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COMMISSION STAFF WORKING PAPER

Accompanying document to the

REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on socio-economic implications of GMO cultivation on the basis of Member States contributions, as requested by the Conclusions of the Environment Council of December 2008

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The Directive 2001/18[1] on the deliberate release of genetically modified organisms (GMOs) into the environment provides that the Commission should, after 3 years, provide a report on the implementation of the Directive including an assessment of the socio-economic implications of deliberate releases and placing on the market of GMOs. When submitting its 2004 report, the Commission noted that there was not sufficient experience to make such an assessment.

In December 2008, the Council invited the Commission and Member States to work again on this question. Therefore the Commission launched a consultation of the Member States on the socio-economic implications of GMO cultivation via a questionnaire.

A report was prepared by the Commission to summarise and analyse the content of the answers of the Member States and stakeholders to the questionnaire. This Commission staff working paper is accompanying the above-mentioned report, and contains the following:

– The questionnaire prepared by the Commission about the socio-economic implications of the placing on the market of GMOs for cultivation (Annex 1).

– Non-exhaustive summaries of individual contributions of the 25 Member States which answered to the questionnaire. These summaries have been reviewed and validated by the Member States, and do not engage the Commission. (Annex 2).

– A review of the available peer-reviewed literature worldwide on the socio-economic dimensions of cultivation of GMOs. (Annex 3)

[1] OJ L 106, 17.4.2001, p.1.

ANNEX 1

Questionnaire about the socio-economic implications of the placing on the market of GMOs for cultivation

A – Introduction note

Article 31.7 (d) of Directive 2001/18/EC[1] provides that the Commission should send to the European Parliament and the Council a specific report on the operation of the Directive including inter alia an assessment of the socio-economic implications of deliberate releases and placing on the market of GMOs. These implications are defined in Recital (62) of the Directive as the socio-economic advantages and disadvantages of each category of GMOs authorised for placing on the market, which take due account of the interest of farmers and consumers. In its 2004 report, the Commission noted that there was no sufficient experience to make such an assessment (the Directive became fully applicable as of 17 October 2002 and several Member States had not transposed yet so only little experience of its implementation was available).

Moreover Regulation (EC) No 1829/2003, its articles 7 and 19, asks the Commission to submit a draft of the authorisation decision taking into account, together with the opinion of the Authority in charge of the scientific assessment, "other legitimate factors relevant to the matter under consideration".

At its meeting on 4 December 2008, the Environment Council adopted conclusions on GMOs mentioning among other things the appraisal of socio-economic benefits and risks of placing GMOs on the European market for cultivation. In particular the Council conclusions indicated the following:

The Council:

7. Points out that under Regulation 1829/2003 it is possible, under certain conditions and as part of a case by case examination, for legitimate factors specific to the GMO assessed to be taken into account in the risk management process which follows the risk assessment. The risk assessment takes account of the environment and human and animal health. Points out that under Directive 2001/18/EC, the Commission is to submit a specific report on the implementation of the Directive, including an assessment, inter alia, of socio-economic implications of deliberate releases and placing on the market of GMO.

   Invites the Member States to collect and exchange relevant information on socio-economic implications of the placing on the market of GMOs including socio-economic benefits and risks and agronomic sustainability, by January 2010. INVITES the Commission to submit to the European Parliament and to the Council the report based information provided by the Member States by June 2010 for due consideration and further discussions.

[1] Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC

This possible consideration of socio-economic factors in the authorisation of GMOs for cultivation has also been raised by several Member States in the Environment and Agriculture Councils of the last months[2].

In order to respond to the invitation of the Council conclusions of 4 December 2008 and to the requirements of the legislation, the Commission invites Member States to submit all information they would consider relevant by January 2010 at the very latest.

In order to help Member States in structuring their responses, the Commission drafted a non exhaustive list of areas and stakeholders which could be concerned. In addition, for each of these categories, we have introduced in the annex a list of leading questions which could be used where considered appropriate.

When preparing their contribution Member States are invited to report *ex post* on the socio-economic impact of GMOs that have been approved in the EU and cultivated in their territory. Additionally, Member States are also invited to assess *ex ante* the possible implications of GMOs of currently pending approvals as well as those which are under development according to the best of their knowledge. One possible source of information in that respect is that recent report produced by the Joint Research Centre titled "The global pipeline of new GM crops" (available at http://ipts.jrc.ec.europa.eu**).**

The submissions must be as explicit and informative as possible and supported by evidence and data. When feasible, the socio-economic analysis – be it *ex post* or *ex ante* – should be quantified. In case documents are attached, they should be accompanied by a summary of the relevant part and a specification about the argument or topic that is being defended.

Where stakeholders are consulted at national level (e.g. farmers and consumers), we would appreciate it if their responses would be incorporated in your submission in an aggregated fashion. The list of stakeholders consulted, as well as any other pertinent information, may indeed be attached to the questionnaire.

Please note that the contributions must only deal with "socio-economic implications of the placing on the market of GMOs including socio-economic benefits and risks and agronomic sustainability" for each category of GMOs. These contributions should cover cultivation of GMOs and placing on the market of GM seeds.

If you choose to fill in the annexed questionnaire, please consider that answers should be broken down by the purpose of the genetic modification (herbicide tolerant, insect resistance, etc) if this affects the content of the responses.

DEADLINE FOR CONTRIBUTIONS: January 2010

[2] Environment Council of 2 March 2009, Agriculture Council of 23 March 2009 and Environment Council of 25 June 2009

B - Contact Details

Member State:

Name of ministry/ies contact Person/s:

Contact Address:

Telephone: **Fax**:

E-mail Address

C – Areas and stakeholders on which Member States are invited to comment

For each question, answers should be broken down:

- by the purpose of the genetic modification if this affects the content of the responses,

- between ex ante and ex post considerations.

1. - Economic and social implications

Upstream

1.1. Farmers

For each question, answers can be broken down by the range of relevant agricultural stakeholders farmers

- *farmers cultivating GM crops;*
- *and/or conventional crops;*
- *and/or organic crops;*
- *beekeepers;*
- *seed producers producing GM seeds;*
- *seed producers producing conventional seeds;*
- *seed producers producing organic seeds;*
- …

Has GMO cultivation an impact regarding the following topics? If so, which one?

- farmers' revenues (output prices and agricultural yields);
- farmers' production costs;

- labour flexibility;

- quality of the harvest (e.g.mycotoxines);

- cost of alternative pest and/or weed control programmes;

- price discrimination between GM and non-GM harvest;

- availability of seeds and seed prices;

- dependence on the seed industry;

- farmers' privilege (as established by Article 14 of Regulation (EC) No 2100/94 on Community plant variety rights) to use farm-saved seeds;

- the use of agriculture inputs: plant protection products, fertilisers, water and energy resources;

- health of labour (possible changes in the use of plant protection products);

- farming practices, such as coexistence measures and clustering of GMO and/or non-GMO production;

- cost of coexistence measures;

- conflicts between neighbouring farmers or between farmers and other neighbours

- labour allocation- insurance obligations;

- opportunities to sell the harvest due to labelling;

- communication or organisation between the farmers;

- farmer training;

- beekeeping industry.

Any other impacts you would like to mention:

1.2. Seed industry

For each question, answers can be broken down by the range of relevant stakeholders, including:

- *plant breeders;*

- *multiplying companies;*

- *seed producing farmers;*

- *seed distributors;*

And/or:

- *GM seeds;*

- *conventional seeds;*

- *organic seeds;*

And/or:

- *industrial / arable crops;*

- *vegetable crops…*

Has GMO cultivation an impact regarding the following topics? If so, which one?

- employment, turn over, profits;

- the production of seeds (easiness/difficulty to find seed producers, easiness/difficulty to find areas to produce these seeds…);

- marketing of seeds;

- the protection of plant breeders rights; - the protection of plant genetic resources.

Does the marketing of GM seeds have an impact on the seed industry and its structure in the EU (size of companies, business concentration, competition policy)? Please specify per sector.

- for plant breeders;

- for seed multiplication;

- for seed producers;

- for the availability of conventional and organic seeds;

- creation/suppression of barriers for new suppliers;

- market segmentation.

Any other impact you would like to mention:

Downstream

1.3. Consumers

Has GMO cultivation any impact regarding the following topics? If so, which one?

- consumer choice (regarding quality and diversity of products);

- the price of the goods;

- consumer information and protection;

Any other impact you would like to mention:

1.4. Cooperatives and grain handling companies

Has GMO cultivation any impact regarding the following topics? If so, which one?

- work organisation;
- handling and storage;
- transport;
- administrative requirements on business or administrative complexity.

Any other impact you would like to mention:

1.5. Food and feed industry

Has GMO cultivation any impact regarding the following topics? If so, which one?

- range of products on offer;
- employment, turn over, profits;
- work organisation;
- crop handling (drying, storage, transport, processing, etc...);
- administrative requirements on business or administrative complexity;

Any other impact you would like to mention:

1.6. Transport companies

Has GMO cultivation any impact regarding carriers (insurance, cleaning, separate lines...)? If so, which one?

1.7. Insurance companies

Does the GMO cultivation have any impact regarding insurance companies (e.g. in terms of developing new products)? If so, which one?

1.8. Laboratories

Has GMO cultivation any impact regarding the following topics? If so, which one?

- employment, turn over, profits;
- feasibility of analyses;
- time necessary to provide the results;
- prices of the analyses.

Any other impact you would like to mention:

1.9. Innovation and research

Do GMO cultivation and the technology spill over have an impact on the following topics? If so, which one?

- investment in plant research, number of patents held by European organisations (public or private bodies);

- investment in research in minor crops;

- employment in the R&D centres in the EU;

- use of non-GM modern breeding techniques (e.g. identification of molecular markers);

- access to genetic resources;

- access to new knowledge (molecular markers, use of new varieties in breeding programmes, etc.).

1.10. Public administration

Has GMO cultivation any impact regarding the actions of the national public administrations and the necessary budget (national and local level) for example policing and enforcement costs

Any other impact you would like to mention:

Economic context

1.11. Internal market

Does the placing on the market of GMO seeds have an impact on the functioning of the EU internal market on seeds? If so, which one?

Does it have an impact on the internal markets for services (if so which impact and which services), for agriculture products and on workers' mobility? If so, which one?

Does GMO cultivation have an impact on monopolies? If so, which ones (emergence/disappearance)?

Does it provoke cross-border investment flows (including relocation of economic activity)?

Any other impact you would like to mention:

1.12. Specific regions and sectors

Answers can be broken down on the purpose of the level (national, regional, local) and according to region.

Has GMO cultivation any regional and local impact in those regions regarding the following topics. If so, which one?

- agriculture incomes;

- farms' size;

- the farm production practices (e.g. increase or decrease of monoculture);

- the reputation regarding other commercial activities of the region/localities.

Any other impact you would like to mention:

2. - Agronomic sustainability

2.1 Agricultural inputs

Does the cultivation of EU approved GMOs for cultivation have an impact regarding the use of pesticides against target insect pests (i.e. corn borer)?

Does the placing on the market of GMOs have an impact, and if so which ones, regarding the use of pesticides or/and on the patterns of use of chemical herbicides?

2.2. Biodiversity, flora, fauna and landscapes (other impacts than the ones considered in the environmental risk assessment carried out under Directive 2001/18 and Regulation (EC) No 1829/2003)

Does the cultivation of EU approved GMOs have an impact regarding the number of non agriculture species/varieties?

Does GMO cultivation have an impact on agriculture diversity (number of plant varieties available, agriculture species, etc?)

Does GMO cultivation have an impact, and if so which one, regarding:

- protected or endangered species;

- their habitats;

- ecologically sensitive areas;

Does GMO cultivation have an impact, and if so which one, regarding:

- migration routes;

- ecological corridors;

- buffer zones.

Does GMO cultivation have an impact, and if so which one, regarding:

- biodiversity;

- flora;

- fauna;

- landscapes.

Any other impacts you would like to mention:

2.3. Renewable or non-renewable resources

Does the placing on the market of GMOs have an impact, if so which ones, regarding the use of renewable resources (water, soil…)?

Does the placing on the market of GMOs have an impact, if so which ones, regarding the use of non-renewable resources?

Any other impacts you would like to mention:

2.4. Climate

Does GMO cultivation have an impact regarding our ability to mitigate (other than by possibly reducing CO2 emissions from fuel combustion – see next section) and adapt to climate change? If so, which ones?

Any other impacts you would like to mention:

2.5. Transport / use of energy

Does the cultivation of EU approved GMOs have an impact regarding energy and fuel needs/consumption? If so, which ones?

Does the cultivation of EU approved GMOs have an impact regarding the demand for transport in general terms? If so, which ones?

Any other impacts you would like to mention:

3 - Other Implications

ANNEX 2

Non-exhaustive summaries of individual contributions of the 25 Member States which answered to the questionnaire.

These summaries have been reviewed and validated by the Member States, and do not engage the Commission

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Austria[1]

1. ABOUT AUSTRIA

- No GMO cultivation[2].
- No experimental research activities on GMOs cultivation[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- Austria appreciates the efforts by the Commission to collect experiences of Member States with regard to socio-economic effects caused by GMO cultivation.
- Many questions were difficult due the lack of European experience with GMO cultivation.
- Consultation of all authorities, agencies, institutions involved in GMO issues, as well as of all provinces of Austria.
- Reference is made to the criteria for socio-economic effects proposed by COGEM in the Netherlands. This proposal should be further discussed at EU level.
- Precautionary measures should be taken in the EU to prevent the unintentional spread of GM plants in the environment and the adventitious presence of GMOs in other products.
- Austria is the Member States having (1) the highest share in the "agri-environmental program" (more than 90% of Austria's agriculturally utilised area); (2) the highest portion of organic growing area.
- A minimum general framework must be guaranteed which allows each farm to maintain a GMO-free production (including cross-border cultivation areas).
- Due to the small structure of Austria's areas under cultivation, "coexistence" of GM and non-GM cultivation is for some crops simply not feasible in Austria.
- Farmers fear of becoming dependent from big seed and crop protection companies.
- The one-sided orientation of the new technologies does not take account of the many regionally specific needs.
- Politically, Austria thus advocates a right of self-determination concerning cultivation, not only vis-à-vis the EU, but also on the part of Austria's nine Federal Provinces, all of which are members of the European Network of GMO free Regions.
- The answer to the questionnaire is complemented by a study entitled "Assessing socio-economic impacts of GMOs – Issues to consider for policy development". Provided that socio-economic factors are further considered at European level, the study recommends

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1 This compilation was prepared by the Commission on the basis of the information provided by Austria, and was validated by Austria.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

to: (1) Launch a process for policy development which allows for inputs of a broad range of stakeholders; (2) Identify and conduct research on impact dimensions and possible impacts of GM cultivation; (3) Based on the research described above conduct transdisciplinary research on best practice models, approaches, and methods appropriate for measuring and assessing the impacts as well as the normative baselines and criteria.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- The prevailing mood concerning GMOs (media and people's opinion) is sceptical to negative. Major problems in neighbourly relations must be expected as well as protest campaigns. Wilful destruction cannot be ruled out.
- GMOs pose the risk of out crossing and contamination of other crops as well as the resulting questions of liability. Long running legal disputes must be expected.
- 15% of all farming enterprises are organic farmers (19.961) and, thus, faced with the problem of coexistence (average).
- Marketability of the harvested products with traces of GMOs would be jeopardised. The same would apply to GM free beekeeping products, dairy sector and livestock (for the latter, GM-free protein feed is an increasing problem; soybean is more and more replaced by by-product from the production of bio-ethanol from cereals). No legal rules protecting GM free producers against such economic disadvantages exist.
- As regards farmer's production costs, no concrete statements can be made due to the lack of experience with GMO cultivation. Herbicides associated to HT crops should generate higher costs for the buyer. There would have no solid proof of actual savings in connection with pesticide use. There are even studies that prove the contrary.
- Analysis show that breeding progress for yielding maize in the United States (with GMOs) and in Austria (without) does not show benefits for GMOs. Maize yields in Austria are even slightly higher than they are in the U.S.A.
- There are conceivable positive impacts on harvest quality (e.g Bt crops), but these can be achieved also by means of conventional breeding and control methods.
- Complete logistical separation between conventional/organic and GM seed/harvest would be hardly achievable, thus the cultivation of GMOs would threaten non-GM farming.
- Similarly to hybrid maize, contractual obligations of farmers concerning the purchasing of the GM seed (with the herbicide for HT seeds) must be expected.
- Probably cultivation of GMOs would have no significant change as regards the availability of seeds. In the long run GM seeds would be more expensive (license fees to the holder of the patent). Though the strategy of the Austrian seed industry to focus on GM-free varieties has proved successful, as all market opportunities can be met with it.

