps is multiplied.[21] Seed is easily contaminated - there are around one hundred points of vulnerability for contamination with GM in seed production.[22] In 2003 it was found that 30 out of 31 conventional lots of Canadian canola (oilseed rape) seeds were contaminated with different herbicide tolerant GM traits.[23]

Although there is no large scale GM cultivation within the EU, contamination incidents are common. For example an investigation of maize and rapeseed in the EU found 280 contamination incidents of authorised GM seeds and 43 of unauthorised GM seeds between 2001 and 2006.[24]

A study by the EU's *Joint Research Centre* (JRC) calculated that, in the worst case scenario, the costs of achieving maize seed purity with GM content below 0.3% could exceed 20% of the margin of seed producing farmers.[25] Income losses could be up to €483 per hectare. For sugar beet seed, the JRC calculated costs for sustaining a 0.1% threshold could be close to €400 per hectare.

Patents are another economic issue relevant to seeds. GMO companies obtain patents on genetic traits used in GM crops which allow them to restrict the use of the seeds and the harvest and to collect royalties on seed sales. These powers enable them to exert tremendous power over the market to maintain repeated sales year on year. In the US the difference between prices for conventional and GM maize seed doubled between 2001 and 2008.[26] Meanwhile the US Justice Department has begun an antitrust investigation of the seed industry with a focus on Monsanto.[27]

Tractor working in the field, sowing potatoes.

Production of soybean flour.

The socio-economic effects of GMOs

1.3 Costs of co-existence in farming

Another crucial point of GM contamination in the supply chain is crop production where conventional and GM crops may coexist side by side. In 2009, only 15 EU countries had national co-existence laws in force.[28]

Contamination from co-existence may be unavoidable in the EU. Data gathered by the EU's Co-Extra programme has demonstrated that given European farming structure, contamination in maize is inevitable. It underlines that the co-existence of GM and non-GM agriculture in the EU might only be achievable under completely different circumstances than today:

Co-existence can lead to considerable costs for both GM and non-GM farmers. For border regions of France and Germany, it is estimated that non-GM farmers can only make a profit if they are able to obtain higher prices thanks to a GM-free status. GM maize farmers only reap benefits if adoption rates are higher than 90 %.[34] According to the researchers, "in the end both parties lose."

Another recent study models the large-scale introduction of Bt maize and herbicide tolerant oilseed rape in Germany. It concludes that costs for monitoring, separation and testing far outweigh the projected economic benefits of lower production costs.

"For each single Euro economically gained by lower production costs, €5 direct costs and loss of consumer utility are incurred. Thus, legal approval of large scale cropping of Bt maize and HR-OSR is not indicated economically."[35]

Sowing Farmers often share machinery for sowing crops, especially maize and other non-cereal crops. Purdue University in the US has developed Planter Clean-out tips for non-GM markets.[36] To minimise the contamination of GM seeds caused by co-mingling in the seed drill, 30 to 40 minutes of cleaning is recommended. The idea that a simple flush of the seed drill would be sufficient to clean it to an acceptable level is not supported by the US scientists. This research is not sufficiently reflected in the European co-existence debate.

Harvest If GM crops are grown, the common practice of sharing the harvester may no longer be feasible due to a high probability of contamination and high costs for cleaning. Exhaustive cleaning of a harvester may cost €1,800 and take several hours.[37] Otherwise, as a JRC model indicates for maize, combined use of harvesting machinery may lead to contamination levels of up to 0.4%.[38]

In one US study, even after extensive cleaning, samples from the first hopper load of soybeans consisted of nearly 40% (by weight) of corn and material other than grain that had contaminated the harvester.[39] The same study showed that a harvester can hold almost 90 kilograms of grain and other material, even if the machine "runs empty" for several minutes.

Case study: Bt maize in Spain

Several reports and studies have documented the negative social and economic effects of GM cultivation for conventional and organic farmers in Spain. There has been a massive decline (between 5% and 75%) of organic maize production in the main GM maize cultivation areas in Spain.[29] At least two traditional regional maize varieties have ceased to exist because they were contaminated and therefore no longer planted.[30] Negative social effects of GM crop cultivation have also been documented: farmers whose fields were contaminated have not dared to make an official complaint due to pressure from seed companies or for the sake of social peace with neighbours.[31] Overall, farmers who try to stay GM-free have to bear considerable costs.

In response to a European Commission questionnaire on socio-economic effects of GM crops, Spanish environmental, farmer and consumer groups documented numerous examples of farmers' unsuccessful attempts to escape contamination.[32] Contamination remains widespread.

Spain, like many other EU Member States, has no mandatory co-existence measures. Data gathered by the EU's *Joint Research Centre* shows that despite this, benefits for GM farmers are only moderate and restricted to one specific region. The study has been criticised for basing profit calculations on insecticide savings, when it has been shown that before Bt maize arrived, only 5% of the maize area in Spain used insecticides to control the corn borer, the pest insect targeted by Bt maize.[33] The study also recognised that the possibility of benefits to GM farmers was only due to the lack of consideration of the costs of co-existence.