[5] For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

Impacts on downstream operators

- Austrian consumers clearly advocate supply with GMO-free products.
- Segregation should cause additional investment, handling and administrative costs for cooperatives and grain handling companies.
- It is becoming increasingly difficult for the food and feed industry to produce guaranteed GM-free products. Additional costs from coexistence and segregation amount to up to 13% of the product turnover for oil mills and the starch industry[6].
- The Austrian food chain has dedicated itself to offer exclusively products not labelled as GM. It avoided the expected high costs of establishing a segregation chain.
- No insurance available that covers the admixture risk (for GM/non-GM growers/actors).
- Public administration: there is no cultivation thus it is difficult to make a quantitative assessment. However, Austria assumes that the precautionary legal regulations will cause significant administrative expenditure (specific expert knowledge, checking compliance with legal regulations on GMO cultivation, monitoring on the entire chain).

Economic context

- Austria questions whether a complete free internal market for GM seeds is desirable, even though potential impacts are not yet measurable. It must be reckoned that such a case would negatively impact the free internal market of GMO-free seeds as well as organic or other GMO-free food and feed products.

Agronomic sustainability

- International experiences have shown that presumably higher pesticide application levels are necessary due to GMOs.
- No HT (herbicide tolerant) crop authorised in the EU, so no conclusive answer is possible for the time being as regards the use of herbicides.
- A study of the Federal Environment Agency on environmental protection and nature conservation in the cultivation of genetically modified organisms by M. Dolezel (2007) concludes that negative effects on biodiversity are to be expected.
- Effects on the biodiversity of the soil are yet to be examined.
- Regions with strong traditions and high-quality production of typical food, small-scaled agriculture, Natura 2000 zones are areas particularly worth being protected. In many of these regions local citizens reject GMOs cultivation.
- Current GMOs have not been specifically shaped for renewable resources (natural resources management, energy consumption, climate change, etc), so this question cannot even been discussed at theoretical level.

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[6] Costs and benefits of segregation and traceability between GM and non-GM supply chains of final food products; Science Centre Straubing (Germany)

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Belgium[1]

1. ABOUT BELGIUM

- The use of GMOs for cultivation is a matter falling under the competence of the Regions.
- No GMO cultivation[2]. One exception: in 2010, a coexistence experiment with Bt-maize (1ha of maize MON810) was conducted to evaluate the Flemish coexistence measures (legislation and sampling procedures).
- Research activities: Dissemination experiments resumed in spring 2009, after a suspension between 2004 and 2008[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- BE answer consists in (1) a compilation of the crude contributions of the 12 stakeholders involved, including some public services, (2) a report of a workshop organised in Belgium on 29 March 2010 on the evaluation of the socio-economic impact of GMOs (available on internet[5]).
- This answer of BE to the questionnaire does not represent the official position of Belgium as a whole.
- In order to properly assess the socio-economic impact of GMO cultivation, a specific effort should be devoted to the identification of the scope of alternatives to such agricultural practice. A systemic approach could then compare short and long-term impacts of a GMO based agriculture to those of existing or other potential innovative pathways[6].
- For the federal Environment department, socio-economic criteria should not bypass biosafety criteria.
- The regional government of Wallonia is in favour of a moratorium on dissemination of GMOs into the environment and putting on the market as long as absence of risk for health and environment as well as socio-economic advantages has not been demonstrated.
- The federal public service Health, Food Chain Safety and Environment organised a workshop entitled “Visions on the evaluation of the socio-economic impact of Food

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1 This compilation was prepared by the Commission on the basis of the information provided by Belgium, and was validated by Belgium.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 http://www.health.belgium.be/eportal/Environment/BiodiversityandGMO/GMOs/19061856_FR?backNode=9222

6 Vanloqueren G., Baret Ph. (2009): How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations. Research Policy 6 : 971-983

GMOs“, organised in Belgium on 29 March 2010. The conclusions of the workshop are available at www.ogm-ggo.be

- Boerenbond (syndicate of part of Flemish farmers) is open to new GMOs for cultivation as long as they are thoroughly evaluated (science-based), sustainable and socially responsible.
- The Greenpeace contribution covers GMOs at large, not just cultivation.
- For the federal Environment department, sustainability criteria should also be developed not only for GMOs intended for cultivation in the EU but also for imported GMOs having a direct scope of food/feed/products use.

3. Overview of the answers to the questionnaire[7]

Economic and social implications

Impacts on upstream operators

- For the federal Environment department and the federal Development Cooperation department, the question of the patenting of the seeds and the interdiction for farmers to re-use and exchange bought GM seeds would remain an important socio-economical issue, to which are linked various other sustainability issues.
- For Greenpeace, the more GMOs are cultivated, the more conventional and biological farmers will have to invest in preventive anti-contaminations means, as GM farmers are not responsible for potential cross contaminations with their neighbourhood (principle of the "polluted-payer").
- If contaminated by GMOs, biological maize can loose its label and price premium, and in the long run its image can be damaged. The 2 preceding considerations could force the emigration for ex. of sweet maize EU producers who want to produce without GM, says Greenpeace, for which this is paradoxical if the majority of EU consumers are opposed to GM food.
- Following APFACA-BEMEFA (national professional association of feed producers), if a better yield is obtained with GM feed cultures (for ex. Bt maize), this could be favourable for the livestock sector accepting GMOs and could raise the profits of feed culture exporters.
- Non-GM livestock farmers have to pay extra costs to guarantee the provision of non GM feed (e.g. non GM Soya from Brazil). Labelling of non GM fed livestock is therefore necessary to justify the premium cost asked to the consumer, who in majority is opposed to GM food in the EU, says Greenpeace, for which it is thus paradoxical that these consumers have to pay these extra costs.
- Greenpeace is opposed to a GM presence tolerance threshold for seeds, as it would lead to insidious large scale contamination of all conventional seeds. The Austrian Seed Purity Act should be considered as a model.

[7] For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

Impacts on downstream operators

- SYNAGRA (national syndicate for cereals and dried fruits trade) considers that GMOs cultivated in Belgium should not be dealt separately in the food chain, in order to avoid supplementary costs in infrastructures and workload. Furthermore, even with segregation, cross contamination cannot be avoided.
- Public authorities (federal Environment department and regional government of Wallonia) report costs to be supported by the public budget already in the absence of cultivated GMOs on the market: cost of risk assessment by the Belgian Biosafety Advisory Council: costs of controls of labelling of products, cost of post monitoring of field trials, costs of control of non contamination of conventional seeds, costs of enquiry outside field trials (that revealed presence and maintenance in the environment of Wallonia of a GM colza not authorized for cultivation). Furthermore, should GMOs be cultivated, all existing monitoring networks should be upgraded and this would take time and involve more money. One should therefore anticipate potential costs that would result from too lately detected negative environmental and/or health impacts.
- The Belgian Federation for Food Industry (FEVIA) stresses that for the moment the use of GMO is limited as much as possible due to consumer's rejection. Should GMOs be cultivated in Belgium, the profitability of the sector would be negatively impacted by increased logistic, segregation and traceability costs along the food production chain. However, should GMOs be accepted by consumers, the range of products proposed to the consumers would significantly expand, agriculture would be more competitive, and the food industry more profitable.
- For Greenpeace, the contamination of bees and thereafter honey is unavoidable when GMOs are cultivated close to a hive.

Economic context

- No impact observed on the internal market as there is no cultivation for the moment.

Agronomic sustainability

- For the federal Environment department, even though some of the problems raised by GMOs are common to conventional agriculture, the GM technology should do better (and not just the same as) than conventional agriculture, at the level of environmental (including climate) , health and food security impacts. This view is shared by the federal Development Cooperation department.
- For the federal Environment department, GMOs cultivation in its present state causes poor preservation of wild and agricultural biodiversity due to the monopole of few big companies focusing mainly on a few big world trade cultures, and the cultivation of clonal monocultures. Sustainability criteria for GMOs cultivation should mind taking into account international environmental and public rights agreements signed by the EU and its Member States. This view is shared by the federal Development Cooperation department.
- Greenpeace considers that cultivation of BT maize ends up in much higher contamination rate of the soil than with conventional practices, due to the continuous production of the pesticide by the crop. Furthermore, the benefit of the eradication of the primary pest is cancelled by the development of secondary pests, which then have to be fought against with additional pesticides. Finally, the excessive use of BT through BT crops could

generate resistance, what would be a big problem for the biological farmers also using BT insecticides.

- Greenpeace considers that HT crops stimulate higher spraying of target herbicides by farmers, who also have to use additional herbicides when resistant weeds appear.

Other implications

- As regards climate change, Greenpeace considers that there is a full portfolio of measures more efficient than the use of GMOs to limit the CO2 emissions from the agriculture sector. Preserving plant diversity, rather than promoting monoculture (of GMOs), is the best insurance policy to resist to the forthcoming increased drought and extreme climatic events.
- Boerenbond (syndicate of part of Flemish farmers) considers that ex-ante evaluation of the socio-economic impact is not possible due to the lack of technical and economic information to build upon and risks to open a process against GMOs without any scientific base.
- Following the federal Environment department, some socio-economical impacts could already be evaluated once the destination of the GMO is planned; this assessment could be built step by step, being potentially informative from the field trial phase on.

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Cyprus[1]

1. ABOUT CYPRUS

- No GMO cultivation[2].
- Research activities on GMOs: no field trial notifications between 2002 and 2007[3].
- No coexistence rules adopted[4].

2. GENERAL COMMENTS

No information

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Countries that cultivate GMOs have increased their use of insecticides but it is difficult to assess the risk and gain specific knowledge since in the EU only Spain cultivates GMOs commercially and no adequate studies have been published. More research is needed.
- Specific conditions in Cyprus: fragmentation of land, small size of fields and small distances between them, high endemic flora, special climatic conditions. This implies that (1) buffer zones are probably not feasible in Cyprus; (2) there is a high risk of contamination and implementing coexistence measures will be costly for farmers. In addition, coexistence would request more coordination between GM growers and other farmers but a majority of farmers don't accept GMO cultivation.
- Potential presence of GM seeds in conventional imported seeds implies addition costs of inspection.
- There is concern regarding the health of the labour resulting from the change in practices in the case of GMO cultivation and the use of new chemicals with unknown practices.
- The seed market is made of small and medium enterprises. GM seeds would reduce the market share of conventional and organic seeds and thus probably have adverse impact on turnover, employment and profit of these small companies.
- Price of GM seeds are controlled by multinational companies and can artificially be set lower than the price of conventional seeds.

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1 This compilation was prepared by the Commission on the basis of the information provided by Cyprus, and was validated by Cyprus.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- GMOs are not accepted by the majority of the citizens.
- Plant genetic resources: conventional seeds must be protected as they will be the base for the production of new developed crops.
- Domination of GMOs will reduce the choice for farmers.
- Incomes of the farmers who cultivate GM seeds could decrease. Depending on the weather or soil conditions, many times more pesticides or fertilizers will be needed for GM cultivation, thus increasing the cost.
- Patent system will reinforce oligopolies

Impacts on downstream operators

- Citizens have expressed their preference to lower the labelling threshold for food and feed and to have GMO-free products with official labelling. Labelling should be clearer and GMOs placed on other shelves.
- Risk of mixing for food and feed. Segregation will increase the cost of storing, handling, transferring and transporting of GMOs for the grain companies and transport companies, as well as administrative costs. It is difficult if no impossible to manage the two parallel systems, in particular for seeds. In general, quality of products will be questionable.
- If GM feed dominate the market and its price drops, there is a risk to reduce the percentage of conventional feed in the market.
- As far as insurance is concerned, GMOs need to be handled differently. There is a need to provide guidelines so as to be able to deal with GMO companies and cover the cases of contamination.
- The state laboratories perform analyses for imports. In the case of an increase of needs, more time will be needed for the results and it is not possible to say how the prices will evolve. There would be an increased need for more labs and investments in new technologies.
- The research institutes of Cyprus are not involved with GMO research (other priorities are set regarding the agricultural sector).
- Public administration: in the event of GMO cultivation, the administrative costs will increase substantially since more monitoring and control will be needed in various sectors of the public administration.

Economic context

- It is difficult to evaluate the potential impact on the internal market but negative impacts are foreseen regarding the local seed producers, as well as the producers of conventional and organic products.
- Unequal competitiveness would rise and monopolies would increase.
- Fewer and larger farms will need to be established (coexistence) and monoculture will increase.
- GMO cultivation will possibly affect the good reputation of an area. An additional negative agrotourism is to be expected (including due to the decrease of biodiversity).

Agronomic sustainability

- As there is no cultivation, it is difficult to assess the impact of GMO on use of inputs.
- The use of pesticides will probably have a negative impact on other useful insects and on the global biodiversity (including fauna and productivity of the soil).
- New traits could offer advantages that could lead to the widespread use of only a few crop varieties, meaning a loss of cultivar biodiversity and a higher susceptibility to plant diseases and pests.
- Bees could be impacted by the change in their diet which may have adverse effects on their health.
- Risk of genetic pollution of wild plants through cross-pollination which may pose public health problems; create "superweeds" (requiring more toxic pesticides to be managed) and threaten extinction for rare plant or change the relatives in a way that could make them play a different ecological role, potentially enabling then to out-compete other species.
- On biodiversity, there is a possibility for adverse impacts on the biodiversity, depending on specific conditions. More serious impacts will be observed in protected areas (e.g. Natura 2000). The endemic relatives need to be examined. The decrease of insect population will limit organisms whose diet depends on insects.
- Small-scale agriculture, natural habitats protection and management would be affected.
- The use of soil will probably be affected (GMO residues may have an impact on productivity of the soil)
- Cultivation of GM plants in order to produce biofuels will have negative impacts to renewable and non-renewable sources and should not be considered as an alternative.
- There is no evidence for specific GM crops that need less water or are tolerant to higher temperatures. Conventional crops can be selected for the specific conditions in order to adapt to new climatic conditions of the island.

Other implications

- No Answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Czech Republic[1]

1. ABOUT CZECH REPUBLIC

- Cultivates MON810 Maize since 2005 (approx. 6,480 ha in 2009)[2].
- Research activities: 11 notifications for field trials between 2002 and 2007[3]. 4 notifications for field trials in 2008 (according to the SNIF database)
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- 526 stakeholders were consulted, with a 12% answer rate.
- The Czech Republic welcomes the questionnaire and the discussions on the socio-economic aspects of cultivation of GMOs.
- "The views of the consultees are not necessarily the same as the formal position of the Czech Republic's government".

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- For 78 % of respondents, GMOs had a positive effect on investment in plant research and subsequent rising number of patents. 67 % experienced a positive effect of GMOs on the employment in the R&D centres.
- 78 % of respondents experienced that the research on GMOs accelerated the use of non-GM modern breeding techniques. Balanced use of GM and non-GM techniques is expected in the future.
- Both GM and non-GM seeds are available, but GM-seeds are more expensive. Dependence from major seed industries was experienced by 74% of responding farmers.
- 90% of responding MON810 growers estimated yield increase to 10% (or higher, depending on pest pressure).

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1 This compilation was prepared by the Commission on the basis of information provided by the Czech Republic, and was validated by the Czech Republic.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- 77% of responding farmers reported equal or lower production costs, resulting from lower (or none) insecticide treatments, lower handling and mechanization. 23% reported higher costs due to more costly seeds.
- Quality of harvest: all consultees cultivating GM maize reported higher quality (less mycotoxins).
- 56% of respondents reported neighbouring conflicts or mentioned threat of such conflicts.
- 77% of responding GM growers reported difficulties to sell the GM harvest (therefore GM harvest is used as a feed in the own farm).
- 93% of responding farmers cultivating MON810 experienced reductions in the use of insecticides as well as fuel. No change in fertilisers or water resources use was recorded. The Czech Beekeeper Union acknowledged the reduction of use of insecticides.
- Respondents report significant gains in labour flexibility when pest pressure is high (less or no need for chemical treatment).
- For consultees cultivating GM maize, the effect of GM crops on livestock is positive – production of plants with lower mycotoxin content finally resulting in lower costs for veterinary care. No opinion on the issue was obtained from organic farmers.
- For 72% of consultees, health of labours improves due to reduced exposure to chemicals. 28% considered that the difference is minimal when chemicals manipulation rules are respected.
- Representatives of organic farming consider that small farms cannot cultivate GM crops (isolation distances difficult to keep within and between small farms).
- For 53 % of consultees, GM maize cultivation has no impact on the beekeeping industry. 18 % of consultees and the Czech Beekeepers Union were of the opinion that Bt maize cultivation would positively influence beekeeping due to reduced use of insecticides. However, monitoring of long-term pesticide use development in GM crops is necessary.
- The Czech Beekeepers Union drew the attention to a possible consumers' reluctance to buy honey products contaminated with GM pollen.
- If GM cultivation significantly expands, difficulties to find sufficient cultivation areas for conventional seeds are expected, and risk of cross-contamination of non GM seeds during growing, harvesting or storage.
- Some respondents fear a monopoly development by international seed companies.

Impacts on downstream operator

- Lower level of mycotoxin leads to higher quality products. However, GMO cultivation in higher extent could decrease the diversity of non-GM products.
- 80 % of respondents consider that GM crops cultivation had a positive effect on consumer information and protection. Obligation for labelling resulted in better consumers' awareness of given products while the right to choice has being kept.
- Segregation GM/non-GM complicates organisation of work and increases costs and administrative burden for cooperatives and grain handling companies (activity records, labelling, controls).
- The food/feed industry, with the exception of the organic industry would benefit from a wider range of products offered due to GM. Some producers of organic products claimed rise of costs for GM-free products marketing.

- Transport companies would face high segregation costs (physical separation, cleaning).
- No insurance product for GM growers exists, but it could be developed in the future.
- 60 % of respondents assumed rise in costs for GMO analyses due to increased demand for inspections and enforcement by authorities, extension of personal capacities, development and/or of new detection methods provided that areas with GM crops enlarge.
- Public administration: extra costs would be faced by the Ministry of Agriculture (co-existence control activities ~ 11.500 EUR/year) and the Ministry of the Environment (GMO reference laboratories ~ 22.500 EUR in 2009).

Economic effect

- 42 % of respondents assumed that placing on the market of GM seeds did not have any significant impact on the EU internal market on seeds (partly due to the very limited - and decreasing - areas sown with GM maize).
- Recent limited cultivation of GM crops in Europe does not enable a strong business competition; therefore an impact on monopolies cannot be quantified.

Agronomic sustainability

- Decrease in use of pesticides is anticipated by most respondents, as pest is spreading quickly in new localities of the Czech Republic. Organic farmers predicted increase in pesticides use in case of resistance development.
- According to 77.5 % of consultees, introduction of GMOs does not put at risk crop varieties as limited to Bt for now. But sound scientific assessment of this potential impact if GM crops are more cultivated in future should be carried out.
- Protected species/migration routes/biodiversity: for a majority, there is no more danger with GMOs than for conventional crops if inappropriately cultivated. Ca 21 % of consultees considered that there is a lack of data to assess any of the mentioned categories for the moment.
- Extensive research carried out in the Czech Republic on impact of Bt on non-target organisms demonstrated positive impact on their diversity.
- No negative impact is anticipated on renewable resources. The real problem lies in bad farming practice (for both GM and conventional crops). Some consider that GMOs could also have a positive impact by increasing production of plants for biofuels.
- According to 38 % of consultees, a positive impact on the use of non renewable resources is expected due to less treatment i.e. less use of fossil fuels (tractors/production of biocides). But no macro scale impact due to the limited surface of cultivated in the Czech Republic.
- According to 86 % of consultees GM crops could help fighting against extension of pest due to warming.

Other implications

- No answer.

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Germany[1]

1. ABOUT GERMANY

- Cultivation of MON810 Maize until 2008 (3371 ha in 2008); cultivation of Amflora[2].
- Research activities on GMOs: 49 field trials notified between 2002 and 2007 (apple; barley; maize; oilseed rape; pea; poplar; potato; *Solanum nigrum*; soybean; wheat)[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- The questionnaire was sent to 25 stakeholders and to all German Federal Länders. 20 responses were received (12 from official institutions, 3 from industry, and one for institutions representing farmers, retailers, consumers, or NGOs, respectively). Germany considers that these 20 responses do not allow answering properly to the Commission Questionnaire. Therefore the German response was kept general but submitting the comments received as additional information.
- The low experience with cultivation of GMOs in Europe does not allow a proper evaluation in the European context of intensive agriculture. It should be evaluated if conclusions from 3rd countries could be transferred to the European conditions.
- The evaluation of socio-economic consequences of the cultivation of GMOs and the definition of criteria should be carried out separately from the risk assessment.
- Documentation including socio-economic criteria which could be relevant for risk management decisions should be considered for the formulation of EU criteria.
- Socio-economic criteria can be included, in addition to the scientific risk assessments, in risk management decisions in the context of a European authorization of GMOs. For this the definition of specific criteria is needed, which needs to be based on a precise and complete definition of the elements of these criteria.
- Socio-economic criteria should consider WTO rules and basic rights of the Lisbon treaty.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

- The responses were, in most cases not covering all questions, so that a summary representing different views is not appropriate. 4 answers were "zero" answers, since no information was provided. Some of the answers were general and some provided available

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1 This compilation was prepared by the Commission on the basis of the information provided by Germany, and was validated by Germany.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

information or reports for further consideration, covering e.g. non target organisms, risks of GMOs, and socio-economic criteria for the evaluation of GMOs.

- It should be kept in mind that the compilation below is necessarily biased due to the reduced number of responses and the incomplete feedback to the survey questions.

Economic and social implications

Impacts on upstream operators

- Competitive disadvantages in the global market for seed producers (they can not use the potential of the technology). In particular SMEs can not invest in green biotechnology (high administrative costs for the regulatory processes without a guarantee on the results, slow transfer of research results into praxis, increased costs for research field trials (security measures), possible destruction of batches in case of micro-contamination.
- The introduction of labelling thresholds for conventional seeds is urgently needed (coexistence is only possible with a threshold based on technical possibilities).
- Reduced production costs due to a reduction in the use of pesticides (Bt-maize), more secured harvest, better quality of the harvest (reduced presence of mycotoxins).
- Higher administrative costs for farmers because of regulatory demands (minimal distance, crop rotation, etc.).
- The coexistence between GMO growers and non-GMO growers needs to be considered.
- The non authorisation of GM plants for feed would give considerable disadvantages to the animal production sector (about 50% of the agronomical production in Germany).
- Legal uncertainty regarding GMO residues in honey. Beekeeping in general is not considered in the legal framework.
- Patents on GMOs and living organisms not supported by farmer associations nor NGOs.
- Farmer advice not to cultivate GMOs because of the negative opinion of consumers.

Impacts on downstream operators

- A threshold for non authorized GMOs in feed is urgently needed for the feed industry.
- An impact on costs for grain handling companies is expected (need to separate non-GMO and GMO production lines, and respective controls).
- An impact on price of goods could be possible but can currently not be predicted.
- The current labelling is not fulfilling the principles of transparency and clarity.
- It is considered that the consumer has no free choice regarding products produced with / without GMOs, since food stuff produced by/with animals fed with GMOs do not need to be labelled. This situation is not building confidentiality of the consumers.
- There are several cases of GMOs which are exempted from labelling since they are since years on the market. These gives an "illusion" of GMO free products.
- No free choice is given to the consumer in the case of cultivation of GM plants since once they are released into the environment they have the potential to reproduce themselves.
- Effects on food producers are expected due to asynchronous authorisation and zero tolerance of non-authorised GMOs in Europe.

- The cultivation of GMOs should only be allowed if the coexistence with conventional crops is guaranteed, since otherwise the free choice of the consumer is not guaranteed.
- Public administration: important cost increase (implementation/monitoring of cultivation).

Economic context

- An impact on the European internal marked is expected (differences between the Member States when transposing the European legislation into national legislation are expected).
- In the case of continuing with the zero-tolerance concept, a reduced availability of feed material is to be expected in Europe (meaning price increase and competitive disadvantage for pork and poultry producers).
- GM-free regions would be acceptable if created on the basis of farmers' voluntary choice.
- To avoid increase of price of consumer products produced using GMOs, GMO growers should contribute to a fond covering the costs of additional administration and labelling.
- So far there are no insurance products covering situations caused by GMOs.

Agronomic sustainability

- The questions of this section were not considered clear. Potential impact needs to be evaluated on a case-by-case basis, depending on the particular GMO.
- The evaluation of cultivation of GMOs vs. conventional crops needs to be done considering the cultivation systems.
- The buffer zones will lead to a concentration of production in some regions (GMO could only be efficiently cultivated in areas with a big structure). Small structured regions will face a competitive disadvantage. Increased costs are associated with this "buffer zones".
- Since tolerance to herbicides or resistance to insects could be achieved also by traditional breeding methods, a change of agricultural management achieved by the use of new varieties should be evaluated independently of the techniques used.
- The non authorization of drought tolerant GM crops would be irresponsible (higher yields with the same resources and less CO_2 emissions).
- The legislation in the areas of GMO and natural protection (Food Fauna Habitat Directive) is not sufficiently harmonised.

Other implications

- Independent and transparent research is needed, in particular long term feeding studies and studies on environmental consequences.
- Research should be focused on problem solving and not on methods.
- The consideration of socio-economic criteria in the EU authorization process of GMOs is not welcomed. This is too "subjective".
- For guaranteeing free choice of the consumers, more information should be given, including on risks and benefits associated with the use of GMO products.

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Denmark[1]

1. ABOUT DENMARK

- No cultivation of GMOs[2].
- Research activities on GMOs: 8 field trial notifications between 2002 and 2007[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- The answer is based on contributions from the Danish Plant Directorate, Danish Veterinary and Food Administration and the National Environmental Research Institute. Relevant stakeholders have contributed too, and Denmark has decided to let the comments from stakeholders stand alone.
- Danish Agriculture and Food Council: GM crops have not yet been grown in Denmark. The main reason is the lack of GM crops with events relevant for the Danish agronomic/climatic context.
- Danish Agriculture and Food Council: A prerequisite for growing GM crops in Denmark is, however, that the freedom of choice is guaranteed for all farmers (GM-growers, organic and conventional).

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Greenpeace: The USDA (USA) states that *"Currently available genetically engineered crops do not increase the yield potential of a hybrid variety. Yield may even decrease if the varieties used to carry the HT or insect-resistant genes are not the highest yielding cultivars*. Similar results are reported from South America.
- Greenpeace: Non-GMO growers are suffering many extra costs to prevent GMO-contamination. The application of the "polluter pays" principle is reversed.
- Danish Seed Council APVD: GM seeds producers may not improve economic output but might realize lower input.
- Danish Seed Council APVD: The farmer must have access to seeds from several companies.