Experiments with "flushing" the harvester with conventional crops in order to dilute the GM harvest have not proven successful. Even after five hours of cleaning the first tankfull contained more than 1% GM contamination.[40] Co-Extra assumes that during a harvest season, the machine must be cleaned just once. Furthermore, Co-Extra only calculates the labour cost for the cleaning (€8-20 per hour) and disregards the cost of renting the machine (€300 per hour). During the harvest neither shared nor private machines can be stopped for several hours without any compensation. Co-Extras calculation of additional costs of €122.96 per hectare for Germany, including the cleaning of the seed drill therefore needs to be corrected. If harvesting and sowing machines are cleaned four times during the harvest time, the real cost are €5,800.[41]

1.4 Transport and grain handling

The risk of contamination of non-GM commodities increases with the number of operators in the supply chain. According to the Co-Extra project, elevators are one of the main sources of unintended impurities in supply chains.[42] In the US, segregation costs for elevators were projected to be up to 37 Cent/bushel (10 €/t) for commodities like wheat, corn or soy.[43]

A University of Illinois survey on grain handling in a pipeline consisting of three sections (country elevator, sub-terminal, and export elevator) found that costs for segregating GM and non-GM commodities were 22 Cent/bushel (€6 /t) for corn and 54 Cent/bushel (€15 /t) for soybeans.[44] The total expense could be 21% of the farm price according to a 2009 projection of overall costs arising from the introduction of GM canola in Europe for the first steps of the food chain (seed producers, farmers, transport, elevators).[45]

According to a study, segregation of GM and non-GM dryers in France would mean a 700% rise in transport costs, this means increased drying cost from 17 to 34%.[46]

1.5 Mills

Mills are another part of the food chain at risk of GM contamination. One of the few studies with real testing (and not just modulation) of the difficulties arising from the processing of GM and non-GM commodities in the same mill was undertaken in Switzerland. The study examined the time needed to clean a mill after GM maize was processed. Even after complete cleaning of the facility and more than two hours of flushing with conventional maize, 1% GM maize (event Bt176) could be detected in non-GM maize meal.[47]

Because of the costs of cleaning, the threat of crossing thresholds and the fear of liability, German mills often choose to avoid GM commodities instead of trying to segregate.[48] But even avoidance costs are considerable. In processing certified non-GM soybeans, there are additional costs of 25% compared to GM soybeans. For rapeseed oil from European sources, avoidance costs make up for 12% of the product price.[49] This is in line with other studies that projected additional costs of 16 to 18% for producing non-GM vegetable oils.[50] Industry expects rising costs if GM cultivation were to take place in Europe because of additional costs for testing and other security measures.[51]

1.6 Food processors and food industry

In the food industry, several sources of costs arise, including technical costs, costs for organisation, for labelling, for avoidance of GM ingredients, for the implementation of traceability systems and for quality management.[52] In the case of a GM avoidance policy, industry expects additional labour costs (0.2% of total turnover), additional analyses costs (0.2% of total turnover) and higher commodity costs (0.4% of total turnover).[53]

The costs of commercial cultivation of GM crops for the German food industry have been estimated to be up to 12.8% higher for rapeseed products, 4.9% for sugar beet products (sugar) and 10.7% for wheat products.[54] These costs add to farm and grain merchant costs. However, the data in this study is calculated on the basis of a threshold of 0.9%. In order to fulfil the thresholds of food industry (usually 0.1 to 0.3%), the true costs are assumed to be much higher.

Interviews with European food producers also found evidence of higher costs for food producers.[55] Cases documented include:

- a conventional maize mill from Germany faces additional prevention costs of €21.90 per tonne adding to total costs of almost €900,000 per year
- an organic tofu producer from Germany, faces costs of €86 per tonne for higher commodity prices, quality management and testing, adding to aggregated prevention costs of more than €155,000 per year
- an organic soy food processor from France, faces costs of €77 per tonne and aggregated costs of nearly €270,000 per year
- another soy food processor, faces prevention costs of €58,000 per year for higher commodity prices, quality management and testing.

In 2005, a study by US scientists concluded:

"... that the introduction of GM food reduces overall EU welfare, mostly because of the associated need for costly segregation of non-GM products"[56]

The data above demonstrate the already high economic burden on the food industry, farmers, mills, seed developers and multipliers can only be tolerated as long as there is no large scale cultivation of GM crops in Europe.