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1 This compilation was prepared by the Commission on the basis of the information provided by Denmark, and was validated by Denmark.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008

4 Source: idem footnote 2

5 more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- Greenpeace: The contamination risk means that, although farm saved seeds are protected by legislation, farmers are in fact forced to use certified seeds to reduce risk of a contaminated harvest.
- Public institutions: Possible impact on farmers: reduction of costs and increased flexibility.
- Danish Agriculture and Food Council: Dependence on seed industry and restrictions in relation to the use of farm saved seeds will probably be of minor importance in Denmark as most farmers is buying certified seeds paying a license even for farm saved seeds.
- Danish Beekeepers' association: Beekeepers fear that GM crops will make biodiversity even further decrease, monocultures increase and have a negative impact on the vitality of honeybee colonies. Beekeeping and honey production is considered to be not adequately covered in the "co-existence" legislation (GMO grower is not liable to pay compensation in case of damage, no protection for the beekeeper against non intentional presence of GMOs in its products).
- Cooperation of biodynamic consumers/agriculturalists: Growing more GM crops in Denmark and in Europe will put a pressure on third countries which cultivate few or no GM crops, and/or third countries where the farmers, the public and the scientists are divided over the cultivation of GM crops. Such countries have very weak public institutions that are unlikely to be able to securely measure and control the use and impacts of the cultivation of GM crops. Furthermore, certified organic agriculture will probably become completely eradicated, since over time the GM traits will spread by natural selection to all non-GM crops.
- Danish Seed Council APVD: It will strengthen competitiveness of European Seed Industry. The development of new products is necessary to increase or secure employment, turn-over and profits. However, it is predicted increasing costs for the breeding companies in the development of GM crops (insurance issues (legal risks), field trials, costly risk assessments. Access to further plant breeding also with varieties containing patented traits must be secured to keep progress in breeding in the future, respecting breeder's exemption.
- Danish Seed Council APVD: As regards seed production, identification of seed production areas with least impact on production of conventional varieties can be an issue.
- Danish Seed Council APVD/Danish Agriculture and Food Council: Seed production (in general) with zero tolerance for adventitious presence is impossible and will be a deterrent for any GMO production in the EU.
- Danish Agriculture and Food Council: Only big companies will have the ability to engage in GM seed development. However, production of organic or conventional seeds opens niches for smaller breeding companies.

Impacts on downstream operators

- Greenpeace: Food industry avoids using GMOs so consumer choice is largely unaffected.
- Danish Agriculture and Food Council: Grain handling companies are already handling GM products (imported feed). However, the introduction of GM seeds will add the following constraints (coexistence, checking that GM seeds are only sold to farmers that have a licence to grow GM crops). Transport companies must prevent spreading and apply coexistence legislation. They are, however, currently handling imported products containing GMOs.

- Public institutions: Innovation and research: increasing need for information and trials on the potential environmental effects (genetic interactions, synergy on target and non-target organisms).
- Danish Agriculture and Food Council: Reluctance regarding GM crops has an impact on European research, eventually on the number of patents held by European companies and also the future access to genetic resources and tools (other modern breeding technologies).

Economic context

- Public institutions: The setting of labelling thresholds for accidental presence of GMO seeds in conventional seeds is not resolved. In practice the individual Member States are setting their own thresholds. This situation harms the trade of seed between Member States.
- Public institutions: The lengthy approval process and the costs make it difficult for SMEs to participate in the development of GM crops and this contributes to the development of monopolies.
- Danish Agriculture and Food Council: it is reasonable to have locally adjusted legislations on co-existence.

Agronomic sustainability

- Public institutions: Experience from Spain seems to indicate that the cultivation of MON810 can result in a decrease in the use of insecticides.
- Danish Agriculture and Food Council: A large scale demonstration project showed that farmers growing HT fodder beet were very keen on using its properties, experimenting reduced dosage or delayed spraying with herbicides, thus leading to high biodiversity in the fields (weeds, insects and birds).
- Greenpeace: HT crops increase weed resistance and increase use of more toxic herbicides.
- Public institutions: The evaluation of possible effects on biodiversity, fauna and flora should be better addressed. Knowledge gaps include: field edge effects, long term effects, landscape effects, non-target effects, monitoring programs.
- Cooperation of biodynamic consumers/agriculturalists: Several already existing challenges regarding environment, climate and public health will further deteriorate. By keeping GMOs out, it is believed that over time the livestock production within the EU will diminish due to an expected lack of GM-free fodder. This will have a large-scale positive impact on climate mitigation, water pollution, water usage, biodiversity and global food resources.
- Public institutions: Future GM-crops (resistant to drought, temporary flooding, saline conditions) constitute a possible adaptive capacity to climate change (but will at the same time pose a pressure on the biodiversity, flora, fauna, landscape and other environmental values).
- Greenpeace: GMO cultivation does not solve any problems but creates many more. In the context of changing climate, the solution for food security is a multifunctional agriculture as outlined by the UN panel on agriculture, IAASTD.
- Public institutions: Life cycle analyses which make the comparison between the effect of cultivation of GM sugar beet, oilseed rape and maize with the cultivation of the conventional versions of these crops have shown that GMO cultivation decreased emissions of CO_2 and ozone, ecotoxicity, acidification and nitrification, emissions of toxic particulates and a reduces in carcinogenicity.

Other implications

- Greenpeace: Socio-economic impact is important in addition to risk assessment. The Norwegian GMO-legislation provides example of the proper way to include socio-economic and sustainability criteria.

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Estonia[1]

1. ABOUT ESTONIA

- No GMO cultivation[2].
- Research activities on GMOs: no field trials but contained use research ongoing[3].
- No coexistence rules adopted yet[4], but planned for adoption in 2011.

2. GENERAL COMMENTS

- As GMOs are not cultivated most of the answers are speculative.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on downstream operators

- Bt maize contains less mycotoxins, quality would rather increase.
- No impact foreseen on the right for farmers to use their own seeds.
- Farming practices would change.
- Implementation of coexistence measures will cost a lot to farmers
- Conflicts between GM growers and organic farmers or between neighbours can not be excluded. Organic farming is very viable and popular.
- No insurance scheme is foreseen. Compensation of damages is regulated according to the Law of Obligation Act.
- According to coexistence measures, training is mandatory for GM growers, paid by the government and the certificate is valid for 5 years.
- An additional notification to beekeepers is required to avoid any possible contamination.

Impacts on downstream operators

- According to a survey among Estonians (2009), 43% of the population would not buy GM products, only 2% agree to buy, rest of them are not sure about their preferences. 54% of answered people prefer to buy organic food. At the same time, price of the products is generally decisive.

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1 This compilation was prepared by the Commission on the basis of the information provided by Estonia, and was validated by Estonia.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- According to a survey among Estonians (2009), 43% of answered people are in the opinion that GMOs have to have an additional special label denoted as GMO.
- The range or products offered would increase.
- Cooperatives and grain handling companies: harvests of GMOs and conventional crops have to be separated, which implies additional costs and workload.
- Food feed industry: probably positive effect on profit but additional costs and workload (transport, storage separation)
- Transport: requirement for cleaning and separate lines.
- No insurance scheme is foreseen.
- Laboratories: increasing number of analysis enhances the laboratory performance and increase profit. Additional workers may be needed.
- Innovation and research: possible impact on investment in plant research, number of patents held by European organisations, investment in research in minor crops, employment in the R&D centres in the EU; use of non-GM modern breeding techniques (e.g. identification of molecular markers); access to genetic resources, and expected effect on access to new knowledge.
- Public administration: Several costs are foreseen (surveillance, operating costs of GMO register etc…)

Economic context

- Possible cross-border investments flows

Agronomic sustainability

- Patterns of use of chemical herbicides would change and the amount of used herbicides may rise as well.
- Supposedly there is no impact on the climate in EU. GMOs are not cultivated in sufficiently large areas to talk about any measurable impact on climate change.

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Greece[1]

1. ABOUT GREECE

- No cultivation of GMOs[2].
- No research activities on GMOs[3].
- No coexistence rules adopted[4].

2. GENERAL COMMENTS

- Questionnaire has been answered by various stakeholders.
- Greece presents a diversity of concerns in case of GM cultivation. The small agricultural plots, the very developed apiculture as well as the anxiety of all scale, from farmers to consumers are only few of the reasons of this position.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Contamination risks for non-GM crop farmers, need for extra controls of all seeds, coexistence cannot be controlled as the acreage in Greece is small, farmers will suffer from contaminations causing conflicts among neighbours.
- Beekeepers would not be able anymore to produce safe and quality bee products, organic and traditional products, products of designations of origin. It is practically impossible to apply coexistence measures able to protect bees from GM crops. The same difficulty would be raised if field trials were carried out. Need for additional analysis.
- Seed production: need for additional measures for seed production, increasing costs.
- Use of HT crops may result to an increase in weed resistance to this herbicide, which would imply need for bigger quantities of other more toxic herbicides, to which farmers will be exposed.
- Concerns about biodiversity, dispersion of GM pollen, production of HT weeds, herbicide accumulation in HT plants, effects on non-target organisms.

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1 This compilation was prepared by the Commission on the basis of the information provided by Greece, and was validated by Greece.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

Impacts on downstream operators

- Consumers are not against new technologies in principle (if clear benefits can be demonstrated); However, they are against green biotechnology.
- Offer of new products.
- GM products would have a lower quality and can acquire lower price, while the non-GM product would present a gradually decreased diversity and will become ore and more expensive. Consumer choice will be significantly limited.
- Consumers' information on labelling is not sufficient. Not enough communication from the EU and governments.
- The polluter pays principle is reversed.
- Seed companies: royalty collection from seed multiplying companies and seed distributors.
- States revenues from taxation of the added value.
- New employment and investment opportunities (directly or through collaboration with public research institutes.
- Additional financial surcharge in all levels (farming, transporting, storing, processing, logistical, control system…)
- GMO cultivation does not take into account ethical-philosophical-religious concerns.
- The suitable and geographically appropriately located storage capacity for grains in the country is considered inadequate to allow for coexistence. Grain handling installations do not have by design the proper structure to prevent mixing.
- Transport: delays and extra cleaning are also expected to add an extra cost but problems will remain minimal if procedures are followed.
- Feed traders consider that there would be significant benefits but there is a need for extra attention.
- Laboratories: more people would have to be employed, which would increase the cost of the final product (in the long term, costs could go down due to the economy of scaling up). People would need to be skilled and specialised. Time for analysis is expected to increase.
- Public administration: government will have to allocate funds and important resources in order to organize, policing, putting enforcement costs and quality control testing.

Economic context

- Risk of mono or oligo-polizing in the seed market.
- Could lead progressively to an increase in the size of farms and decrease the number of farmers and monoculture.

Agronomic sustainability

- In case of insect resistant plants, possible increase of secondary pests, target insects may express resistance to the compound produced by the GMO, GM plants may become susceptible to other pests. In all cases, increase of insecticide use will occur.

- In case of HT crops: possible increase of selection pressure for resistant weed biotypes and reinforcement of the use of broad spectrum herbicides.
- Possible irreversible adverse effects on biodiversity.
- Loss of traditional varieties and knowledge. Reducing diversity of cultivars may case problems such as higher susceptibility to plant diseases and pests.
- If GM plants pass their new traits on to wild relative, it could make these relatives play a different ecological role, possibly enabling them to out-compete other species.
- Insect resistant GMOs may reduce the number of phytophagous and pollen-feeding insects in the field, which could have an impact throughout the food chain.
- Peer-reviewed studies have demonstrated that the effect of Bt maize are far from predictable.
- Competitive trade advantage of GM cultures would damage biodiversity and result in degradation of bee feeding.
- Recent scientific work has shown that toxin Cry1Ab has negative effect on communication, learning capacity of bees and feeding collection capacity.
- Possible impact of GM plants on the environment can be summarized as follows:
  - Transfer of genetic material to sexually compatible plants in the wild;
  - Expression of pollen-mediated toxicity;
  - Effects on microbially-mediated biogeochemical cycles and soil biotransformation and decomposition processes on ecosystem function;
  - Increased persistence in the environment through increased survival, establishment and invasiveness of GM plants;
  - Adverse effects on non-target organisms;
  - Wider biodiversity implications as a consequence of specific agronomic practices to manage GM plants;
  - Changes in pesticide residues as a result of changed crop protection practices on/or metabolic changes in GM plants.
- Bt toxin may affect headwater stream ecosystems.

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Spain[1]

1. ABOUT SPAIN

- MON 810 cultivated since 1997 (76,057 ha in 2009)[2].
- Research activities: 165 field trials notified between 2002 and 2007 (cotton, grape/plum, carrizo citrange, maize, potato, rice, soybean, sugar beet, wheat)[3].
- No coexistence rules adopted[4].

2. GENERAL COMMENTS

- Spain welcomes the questionnaire, but considers that the collected data may be of limited value as only (Bt) maize is cultivated in Spain (20% of the total cultivated surface).

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Potential for EU research would be significant if GMOs were better accepted in the EU. However R&D on GMOs would affect research on conventional/minor crops, as multinational will not invest in this domain spontaneously. Access to technology by SMEs will be limited during the patent protection period, but afterwards much material would be available for research. For the public administration and researchers, the current lack of visibility on the evolution of the European legislation on GMOs and the lack of labelling on non GM techniques (e.g. molecular markers) discourages research in this domain.
- According to the research institutions, for provinces infested by corn-borers (Aragon, Cataluna), the benefit for the farmer is clear. An ex ante study estimated that, under high pest pressure, MON810 would increase yield by 11% (1.500 kg/ha) (Novillo et al., 2003).Also, another *ex ante* study under Spanish conditions proved that Bt-cotton would save 15,8 l/ha of insecticide and increase yield by 12% more than conventional cotton under 1998 conditions (Novillo et al., 1999).
- An *ex post* survey measured that the use of Bt-maize seeds in Spain resulted in gross margin increases from 3 to 135 € per hectare depending on the year and areas of cultivation (Gómez-Barbero et al, 2008).

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1 This compilation was prepared by the Commission on the basis of the information provided by Spain, and was validated by Spain.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- The growing surface planted in Spain –from 22.000 ha in 1998 to 76.000 ha in 2009[6]– after 12 years of local experience is a strong *ex post* indicator of higher farmer revenues.
- Seed prices are higher, but production costs decrease due to less inputs use and workload.
- In Spain selling prices of GM and non GM livestock maize are equivalent.
- For environment protection associations, GM crops increase the production price of conventional/organic crops, and negatively impact their market price when admixtures occur. Furthermore, GMOs do not have market advantage; they are mainly used for local/farm. These associations also maintain that GMOs require more chemicals than conventional crops.
- In Spain, there are no normative measures in place for co-existence, and according to public authorities/seed growers, with 12 years of experience in Bt maizes no problems have been reported so far thanks to appropriate good farming/co-existence practices.
- For environment protection associations, co-existence is of concern as there are no rules of compensations of cross contaminations. If co-existence management costs were integrated in the cost chain, levels of use of GMOs by farmers would drop.
- No problem of availability of GM/non GM seeds according to public authorities and innovators. Dependence to the seed industry is similar to conventional/hybrid seeds.
- No problem identified so far by the beekeepers.
- For public authorities and innovators, Bt maize harvests contain less mycotoxins.
- For public authorities and innovators, decreased use of/exposition to insecticides helps improving worker's health. The benefit would be less clear with Herbicide Tolerant (HT) crops: Glyphosate is less toxic for users, but exposure to pesticides can remain high as more herbicides can be used depending of farming practices.
- For public authorities and innovators, patenting of the crops and prohibition of plant breeder's right is not perceived as an additional constraint or as an additional risk on availability of non GM varieties, compared to hybrid crops. Furthermore, the European seed industry will loose competitiveness if it is not more involved in GMOs.
- If there is – still or growing – demand for non GM seeds/products, even in local markets, seed producers will have an interest in providing such products to the market place.
- Since there is no legislation in the EU concerning the presence of GM seeds in batches of conventional varieties, there is disparity in the criteria and measures taken by Member states; therefore, a 100% GMO free organic farming cannot be guaranteed.

Impacts on downstream operators

- For the administration, GMOs contribute to enlarge consumers' choice (GMOs, conventional, organic), decrease prices. Acceptance levels of Spaniards for GM food are among the highest of the EU (Eurobarometer 2005: 74%). However, consumers can be misled by the lack of explanation on the fact that GM labels are not risk indications, and by "eco activists" campaigns. Better information would help increasing acceptance levels.
- Environment protection associations consider that GMOs hinder the freedom of choice of consumer as labelling do not mention when livestock was fed with GMOs, there is no "GMO free" labelling and the legislation ignores long term health effects of GMOs.

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6 http://www.mapa.es/agricultura/pags/semillas/estadisticas/serie_maizgm98_06.pdf

- Cooperatives and food industry handling GM and non GM crops will have to cover relatively high costs of testing and segregation to guarantee the purity of their stocks.
- The prices of the organic products will increase due to the segregation measures and the difficulty to access to non GM seeds (*ex ante* assessment).
- Transport companies will have to face higher costs of segregation/cleaning. The future regulation on Low Level Presence (LLP) should even more increase these costs.
- Insurance companies do not propose GM specific products for the moment.
- Testing laboratories will perform more analysis with more staff, thus tests will be quicker and more efficient. Levels of tolerance threshold can influence the costs of the tests.
- For the moment, it is likely that costs of the controls required by disproportionate EU regulations may be higher than the financial benefit, therefore the net overall financial impact for the society is negative.

Economic context

- The divergence between MS on cultivation authorisation or LLP, despite the community authorisations, affects the internal market for goods. No identified impact on services.
- The high regulatory costs have left the GM traits market in the hands of few multinationals (for business, but also R&D capacity reasons), which could lead to oligopoly in the seed supply if the GM traits were not shared with other companies, i.e. hindering the internal market.

Agronomic sustainability

- The use of Bt maize in Spain resulted in a reduction of 0,54 insecticide applications per ha (Gomez Barbero et all, 2008).
- For the public administration, use of HT crops based on a single herbicide without proper stewardship could end-up in increase of herbicides use when weed resistance develops.
- For the public administration and the research institutions, no environmental impact should be expected since an assessment is performed at EU level. The 8 year experience of Spain with MON 810 shows that there is no risk. HT crops can have a positive impact when cultivated according to good farming practice. The impact of cultivation of GM crops should be put into the perspective of the modern cultivation practices, which can have harmful effects on the environment/biodiversity.
- For innovators and public administration, the impact of GMOs on renewable/non renewable resources should be positive as plants will need less water/rotations to reach similar yields than conventional plants. Furthermore, less needs in insecticides/herbicides means less production, transport and recycling of these agro-chemicals.
- Climate change: new GM traits could be more adapted to drier climate conditions.
- CO_2 emissions: benefit expected due to reduced transport and applications of pesticides, and simplified tillage operations.
- Recent studies for indicate that if EU farmers could use GM maize, cotton, soya oilseed rape and sugar beet varieties successfully used elsewhere, farmer margins would increase by between €443 and €929 million /year (Park, J., McFarlane, I., Phipps, R. and G. Ceddia, 2011. *New Biotechnology*).

- Plant biotechnology has an important role to play in helping to achieve the Millennium Development Goals (Yuan et al., 2011. Plant Cell Rep, 30: 249-265).

Other implications

- The balance of socio-economic implications may not be homogeneous for the different GMOs, for each GMO across the EU, or even within a Member State. It should be up to the individual farmers to decide case by case the convenience to choose among those GMOs with a positive Opinion on its cultivation by EFSA and Member State Authorities.

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Finland[1]

1. ABOUT FINLAND

- No cultivation of GMOs[2].
- Research activities on GMOs: 2 field trial notifications between 2002 and 2007[3].
- No coexistence rules adopted[4].

2. GENERAL COMMENTS

- The Finnish contribution is a compilation of answers received from the following stakeholders: MTT Agrifood Research Finland; Finnish union of organic farming (FUOF); Finnish beekeepers association; Finnish Food and Drink Industry Federation (FFDIF); Professor in Microbiology/University of Helsinki; Finnish Environment Institute (FEI), the Finnish Consumer's Association (FCA), the Seed Traders Association (STA), Finnish Forest Research Institute (FFRI), the Sugar Beet Research Centre Finland and professors of agro-ecology and plant breeding of the University of Helsinki.
- Answering to the questions considered challenging (only ex ante assumptions). The authorities asked the respondents to assess the potential impact of the first probable GM crops in Finland, i.e. potato and sugar beet.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Co-existence issues in the field of potatoes are minimal.
- Preventing the unintended spread of pollen and seed of GM plants is impossible. Possible contamination worries organic beekeepers. The legislation must ensure that the preconditions continue to exist for organic production. Beekeepers must have free access to information of places where GM-plants are grown.
- Conflicts with neighbouring farmers or other neighbours may arise.
- Bees' health and quality of honey can be affected by low nutritional value of GM pollen.
- Bees could go on non-food GM plants and pollen could be found in honey. All GM plants entering the market should be accepted for as human food.

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1 This compilation was prepared by the Commission on the basis of the information provided by Finland, and was validated by Finland.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- The competitive advantage of Finnish agriculture rests with GMO-free products.
- Cultivation of GM potatoes may concentrate production further. However, GM production may support the visibility of organic farming (status of an alternative mode of production)
- Plant breeders: new traits via GM in existing varieties may boost the use of certified seeds and breeding of new varieties. But limited access of conventional breeding companies may lead to a concentration of the business.
- GM cultivation could lead to narrow the range of varieties under cultivation.
- Additional challenge: to have enough farmers and acreage for seed production as a whole.
- Only a few plant-breeding organizations have had capacity to develop GM crops. Patenting has strengthened this trend. Revision of the criteria of patentability should be considered for broadening of the genetic base of crop varieties under cultivation.
- Biotechnology has made possible deeper analysis of plant genetic resources and their improved use for plant breeding.
- Investments in plant production research are likely to be increased. Focus should be on integrated approached to plant protection, funded by public funds.
- The availability of genetic resources for breeding is a prerequisite for Finland for all kind of breeding because it is not possible to use varieties used in other regions. Private seed companies may not develop appropriate varieties for Finland. Public research is necessary.

Impacts on downstream operators

- Impact on consumer choice if better quality and larger diversity of products. Consumers must have a chance to make an informed choice. Consumers need to get a clear benefit.
- Link between price, GM-characteristic of goods and propensity of consumers to buy them is not clear.
- Cooperatives, grain handling companies, transport companies: handling, storage, logistics can be a problem.
- Insurance companies: the fact that no insurance in the world has developed services for GM farmers shows that the risk is too high and fully unknown.
- Laboratories: controls will increase, thus unit price of analysis will decrease and quality of tests will increase.
- Public administration: need for national enforcement policy, new guidelines, additional labours and other implementation costs.

Economic context

- Decrease in autonomy of farmers may be a concern but should not over-estimated.
- Possible cross-border investments flows.
- If the requirements call for rotation, the farm's business becomes non-profitable.

Agronomic sustainability

- GM potato has potential to decrease the use of fungicides but risk of resistance is possible over time.
- There is an interest in the GM potato to reduce the production costs of seeds (losses due to viruses and mycosis are very high).
- There is a possibility to reduce the use of herbicides when cultivating HT sugar beet but the cultivation of HT rapeseed may increase the amount of herbicide used.
- 2 HT beets were tested[6] and demonstrate an economic benefit in using the HT version. The risks and benefits of the GM varieties could be considered. Benefits would be: more reliable and flexible weed control, use of glyphosate (considered to be a low risk herbicide), reduced use of tractor (less fuel use and soil compaction). Risks would be: disappearance of other herbicides from the market, accelerated appearance of HT weeds, HT gene moving to weedy relatives and causing a more problematic weed development, increase of the use of total mount of herbicides
- GMO sugar beet and other GM crops are valuable steps. It would be extremely important to make good evaluations for minimizing the environmental risk.
- HT sugarbeet would diminish the quantity of weeds, which are important for bees, butterflies, and used as feed by many birds.
- Impact of herbicides on ground waters.
- Crossbreeding between the GM potato and wild relatives is impossible.
- When cultivating HT crops, less biomass is produced which affects the biogeochemical cycle of soils.
- Cultivation of transgenic potatoes may hinder/complicate crop rotation and increase the demand for fertilisers produced with non-renewable resources.
- The efficiency of the use of field and forest biomass can be improved by plant breeding based on new genetic know-how and by boosting the efficiency of production processes. Agricultural production requires prevention of the environmental impacts of modern agricultural practices. GM crops have shown efficiency in the reduction of chemical loading and erosion of agricultural environments. Crop yields can also be improved.
- Warming may allow to cultivate rapeseed more northwards but could also increase variability of viruses.
- New 'more adapted varieties should be developed. GM techniques are likely to speed up selection programs.
- Organic agriculture would help improving the state of the Baltic sea. If GMOs are expanded, this potential will be lost.
- Transportation of GMOs is a risk for uncontrolled spreading and admixture. Very strict transport conditions are therefore necessary.

Other implications

- No answer.

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[6] 1998-2000

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by France[1]

1. ABOUT FRANCE

- Cultivation of Bt maize until 2007[2].
- Research activities on GMOs: 75 field trial notifications between 2002 and 2007[3].
- Coexistence legislative framework adopted[4].

2. GENERAL COMMENTS

- The French contribution consists in (1) an opinion of the High Council of Biotechnologies, consisting of an opinion of its scientific committee and a recommendation of its economic, ethical and social committee, (2) contributions by scientists from the National Institute of Research in Agronomy (INRA) and (3) contributions from 43 stakeholders.
- The format and methodology of the questionnaire was challenged by several respondents.
- The High Council for Biotechnologies made suggestions on the methodology and procedures to consider socio-economic factors in the process of evaluation and authorisation of GMOs.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Seeds producers and growers stress that GMOs are effective tools for farmers to better manage pest pressure and prepare to the forthcoming climate changes. If properly regulated, co-existence should not be problematic.
- For environmental associations and organic producers, co-existence is inefficient in most of regions, thus non-GM farmers have to set self-protection measures that impact negatively their production cost. Furthermore, the commercial value of their products can be devaluated in case of adventitious presence of GMOs.
- Environmental associations and organic producer stress that apiculture is at heart of the problem. Honey can contain GM pollen (with negative impact on the marketability of the

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1 This compilation was prepared by the Commission on the basis of the information provided by France, and was validated by France.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

products and by-products) and bees can be vectors of diffusion of GM pollen into non-GM crop fields.

- Environmental associations and organic producer consider that GMOs increase the dependence of farmers toward seed/agrochemical companies, and make impossible the practice of farm-saved seeds. However, conventional maize producers stress that GM crops growers are not more dependant than those cultivating conventional hybrids. Such dependence is the consequence of the political decisions taken at European and international levels.
- Insurance companies do not propose insurance schemes for adventitious presence of GMOs in non-GM harvests.
- For seed producers, when pest pressure is significant, farmers can increase revenues by using Bt crops (less field work/spreading, higher yields, better quality of the harvest). However conventional and organic farmers stress that the increasing price of GM seeds, associated to lower yields than announced by producers, can counterbalance these advantages. Furthermore, they consider that monoculture practice in Europe is the initial problem: with more annual rotations of cultures, pest pressure would be much lesser, thus conventional crops would remain efficient.
- In areas with GMOs, shared agricultural material will be more expensive or less available for all farmers, due to the higher cost and length of cleanings.
- As regards the cost of co-existence in general, reference is made to the study Coex1 by the Joint Research Center. Organic farmers and environmental association consider that all co-existence costs should be covered by the GMO growers ("polluter pays principle").
- Seed producers and the association of maize growers underline that, when pest pressure is high, Bt maize harvest contain significantly less mycotoxin than conventional maize. However, small and organic farmers stress that, even if the former is true, the mycotoxin rates in conventional crops remain much lower than European norms.
- Farmers feeding livestock with GMOs have never experienced animal health problems over the last ten years. They call for a better management of asynchronous authorisations of GMOs worldwide, to improve feed supply. Non-GM breeders highlight the difficulty to ensure proper GM-free feed supply as well, and the extra costs of the segregation measures, which cannot be valued unless a proper labelling exists.
- The seed industry declares that they will keep developing seeds for all markets, i.e. conventional, GM and organic. France being the second exporter of seeds worldwide, GM seeds should be grown locally, what would be possible if the maximum acceptable levels of adventitious presence of GMOs in conventional seeds are not too low.
- Farmers and environmental associations fear the development of patent protected events, which will increase legal uncertainty for farmers, who will have difficulties to know whether varieties they use are protected or not.
- Seed producers consider that farmers and downstream operators are already well acquainted with the management/segregation of separate varieties along the food chain. Inclusion of GMOs should not be a major issue if adventitious presence thresholds are not too low. However, COOP de France underlines that the stricter thresholds for GMOs are more challenging. Environment/organic associations consider that such segregation will generate unbearable extra-costs for the non-GM food chains and for consumers of non-GM food.

- Seed producers and maize growers regret that France lost all its R&D expertise (public and private) on GMOs in the last ten years (c.f. destruction of experimental cultivations). Consequently, young researchers are not attracted by biotechnologies, and France fully depends from innovations developed abroad.

Impacts on downstream operators

- Consumers, environment protection and conventional/organic producers associations claim that consumers do not see any added value in GM food. 72% of French consumers think it is important to be able to consume GM free food. 60% of French consumers consider that France should better develop its conventional agriculture rather than GMOs. (source: sondage CSA/Greenpeace of 30-31 January 2008)
- Clear labelling of food is important (GM food stuff and meat/milk from animals fed with GMOs). For 71% of French consumers, "GM free" must mean 0% of GMOs, and not 0.9%). (source: idem above)
- The increased cultivation of GMOs will have a qualitative and quantitative impact on the activity of testing laboratories.

Agronomic sustainability

- A micro-economic inquiry performed in 2008 in 8 farms by AGPM concluded that MON810 allows reducing the use of insecticides. Saving for farmers can be up to 93€/ha, depending of the number of applications.
- Environment and organic association contest the agronomic sustainability of GMOs over time, even if results could be positive in the first years. Furthermore, GMOs are associated to the intensive monoculture model, which agronomic sustainability is negative (fertilizers, over consumption of water).
- Seed producers consider that HT and Bt users can help limiting the use of renewable and non renewable resources (less tillage and spreading), and sequestration of greenhouse gas. Environment and organic associations consider that same or better results can be achieved thought improved cultivation practice of conventional crops.