The socio-economic effects of GMOs

2. Political action on the socio-economic impacts of GM production

2.1 Political call for socio-economic assessments

The current EU framework of GM policy does allow the European Commission to consider *"other legitimate factors"* (than environmental and health risk assessment) in the authorisation decision. But this has not been implemented and applicants have not been asked to deliver relevant data.[57] There is however increasing awareness of the socio-economic impacts of GM cultivation. In 2008 EU environment ministers asked the European Commission to deliver[58]:

"relevant information on the socio-economic effects of the marketing of GMOs, including the socio-economic benefits and socio-economic risks as well as the agronomic sustainability and exchange."[59]

Furthermore in 2010, the European Commission launched a proposal which would allow Member States to reject GMO cultivation for reasons other than health and environmental concerns.[60] With this policy shift, the Commission plans to give EU Member States new rights to stop GM cultivation in their territory, for example with reference to socio-economic effects of GM crop cultivation.[61]

In 2010 the European Commission began a report on the socio-economic impacts of the cultivation of GM crops, based on responses from the national governments. At the time of publication it has not yet been released. Several ministries have underlined that they struggle to assess cultivation and its impacts on the whole food chain and only 50% have responded with information. Instead the others forwarded a collection of responses from GM industries, farmers' organisation and other stakeholders. A major concern highlighted by some ministries is that the conflicts between farmers will increase if GM crops are cultivated. Several ministries were aware of the increasing GM seed prices in the US and increased social conflicts caused by the cultivation of GM crops.

2.2 How socio-economic effects are implemented in national GMO laws

Within European countries, socio-economic impacts of GM crops are considered only in Norway, and, to a smaller extent, in Austria.[62]

In Norway, socio-economic impacts of GM crops are considered in the Gene technology act.[63] The regulations in Article 17 refer to aspects like sustainability, social utility and ethical considerations. The basic question is *"whether the deliberate release of genetically modified organisms will be of benefit to society and is likely to promote sustainable development"*. Assessments are based on the principles of cost-benefit analysis as well as long term sustainability. GMOs can be rejected due to concerns about their sustainability.

Additionally Article 16 demands that the applicant present:

"emergency measures, including any cleaning ... to limit or mitigate adverse effects on the environment or human or animal health of the unintended release or spread of the genetically modified organisms."

In Austria, the assessment of socio-economic effects is laid down in the Gene Technology Act. Article 63 includes a provision on products that are considered 'socially unsustainable'. This provision allows a means not to grant permission to products that may have posed an 'inappropriate burden to groups of the population'.

Socio-economic impact assessment in the Norwegian Gene technology law

Article 17 of the "Regulations relating to impact assessment pursuant to the Gene Technology Act" specifies "other consequences than those on human and animal health and the environment":

1. positive or negative effects of the project in relation to sustainable development,
2. ethical considerations that may arise in connection with the use of the genetically modified organism(s), and
3. any favourable or unfavourable social consequences that may arise from the use of the genetically modified organism(s).

Soya plant ready to be harvested.

Shipment of soy beans onboard the cargo vessel.

2.3 How to implement socio-economic effects into European GMO regulation?

The European GMO framework delivers two possibilities for the addition of socio-economic effects into the general risk assessment and management.

1. The basis for an assessment of socio-economic implications could be Regulation 1829/2003. Art. 7 and 19 of the regulation foresee the inclusion of 'other legitimate factors' for the assessment of GM crops. The preamble specifies that these other factors 'in some cases' 'may' be taken into account.

2. EU General Food Law (Regulation 178/2002) states: *"It is recognised that scientific risk assessment alone cannot, in some cases, provide all the information on which a risk management decision should be based, and that other factors relevant to the matter under consideration should legitimately be taken into account including societal, economic, traditional, ethical and environmental factors and the feasibility of controls"* (Preamble 19).

In a recently published report, scenarios for a European body which would assess socio-economic impacts are developed.[64] Socio-economic factors have so far been perceived to belong to the realm of risk management, i.e. the EU and Member States. According to the report, at the moment there is no body at EU level which could deal with socio-economic assessments.

Seed fields.

3. Conclusions and recommendations

Experience shows that GM crops have substantial socio-economic impacts. In sum, the data presented indicates that any projected economic benefit of GM cultivation is by far outweighed by the economic costs of segregation of non-GM and GM in seeds, fields, harvesters, mills and in food production. This is due to massive increases in herbicide use, ongoing contamination, and increased costs throughout the food chain. It is important that these issues are taken into account if any GM crops are to be approved to be cultivated in, or imported into, Europe.

The costs of segregation, traceability systems and testing currently fall on the conventional and organic sectors. This is unfair and distorts the market. Biotech companies, traders and other GMO users must take responsibility to prevent contamination to ensure that the conventional and organic market in the EU can flourish without unjust financial burdens.

Friends of the Earth Europe is calling for:

1. **Strict and compulsory anti-contamination measures in all European countries.** All costs to prevent contamination must be covered by the polluters. This includes complete segregation along the food chain (breeding, production, transport, storage, drying, processing). If investments to secure non-GM production are necessary their cost must be covered by those who place GM crops on the market.

2. **The socio-economic impact assessment of GMOs must be integrated into the EU approval system.** Article 7 and 19 of the GM regulation 1829/2003 must be extended into a full socio-economic assessment. The Norwegian approach in which applicants are obliged to present emergency response plans with methods to control unexpected spread of GMOs is a good workable model. These costs and measures have to be assessed for all crops before they receive market approval in the EU.

3. **Guaranteed liability of polluters** Farmers, consumers and taxpayers need guarantees that companies bringing GM crops to the market will be strictly liable for any harm they may cause. The polluter pays principle must hold so that compensation is available for contamination incidents and that those who contaminate food and feed with GMOs are held responsible for their actions.

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