Other implications

- Several respondents underline the need to address rapidly the challenge of world food crisis in the next 40 years. Increase of yields and more sustainable agriculture practices are quoted among the cornerstones to consider, though with diverging opinions on the potential role to be played by GMOs in this context.
- Several respondents consider that the questionnaire should have taken into account wider problematics, such as self-sufficiency in food or agricultural policy of the Member States and the European Union.

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Hungary[1]

1. ABOUT HUNGARY

- No cultivation of GMOs[2].
- Research activities on GMOs: 26 field trial notifications between 2002 and 2007[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- Only estimations of ex ante impacts are in the report, which are considered highly dependent of regional/national characteristics of where the GM cultivation takes place.
- Hungary considers that a new system of evaluation should be set up, inspired by Norway, where the impact assessment of a GM release should consider health, environment, benefit to society (in both the producing and the receiving countries) and promotion of sustainable development.
- The contribution contains two studies:
  - Economical impact of the introduction of GMOs into the Hungarian Agriculture (György Pataki, Réka Matolay);
  - Norwegian assessment guide: Sustainability, Benefit to the Community and Ethics in the Assessment of Genetically Modified Organisms: Implementation of the Concepts set out in Sections 1 and 10 of the Norwegian Gene Technology Act (The Norwegian Biotechnology Advisory Board).

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Surveys of farmers show negative opinion about the benefits of using GMOs.
- Cross-contaminations are unavoidable (cf international practices). Extra costs due to laboratory test for GMO contamination will increase production costs and tensions between farmers.
- Experience in Spain shows that organic agriculture has drastically decreased in regions of GMO cultivation. Biotech products do not have added value for consumers therefore

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1 This compilation was prepared by the Commission on the basis of the information provided by Hungary, and was validated by Hungary.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

support to organic agriculture seems to be more economically rational in terms of agricultural policy.

- Yields are not improved, according to international studies (including USDA 2006).
- International experience with GMOs shows advantageous effects for large scale farmers. However, increase of profitability cannot be unequivocally established or proved. The decrease of use of pest/weed control materials tend to reverse after 3 years (due to resistances), impacting the margin of the farmer's cost.
- Hungary is the second maize producer in Europe (food, feed and sowing seed), with 2/3 of its export. They get high premiums on the market due to their GMO free status.
- Use of GMO can lead to less labour needs. The local populations should be maintained by agriculture. The Hungarian family based model of agriculture should be preserved.
- Seed producers will have to set up segregation systems. Hungary wants to preserve its capacity to produce GM-free seeds (clear market advantage on the export market).
- GM seeds are more expensive and lead to loss of the farmer's privileges (re-plant, exchange of seeds), thus loss of incomes.
- Organic/conventional farmers will have to set up co-existence measures and perform purity tests.
- Co-existence implies establishing buffer zones. This is not possible in Hungary due to the land ownership characteristics: small plots, prominence of numerous small families.
- If adventitious presence is beyond 0,9%, prices of conventional/organic goods will drop. GMOs can decrease the profitability of farmers and industry using non GM materials.
- There is a need for a study on the impact of GMO cultivation on farmers' revenues, based exclusively on European data or estimations.
- Beekeepers are firmly opposed to GMOs as coexistence is inefficient (bees fly up to 6 km away).Furthermore, according to a Hungarian study (Békési, 2006) adverse effects have been shown on the chance of the larvae’s survival and the adult bees’ resistance to the *Nosema apis* microsporidian parasite.
- If large scale GMO cultivation is introduced, demand for conventional/organic seeds will decrease. Production of such seeds will also be more difficult (available land, buffer zones, etc), more costly and risky (marketing price in case of adventitious presence). Overall, loss of profitability of the whole conventional/organic sector, leading to its vanishing. Local and traditional varieties may disappear which also means that without customs the domestic plant breeding institutes will have difficulties to survive.
- The whole seed business would be concentrated in the hands of very few multinational seed companies. Hungary considers this as an "internal safety issue for the EU".

Impacts on downstream operators

- The majority of the consumers both in Europe and in Hungary, is not in favour of GM based foods.
- Cost of co-existence will impact marketing price and the profitability of the non GM sector.
- Cooperatives, grain handling companies: Co-existence will increase cost of handling/transport. It will be more difficult to produce GM free products.

- Transport companies: Segregation will make the process more complex and slower.
- GM promotes the model of integrated, monopolistic production and marketing.
- Insurance companies consider this field too risky, no products have been developed so far.
- Profits of laboratories will increase but they will face difficulties with stacked event GMOs.
- Independent research on risks is being hampered by obstructive behaviours of the industry, and difficulties to access research material due to patents.
- Public administration: management of co-existence measures and post market monitoring will increase costs for the administration (more expert knowledge and staff in controlling authorities). If contamination occurs, it generates extra costs due to national compensation found, or increased cases taken to Court.

Economic context

- Free movement of conventional/organic seed/food/feed will be hampered. This will also infringe the free choice of farmers, operators and end consumers.
- When assessing the impacts of the placing on the market of GMO seeds on the internal EU market, its implications on national economies of particular Member States – especially which are the significant producers in the affected sector – including Hungary should also be taken into account.
- Dependence of the EU market from few non European multinational has a negative impact on the European economy.
- In a context of export markets not accepting GM maizes, regions cultivating these crops suffer a decrease in the income of farmers and other economic actors. This leads to decrease in market shares and to a rise in production costs (segregation and identity preservation).
- Hungarian regions are not affected by the corn borer (so they have no interest in MON810 or similar Bt maize). Corn borer is not a significant pest, which only appears once in every ten years in the southern part of the country. Even in this case, maize can be protected against the pest by using traditional agricultural techniques.
- GM production requires intensive farming model. This deepens the dependence on high energy and resource use, leads to rising climate emissions, and concentrates the lands in fewer hands.
- GM production models require less workers (increase of unemployment).
- There is a high risk put on the regional biodiversity in Hungary, which is an important economic driver (number of GMO free regions is constantly rising in Hungary).

Agronomic sustainability

- No local experience, but international data demonstrates that GMOs lead to higher use of weed/pest control inputs.
- Introduction of GMOs endangers the agricultural and natural ecosystem. Hungary is one of the zones with high biodiversity in Europe, therefore does not accept to take any risk where consequences cannot be anticipated beforehand. It is well known that the European Union gained a significant environmental contribution with the accession of Hungary. A

price can basically not be put on the economic value of this asset, although it also appears in several sectors besides agriculture (for example, tourism).

- Several research publications showed that the MON810 GM maize could cause remarkable damages in the population of Peacock butterfly which is protected in Hungary.
- Extensive cultivation of uniform, high yielding crop varieties can cause the replacement and loss of traditional crop varieties.
- GMOs cultivated intensively are dependent on high energy and resources use. Therefore GM cannot be considered as a sustainable farming method. Furthermore, intensive agriculture affects the quality of soils, water and groundwater. Moreover, additional CO_2 gas emission can come from using crop protection products and/or artificial fertilizers, or tillage.
- Emerging of weeds tolerant to herbicides leads to more herbicides use (glyphosate and older chemicals).

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Ireland[1]

1. ABOUT IRELAND

- No cultivation of GMOs[2].
- Research activities: 1 notification between 2002 and 2007 (potato)[3].
- No coexistence rules[4].

2. GENERAL COMMENTS

- The Irish policy is based on the objective in the Renewed Programme for Government (October 2009) to declare the Republic of Ireland free from the cultivation of GM plants.
- Ireland would favour modification of the regulatory framework to allow Member States greater autonomy in decision-making on the cultivation of GM crops and the strengthening of environmental risk assessment procedures.
- A significant artisan food sector has emerged in recent years, in response to strong consumer demand for locally produced, hand-crafted food products.[5]
- The Irish contribution summarises the 53 comments received by the Department of the Environment, Heritage and Local Government. The submissions can be categorized as follows: academic R&D; agribusiness R&D; beekeeper; consumer; farmer; organic farmer; Government agency; industry representatives and interest groups/NGOs.
- The contributions indicate a predominantly negative attitude to GMOs among the public. A number of respondents felt that Ireland would benefit economically and socially by maintaining a GM free position and by marketing agricultural produce accordingly.
- The Environmental Protection Agency (EPA) suggested that EU Member States should include an assessment of socio-economic implications prior to a decision on GM crop for cultivation, as is the case in Norway.
- IGFA considers that it should be left to the normal working of the market to recognise and translate the socio-economic factors through supply and demand.
- The lack of inclusion of a stand-alone "human health" category was queried by several respondents, indicating a wish to see separate processes in terms of environmental risk assessment and health risk assessment, as part of the authorisation process.

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1 This compilation was prepared by the Commission on the basis of the information provided by Ireland, and was validated by Ireland.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 Food Harvest 2020: A Vision for Irish Agri-food and Fisheries, http://www.agriculture.ie/

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[6]

Economic and social implications

Impacts on upstream operators

- According to a study carried out by Teagasc[7], late blight potato is a major problem in Ireland (annual losses estimated at 15 million€ per annum). Currently, under Irish climatic conditions, in order to protect the potato crop, this pathogen requires as many as 14 fungicide applications during the planting season to ensure adequate protection. Net benefit to the grower using blight resistant GM potatoes has been estimated to be above 198€/ha.
- The study carried out by Teagasc also concluded that there might be a positive economic impact with little social impact if certain GM crops were cultivated by Irish farmers.
- Multiple respondents on behalf of farmers and the farming sector felt the current GMO model is of benefit primarily to very large-scale mono-culture type production and that this was not a model of production which would prove suitable for the Irish market.
- Most farmers and farmer representative groups are opposed to GM crops and feel that their business would be negatively impacted by GM cultivation. Respondents feel that GM-free status offered far more economic potential and would allow Irish farmers to access higher value markets. However some tillage farmers respondents feel limited by the current GMO policy while having to compete against imported GM products.
- According to the Irish Cattle and Sheep Farmers Association's, GM seeds are more expensive (Source: DG Agri, 2000).
- Organic farmers feel their business would be negatively impacted (coexistence, additional costs, damage to Ireland's organic strategy, lack of availability of GM-free feed.
- Beekeepers feel that consumer perception of Irish honey would be severely damaged if the end product was perceived to be GMO contaminated. Respondents query the legal protection available to beekeepers to protect against financial loss due to the reduced marketability of their product or for the establishment of beehives in GMO cultivation areas.
- Conventional and organic seeds: additional measures would be required to protect against GMO contamination and there would be increasing costs associated with the protection and certification of genetic purity of seed lines.
- The Agricultural Science Association noted that the glyphosate resistance of GMO crops increases the flexibility of timing and reduces the number of applications required. This could allow for increased labour flexibility.
- Cost of coexistence is difficult to quantify due to the lack of experience. Comments received suggest that it would seem appropriate that GM cultivators would bear responsibility for the cost of any co-existence measures.

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6 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

7 Flannery, M. et al, *An Economic Cost-Benefit Analysis of GM Crop Cultivation: An Irish Case Study*, AgBioForum, 2004, Vol. 7, No. 4, p. 149-157 http://www.gmoinfo.ie/index.php?option=com_content&task=view&id=76&Itemid

- When considering social aspects, most farmers focused on the problem of cross-contamination. ICSA in particular underlined that agricultural land use of Ireland and farming practices are not conducive with coexistence due to the interconnections of Irish agricultural systems. This could thus result in disputes between neighbouring farmers.
- The Agricultural Science Association believes that the issue of farmer training is critical in preventing widespread disharmony and is highlighted in the Irish coexistence guidelines. Training would be required for producers and also for their neighbours.
- The ICSA consider that, from a farmer's point of view, the implications of seed patenting is disturbing. The right to produce your own seed must not be undermined.

Impacts on downstream operators

- Several NGOs and consumer respondents argued that an increase in GM crops would have a negative impact on consumer choice, especially if coexistence is impossible.
- Where non-GM sources of soya and maize (used as animal feed) carry a significant price premium (Benbrook, 2009) this could mean that production of Irish livestock products is at a disadvantage relative to international competitors.
- The Irish Grain and Feed Association considers that all stakeholders in the feed/food chain must have equal access to the best available scientific technology.
- Public administration: checking compliance with legal regulations and additional administrative requirements will incur significant administrative expenditure.

Economic context

- The Irish Grain and Feed Association feels that the EU system favours the large players due to increased cost and complexity. This has discriminated against smaller indigenous players and fostered market dominance by the largest private seed companies.
- The Irish Grain and Feed Association considers that intellectual property rights are a corner stone of the EU competitiveness agenda and apply to all agricultural stakeholders.

Agronomic sustainability

- This question cannot be answered conclusively based on Irish data (no GMO cultivation).
- According to IGFA, it is the informed application of the correct agronomic practice for different conditions that deliver sustainability. No single technology can deliver alone.
- Farmers could use fewer chemicals (Spanish experience). The ongoing revision of the EU Plant Protection Products (PPP) legislation seeks at reducing PPP application rates. The use of blight resistant potatoes through traditional or GM breeding techniques may have to replace the use of PPP.
- The EPA refers to post market monitoring plans in Spain over a ten year period that concluded that no adverse effects on non-target arthropods or soil micro-organisms have been observed in relation to the use of Bt crops.
- HT crops: 1) Potential advantages: enhanced flexibility in weed control, use of less persistent herbicides and less frequently, facilitate low or no tillage cultural practices 2) Potential disadvantages: emergence of HT weeds populations (not linked to the GM characteristic), potential gene flow to related weed species.

- The herbicide programme used on GM oilseed rape and sugar beet had a negative effect on biodiversity (fewer weeds later in the season for organisms at higher trophic levels (e.g. farmland birds) compared to conventional management. This is not seen for HT maize.[8]
- GM varieties did not deplete the soil of weed seeds.[9]
- The EPA considers that Post Market Monitoring plans performed by the notifiers should be audited by authorities.
- Teagasc underlines that the adoption of HT crops must be completed with a weed management strategy.[10]
- Teagasc considers that GM crops relevant to Irish agriculture would not pose a risk to bee populations as the traits are not insect targeting. However, according to the Banner Beekeepers Association, in mono-crop areas, bees could have a poor diet.
- The Teagasc CINMa index has highlighted that the use of crops with increased nitrogen use efficiency would reduce nitrogen application by 40%, significantly reducing runoff into water and air.
- Bioremediation (use of GMOs to remove toxic pollutants from the environment) was cited as possibly having a positive environmental impact, based on international examples.
- The EPA and Teagasc underline that when cultivating HT crops, less weed biomass would be produced which could affect the biogeochemical cycles of soils. However, using GM blight resistant potato would decrease the number of PPP applications and thus the compaction of soil.
- The EPA considers that GM crops could have a positive impact on energy requirements and fuel consumption by using less fuel resulting from minimum tillage cultivation and lower amounts of Plant Protection Products applications
- The EPA considers that GMO technology could positively impact climate change via:
    - Carbon sequestration (reducing the amount of ploughing in conventional tillage).
    - Reduced fertilizer use and N_2O (nitrous oxide) green house gas emissions.
    - Produce crops to improve the climate impact of ruminants.
- Possible need for more specialized forms of transportation to avoid admixtures.

Other implications

8 The Farm Scale Evaluations; http://webarchive.nationalarchives.gov.uk/20080306073937/http://www.defra.gov.uk/environment/gm/fse/

9 Botanical and rotational implications of genetically modified herbicide tolerance in winter oilseed rape and sugar beet (BRIGHT Project); http://www.hgca.com

10 Hurley et al. (2010), Effects of Weed Resistance Concerns and Resistance Management Practices on the Value of Roundup Ready® Crops, Journal of Agrobiotechnology, Management and Economics, Vol.12, Article 5.

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Lithuania[1]

1. ABOUT LITHUANIA

- No GMO cultivation[2].
- No Research activities on GMOs.
- Coexistence rules adopted[3].

2. GENERAL COMMENTS

- The Ministry of Environment of Lithuania provided an extensive study on the socio-economic implication of GMOs which are authorised in Lithuania. In this document, two kinds of GM products were analysed: food and feed. The conclusions of this study are not directly relevant in the context of this exercise.
- The socio-economic implications of GMO cultivation were not analysed. Research on GM products in Lithuania is primarily focused on public opinion, labelling procedure and cultivation opportunities. There has been little research into the economic aspects of the use of these products on a national level.
- The study analyses:
    - The place of GMOs in the food and feed markets
    - The impact of GM food and feed on the social environment (in the EU and in Lithuania, controls, public attitude, attitude of business representatives)

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1 This compilation was prepared by the Commission on the basis of the information provided by Lithuania, and was validated by Lithuania.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: idem footnote 2

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Luxembourg[1]

1. ABOUT LUXEMBOURG

- No cultivation of GMOs[2].
- Research activities: information not available[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- Introductory statement in which Luxembourg supports the inclusion of socio-economic criteria in the authorisation procedure of GMOs at European level.
- Luxembourg does not grow GMOs, so they have no ex post experience to report, and in general they had difficulties answering the questions.
- Luxembourg welcomes the socio-economic criteria proposed by the Dutch COGEM. However, implementation details should be discussed at European level.
- Freedom of choice of farmers and consumers is an important socio-economic criterion. Farmers favour GMO free cultivation in Luxembourg, so co-existence measures are necessary, even though not always sufficient.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Farmers of Luxembourg have no economic interest to cultivate: Bt or HT GM are not useful; anticipated problems to market the harvest in a strongly anti-GMO market; Liability in case of adventitious presence of GMOs in conventional/organic seeds remains an issue.
- Yields and quality of the harvest are not expected to increase. GM crops prices are expected to be low due to the reluctance of the Luxemburguese market towards GMOs. Conventional crops should obtain a premium, however they are also at risk of being devaluated in case of adventitious presence of GMOs.

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1 This compilation was prepared by the Commission on the basis of the information provided by Luxembourg, and was validated by Luxembourg.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- Furthermore, co-existence measures will increase the production costs, hence impact the gross margin of farmers. Co-existence will also interfere with farming practice such as rotations. Thus cost of co-existence measures must be supported by the GMO growers.
- GMO growing might disturb the cooperation between farmers since it would no longer be possible to share machineries due to segregation needs.
- GMO seeds are more expensive, so probably they will not lower the production costs.
- Occurrences of GMOs will increase the cost of production of conventional and organic seeds due to co-existence measures and management of adventitious presence.
- The farm saved seeds are limited due to the patents linked to the GM crops.
- Organic farmers can be negatively impacted by adventitious contamination (loss of organic labels, organic premium) and costs of preventive measures (co-existence, controls, analysis)
- Co-existence measures are inefficient to protect beekeepers of GM contamination of the honey. Thus, the honey would be almost impossible to market. Beekeepers are particularly vulnerable regarding (voluntary and unintentional) dissemination of GMOs.
- The quality of harvest should increase for Bt maizes.
- Impact on health of workers is not demonstrated as reduction in agricultural toxic inputs is not obvious.
- Costs of alternative pest/weeds control programmes are well known, but no data are yet available on the cost of GMO resistance management.
- GMOs reinforce the concentration of the seed sector into few major actors, generating a loss of diversity, while sustainable agriculture needs a wide variety of seeds.
- The growing of GMOs risks to increase the cost of seed multiplying companies, seed producing farmers and seed distributors due to segregation measures (for GM, conventional and organic actors).

Impacts on downstream operators

- A large majority of consumers are opposed to GMOs.
- Segregation will increase costs for all actors of the food chain.
- Laboratory tests are already expensive due to inadequate testing methods and high costs of the reference materials. The increase of GMOs authorisation will increase testing costs.
- Public administration: if more authorisations are granted, public administrations will have to increase control measures.

Economic context

- More GM crops will lead to less diversity of varieties and species used by farmers, marketed by few major seed companies.

Agronomic sustainability

- No local data, but based on international studies Luxembourg denies the benefit of GMOs in term of reduction of agricultural inputs (even increase of pesticides use).

- Loss of diversity due to concentration of the seed industry, affecting negatively biodiversity, including animals (migration routes, ecological corridors). Furthermore, possible negative effect on non-target organisms.
- Current GMOs do not demonstrate clear-cut positive effect on use of renewable and non-renewable resources.
- Due to segregation measures, transport of agricultural raw material will increase.

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Latvia[1]

1. ABOUT LATVIA

- No GMO cultivation[2].
- Research activities: no field trial notification between 2002 and 2007[3].
- Coexistence rules have been adopted[4].

2. GENERAL COMMENTS

- LV Ministry of Agriculture funded a study in 2007 on "Economic evaluation on growing of GM crops in Latvia". Findings are spread in the contribution, following the questionnaire's categories.
- A public questionnaire "For or Against GMO in Latvia" was organized by the Ministry of Environment of Latvia during the period of December 10, 2008 – March 10, 2009. There were 37.440 respondents[5]:
  - 95% of all the respondents are against GMO cultivation;
  - 94% of all the respondents are against GMO ingredients in fodder;
  - 96% of all the respondents are against GMO ingredients in food;
  - 91% of all the respondents are for GMO free zone.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[6]

Economic and social implications

Impacts on upstream operators

- Cost of co-existence measures, theoretically calculated, would be high and would over costs the potential benefits of GM cultivation. Main reasons are:
  - small size of the fields
  - conflicts with neighbours and neighbouring countries would be unavoidable and serious
  - Insurance companies don't want to insure GM crops
  - less opportunities to sell the harvest due to labelling
  - high risk for beekeeping industry in case of GM rape seed crops
- Based in the above mentioned study, potential losses are linked to the following business activities (be it professional or amateur): organic farming, seed farming and seed

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1 This compilation was prepared by the Commission on the basis of the information provided by Latvia, and was validated by Latvia.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 total population of Latvia by Eurostat data at 1 January, 2009: 2.261.294 inhabitants

6 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

production centre for highest class of seeds (especially for cruciferous), beekeeping, rural tourism.

- Regarding the possible damages of GM crops, comparison is made with Heracleum sosnowskyi Manden.

Impacts on downstream operators

- Impact on consumer information and protection is mentioned.
- Potential impact on laboratories is mentioned, especially regarding the price of the analysis. If the number of GMO samples significantly increases, it will cause employment growth. This will imply more need for training and expensive new equipments.
- Seed testing laboratories, working on conventional seeds quality, would face additional costs to ensure purity and coexistence. Prices would increase.

Economic context

- So far, no impact of GM seeds on the seed market (less importance of GM seeds due to climatic conditions).
- Regarding the internal market for services, there could be an impact for State plant Protection Service involved in control and monitoring of coexistence conditions in Latvia.
- Following potential impacts are mentioned: farms' size, increasing monoculture, loss of reputation for other activities in the same region.
- Based on the 2007 research project, the largest losses are expected in the Vidzeme region (27,6%) and Kurzeme region (26,2%). In these regions, the expected losses exceed 50% of all potential losses in organic farming in the country, which may result from uncontrolled spread of GM products.

Agronomic sustainability

- There is no GMO cultivation, so no impact on the agricultural inputs. Thought theoretical impacts are mentioned in some cases (potential to reduce use of pesticides or/and patterns of use of chemical herbicides.
- Potential impacts on biodiversity are mentioned for number of agriculture species/varieties, agriculture diversity, protected or endangered species and their habitats, ecologically sensitive areas, migration route, ecological corridors, buffer zones, flora, fauna and landscapes.
- Latvia is considered as one of the richest European countries regarding biodiversity resources. GMO cultivation may have negative impact on biodiversity.

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Malta[1]

1. ABOUT MALTA

- No GMO cultivation[2]
- No Research activities on GMOs[3]
- coexistence rules: no information available[4]

2. GENERAL COMMENTS

- Maltese authorities envisage that, should GMO cultivation take place, a number of socio-economic impacts would occur, most notably affecting the agronomic sector.
- Maltese agriculture is quality oriented. Government and private sector are engaged in efforts and initiatives (including funding) that promote and encourage quality schemes including organic production.
- It is recognised that GMO cultivation would jeopardise these investments due to the fact that it is very difficult to apply co-existence measures in the context of the Maltese agricultural landscapes (intensive and mixed cropping, small-scale agriculture, high density of fields in close proximity).

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- In general and as a result of targeted consultations on the subject, the public and relevant stakeholders have repeatedly expressed their opinion that Malta should remain GMO-free.
- Extensive consultation would need to be carried out with the relevant stakeholders on the envisaged impact of GMO cultivation and, therefore, Malta is not in a position to provide any feedback at this stage.

Impacts on downstream operators

- Extensive consultation would need to be carried out with the relevant stakeholders on the envisaged impact of GMO cultivation and, therefore, Malta is not in a position to provide any feedback at this stage.

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1 This compilation was prepared by the Commission on the basis of the information provided by Malta, and was validated by Malta.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

Economic context

- Specific regions and sectors: see general comments.

Agronomic sustainability

- EU-approved GMOs for cultivation are MON810 maize and Amflora potato. Maize is not viable in Malta (lack of water) and there is no maize relative. However, EU-approved GMOs which do not have approval for cultivation may have an impact on non-agricultural species/varieties. Authorisation of GM oilseed rape could compromise the wild genetic pool of Brassicaceae (22 varieties of Brassicaceae, most of which are found in the wild and have a flowering period with overlaps with GM oilseed rape).
- GM crops are an intensive monoculture system with no tillage and no crop rotation; therefore agriculture diversity would decrease considerably in an area.
- The Maltese islands have 46 national and international ecologically sensitive areas dispersed in a territory of 316 km^2. GMO cultivation would be either in or in the vicinity of one of these areas. Therefore an impact on protected fauna or wild flora would be inevitable (hybridisation with wild stock, increase herbicide use, degree of monoculture, decrease in crop rotation, in tillage).
- Maltese landscapes are known for their colourful nature due to the fact that fields are mostly less than one hectare and surrounded by rubble walls to reduce erosion and mark field boarders.
- Thus multiple ownerships occur in a large agricultural area unlike in the rest of Europe where such a large area would be owned by a single farmer. The colours mentioned earlier are made up of the variety of crops that would be found in a multiple owned area (farmers growing different crops). If GMO cultivation would take place, to be viable, farmers would have to grow the same crop (with the farmers on the borders growing refuge plants). This would destroy the landscape and biodiversity and affect the flora and fauna of the area.
- Considering renewable and non renewable resources, climate, transport and use of energy, extensive consultations would need to be carried out with the relevant stakeholders on the envisaged impact of GMO cultivation and, therefore, Malta is not in a position to provide any feedback at this stage.

Other implications

- No Answer.

Socio-economic implications of GMO cultivation Non exhaustive compilation of the contribution by the Netherlands[1]

1. ABOUT THE NETHERLANDS

- No cultivation of GMOs[2]
- Research activities on GMOS[3]: 59 notifications between 2003 and 2007 (carnation, potato, apple, maize).
- Coexistence rules adopted[4]

2. GENERAL COMMENTS

- NL answer consists in (1) a filled in questionnaire, (2) a report by the advisory committee on GMO (COGEM) on socio economic aspects of GMOs, (3) a report by the agricultural economic institute (LEI) on economic effects of the EU GMO policy.
- COGEM report: COGEM was requested to draw up socio-economic criteria for the application of GMOs in agriculture, including sustainability aspects. COGEM considers that sustainability relates to social, economic and environmental aspects. It is not a static concept, but a dynamic one, which depends of the context (e.g. society, culture and religion), time, knowledge, technological capabilities, etc.
- Using conventional agriculture as a frame of reference, COGEM suggests the following nine criteria as "building blocks" for an assessment framework on the socio-economic and sustainability aspects of GMOs:
  1. Benefit to society - increase in yields, harvest security and other forms of general benefit to the society;
  2. Economics and prosperity - contribution/improvement of local and overall prosperity and of the economy;
  3. Health and welfare – preserve/improve, for workers, the local population and consumers;
  4. Local and general food supply;
  5. Cultural heritage – if desired, specific elements of cultural heritage or local customs should be preserved;
  6. Freedom of choice – both consumers and producers should be able to choose between GMO and GMO-free products;
  7. Safety – in terms of both personal health and the environment;

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1 This compilation was prepared by the Commission on the basis of the information provided by the Netherlands, and was validated by the Netherlands.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: information provided by the Ministerie van Economische Zaken, Landbouw en Innovatie of the Netherlands.

8. Biodiversity - does not **a)** lead to a reduction in the agro-biodiversity of the agricultural environment and where possible strengthens it, and **b)** damage protected or vulnerable biodiversity;

9. Environmental quality - The production and processing of GM crops means that **a)** the quality of the soil, surface water and groundwater, and air, does not deteriorate and, where possible, is improved and **b)** the emission of greenhouse gases along the entire chain (development, production, processing and transport) remains neutral or declines relative to conventional agriculture.

- Several elements are already part of existing European assessment/regulatory frameworks (e.g. environmental quality, freedom of choice). Therefore, the criteria relevant for socio-economic evaluation of cultivation of GM crops in Europe that are not yet existent are: (1) Benefit to society, (2) economics and prosperity, (3) Cultural heritage. COGEM notes that for the operationalization of the criteria it would be desirable that the indicators used to measure the criteria: a) are objectively measurable, and b) can be estimated in advance. Such indicators are not yet readily available for all criteria.
- In an accompanying letter, the Dutch authorities indicate that it is important that when considering cultivation of genetically modified crops in the EU Member States, these three themes, which cannot be assessed on the basis of the current regulations, can be taken into account. By giving Member States the possibility to decide on cultivation of GMOs on their own territory, Member States can gain experience on these themes, if they so wish. To be able to apply the criteria in practice, objectifiable and measurable indicators must be developed for use with these criteria. Furthermore, WTO compliance is important.
- The COGEM report also points out that all 9 criteria are relevant for cultivation outside Europe followed by import into Europe. However, COGEM indicated that, in view of trade relations, as well as politically and legally, it is much more complex to draw up an assessment framework for sustainability of import than for cultivation in the EU.
- COGEM also notes that the introduction of an assessment of the sustainability aspects of GM crops could raise questions concerning the sustainability of certain conventional crops and cultivation methods which at present, are not assessed in this way. COGEM points out that the rejection of a GM crop on the basis of socio-economic arguments, while these equally apply to conventional crops that are not subject to such criteria, could be met with incomprehension.
- The report by the Agricultural economic institute (LEI) on economic effects of the EU GMO policy concludes that asynchronous EU approval of GM crops coupled with the operation of a zero tolerance threshold for the presence of GMOs not yet approved in the EU causes trade disruptions. This problem will increase with the more widespread cultivation of GMOs outside the EU and can damage the competitive position of European industry and lead to loss of employment.
- "GMOs in European Agriculture and Food production", report of the conference organised in The Hague (25-26 Nov 2009).

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- NL has no experience in cultivation of GMOs: only ex-ante estimations of the socio-economic consequences of GMOs. In the future farmers could be interested by GM potatoes (Amflora and another multiple fungi resistant trait currently developed).
- Several studies conclude that socio-eco aspects of gm crops should be assessed on a case by case basis, taking into account the specific characteristics of the GMO event, but also aspects like the cropping system, use of good farming practice or the climate or region where the cultivation takes place.
- GM, conventional and organic growers already agreed on co-existence measures, which will be formalised by the Dutch product board for arable products. Co-existence measures are of vital importance to avoid economic damages for the non GM producers.
- Seed industry: experience with imports show high costs for checking potential adventitious presence of GMOs in seeds and segregating distribution lines.

Impacts on downstream operators

- There is no GMO cultivation so no impact.
- For food containing GMOs, EU labelling requirements guarantee freedom of choice for consumers.
- If GMOs come to the market, limited extra administrative requirements to be expected: obligation for the farmer to register the place of cultivation and for the industry to register which GMO will be processed and when (by using existing traceability systems).
- Furthermore, measures will be necessary to avoid mixture of GMOs and non GM commodities during storage, transport or processing.
- No GMO specific insurance product for the moment.
- Laboratories: no current experience, but future development would result in an increase in demand of GMO analysis.
- Innovation and research: no or very few research in GMOs by public players in NL. SMEs are discouraged by the very high development/authorisation costs.
- Difference in definition of GMO between the EU and the USA is mentioned as a source of legal uncertainty, hence decrease in investment and development of new seeds which stunts innovation and can negatively impact progress in the field of sustainability. Seed producers would need more clarity on the status of new breeding techniques.
- Public administration: no costs related to cultivation for the moment. Focus on contained use, field trials and imported GMOs.

[5] For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

Economic context

- No impact observed on the internal market as no cultivation for the moment.

Agronomic sustainability

- Since there is no commercial cultivation of GMOs in the Netherlands, there are no observed impacts in the Netherlands on the mentioned topics.
- As regards climate change, possible future cultivation of GM potatoes could lead to cheaper and more environmentally friendly starch production.

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Portugal[1]

1. ABOUT PORTUGAL

- Cultivation of MON810 Maize (4851 ha in 2008)[2].
- Research activities on GMOs: 11 field trials notified between 2002 and 2007 (Maize)[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- Portugal received 14 answers to the questionnaire (Public administration, farmers, seed industry, consumers, cooperatives and grain handling companies, food and feed industry, insurance companies). These answers were sent as such to the Commission.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Farmers cultivating GM maize report in average an improvement of the productivity, even if pest pressure is limited. Lower use of pesticides allows smaller exposure of workers to chemicals, larger flexibility of operators in other tasks.
- Farmers cultivating GM maize do not report neighbourhood conflicts after 6 years of cultivation, and segregation of harvests to maintain their integrity has been set up without major difficulties. For farm structure, especially in regions of small farms, farmers have adopted the culture of the "production areas" which is under the current legislation. However this solution is extremely complicated to administer, although being the only solution to the cultivation of GM corn in certain areas.
- Organic farmers, although not having yet experienced neighbouring with GM fields, are concerned by the risk of conflicts when this will happen. Furthermore, they claim for strict coexistence rules, and effective compensation schemes in case of contamination of fields/harvests. Furthermore, the farm-saved seeds practice should be preserved.
- According to the association of farmers (ANPROMIS), the cultivation of corn varieties containing the MON810 event can be justified only in areas where traditionally there are attacks from corn borers.

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1 This compilation was prepared by the Commission on the basis of the information provided by Portugal, and was validated by Portugal.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- The Ministry of Agriculture (DGADR) mentioned that the cultivation of BT maize only represents around 3,8% of the total maize area. In Portugal farmers who wish to cultivate GM maize must fulfil with national coexistence legislation that includes the following obligations: participate in specific training courses, register the cultivation parcel, inform by written notification about their intent to cultivate GMO, apply measures of coexistence, among others. As mentioned before there is coexistence legislation in place in Portugal. According to this legislation the Agricultural central and regional services have performed inspection and controls activities, with no additional costs to the GM growers.
- The seed industry referred to international studies to contribute to the questionnaire. As regards Portugal specifically, over the period 2005-2007, yields would have increased by 12,5%, ensuring in 2007 a net increase in gross margin of 143,94$/ha, and an impact of farm income at national level of 610.000$ (source: Brookes 2008).
- According to organic farmers, in the Alentejo regions part of the farmers cultivating GMOs left this production due to lack of interest.
- Farmers cultivating GM maize and the Ministry of Agriculture report that GM and non GM crops are sold the same price, and that there are no particular difficulties to market the products. However, GM seeds are more expensive.
- The feed and meat sector would gain competitiveness, as GM crops could make Portugal produce more corn and be less dependent on third countries.
- Control and monitoring program made by the Ministry of Agriculture (284 farmers inspected in the last 5 years). Main outcomes are: better quality of the harvest (less mycotoxin), increased production, reduction of insecticide use (including less exposure of rural workers), and higher cost of the seeds. Globally, the economic balance is considered positive.
- According to the Ministry of Agriculture, there are no direct impacts on other production systems (organic, conventional, beekeeping).
- Creation of GM production zones, which are the results of voluntary associations of farmers (cf. coexistence rules, all the production will be labelled as containing GM varieties).

Impacts on downstream operators

- The Portuguese market would be adaptable to handle GM and conventional grains. Grain handling companies have been able to opt to be suppliers of GM labelled grains, non-GM labelled grains or both of them, through grain segregation when necessary.
- No impact on consumer choice, information and protection is expected.
- Grain handling companies would face additional costs for handling, storage, administrative requirements and traceability. Segregation at port discharge and warehouse storage level between GMOs and non-GM cereals increases the costs more than 50%.
- Public administration: enforcement and implementation of legal provisions require the implementation of monitoring and control programs and the availability of specialized experts and laboratory infrastructures (financial implications).

Agronomic sustainability

- Organic farmers are concerned by the risk of developing resistance to the Bt toxin, as they have a very limited choice of pesticides that they can use.

- Environmental benefits: less use of pesticides namely insecticides.

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Romania[1]

1. ABOUT ROMANIA

- Cultivation of GMO since 2007 when Romania joined the EU: 7146 ha of maize MON810 in 2008[2] and 3243 ha of maize MON810 in 2009. Romanian farmers cultivated GM soybean line MON 40-3-2 between 1999 and 2006.
- Research activities on GMOs: 42 field trial authorizations between 2007 - 2009[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- The contribution contains inputs from the Ministry of Agriculture and Rural Development, the National Authority for Consumers Protection, the National Environmental Guard, the National Sanitary Veterinary and Food Safety Authority, the Public Health Institute Bucharest, Monsanto Romania, Pioneer Hi-Breed Romania, Syngenta Agro SRL and Europabio. Despite the fact that many NGOs are strongly involved in this issue, they did not send any contribution.
- The Romanian authorities stressed the following: *"We can say that overall, this is not a relevant and/or balanced position for Romania to reflect the opinion on socio-economic advantages and disadvantages of each category of GMOs authorized, more like an opinion of GM industry and of the authorities mentioned above."*

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

Impact underlined by the control authority:

- Conflicts between farmers and between farmers and neighbours.

Impacts revealed by the companies acting in the field of GMOs (no answer from other stakeholders):

- Main impacts of GMOs: increased labour flexibility, lowers production cost (saving time, energy, insecticides), increased income, better quality of the harvest (no production losses

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1 This compilation was prepared by the Commission on the basis of the information provided by Romania, and was validated by Romania.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

due to insects attack, less mycotoxins and less pesticides residues), improved health and safety for farmers (reduced use of insecticides).

- GM, conventional and organic growers of maize have co-existed (with good farming and co-existence practices).

Impact on downstream operators

Impact underlined by the control authorities:

Public administration:

- carrying out inspections to the GMO cultivators and users in order to check the way there respect the regulations on protection of the environment (National Environmental Guard);
- official control of traceability and labelling of GM food and feed include significant number of qualitative and quantitative analysis and a number of samples to be taken by official inspectors (National Sanitary Veterinary and Food Safety Authority);
- The costs are supported from the state budget.

Impacts revealed by the companies acting in the field of GMOs and public authority for environmental protection:

- No impact on insurance mechanisms in Romania, as there is no such a product developed by the insurance companies.

Economic context

- Respondents concluded that the placing on the market of GMO seeds has an impact on the internal market. This issue is to be assessed.

Agronomic sustainability

Impacts underlined by the control authorities:

- Contradictory answers on the impact on the number of non agriculture species/varieties and on agriculture diversity, due to the different results of the specific studies on agricultural biodiversity made by the Ministry of Agriculture and Rural Development and the on-site observations of the National Environmental Guard.
- No impact on the use of pesticides against target insect pests.
- No negative effects on migration routes, ecological corridors, buffer zones.

Impacts revealed by the companies acting in the field of GMOs:

- Reduction of greenhouse gas emissions.

Other implications

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Sweden[1]

1. ABOUT SWEDEN

- GMO cultivation: Amflora potato[2].
- Research activities on GMOs: 24 notifications between 2002 and 2007 (Apple/pear; Arabidopsis thaliana; linseed/flax; maize; oilseed rape, poplar, potato, sugar beet)[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- The contribution is constituted of a general statement and answers to the questionnaire. It elaborated with the input of the 118 stakeholders. The answers to the questionnaire are exclusively ex ante answers, based on stakeholder's input and review of the literature.
- The Swedish authorities state that the European regulatory framework allows for socioeconomic considerations to be taken into account on a case-by-case basis but consider that a general application of these criteria is unlikely to make the process easier, more consistent or foreseeable. Transparency of the decision process may also be negatively affected.
- The regulatory framework should be based on sound science and precautionary principle. The scientific evaluation of the safety of the GMO must not be compromised.
- A balancing act between the interests of different agricultural sector in the EU is considered to be politically very complicated and costly.
- Compliance with EU regulation and WTO should be taken into consideration if socio-economic considerations are to be taken within the EU-process. Indirect socio-economic effects on developing countries need to be considered.
- A free choice for farmers and consumers to choose conventional, GM or organic products alike is an important guiding principle for Sweden.

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1 This compilation was prepared by the Commission on the basis of the information provided by Sweden, and was validated by Sweden.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Decision to plant GM crops pertains to the farmer, who will assess its impact. Factors to consider are variation of biotic and abiotic challenges (climate, pest/weed pressure); cost of seeds; cost of biocides.
- Farmers could benefit from use of GMO crops through the more secure and sometimes higher yields that has been demonstrated. The profitability for the farmers depends on the natural variation of biotic and abiotic challenges of the year as well as the cost of seed compared to the cost of the pesticides replaced.
- The benefits of the potato late blight resistant are highlighted: less need for pesticides.
- Analysis done by the Swedish Agricultural Board anticipates higher profit for farmers using GM rapeseed, maize, potato and sugarbeet (decrease of use of chemicals). For rapeseed, arbitration should be made between mechanical weed control (high carbon foot print) and chemical weed control (associated with HT rapeseed).
- It is likely to have a price premium for non-GM crops. However, experience in Spain (maize) and worldwide (rapeseed) show that this is not always the case. Canadian GM rapeseed is sold at higher price than conventional because it contains fewer weeds.
- GMO patenting model prohibits the cultivation of farm saved seeds (which is otherwise possible in the EU under certain conditions). This can be seen as negative and costly for farmers. From the Competent Authority's perspective, this is good as all products must be withdrawn from the market when the authorisation expires.
- Organic farming: Problematic to maintain the zero tolerance regarding GMOs, risk to loose the organic certification and price premium. Price controls/inspections may increase.
- Beekeepers: Honey will contain GM pollen and there is some legal uncertainty concerning this.
- Use of insect resistant seeds demonstrated less mycotoxin quantities in harvests, what benefits both farmers and consumers, and possibly less pesticides residues. However, it may be of economic interest to cultivate corn instead of pasture, which would increase the use of pesticides all in all.
- Three Swedish authorities pointed out that growing glyphosate tolerant crops (sugar beets, oilseed rape and corn) has possible positive effects on health because more dangerous substances are replaced by a lesser dangerous one (Jordbruksverket 2007).
- Swedish seed industry is relatively small and is integrated to multinationals. This industry is hindered by the lack of a threshold for adventitious presence of GM seeds in seed lots.

[5] For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

Impacts on downstream operators

- Consumers have a negative attitude towards GMOs[6]. There is a perceived high willingness to pay for GM-free products according to a multiyear survey between 2001-2007 in Stockholm. However, a study on actual purchase of strawberries showed that at a lower price, consumers are willing to buy GM-strawberries if not treated with pesticides. Another Nordic study shows that acceptance of GMOs can be influenced by fat content and taste[7]. A general survey on attitude showed that gene technology is welcomed when impacting allergies and reducing the use of chemicals in agriculture.
- Cooperatives and grain handling companies: labelling and traceability of GM-food incur costs. Costs of keeping production lines separated are only sustainable for large quantities.
- Most of feed companies are GM free, due to policies of farmers and food industries. All food industries except pork industry have voluntary GM exclusion policies in place.
- Food and feed industry: soy is the most impacted (Sweden is dependent on imports for feed). As GM-soy cultivation increases worldwide, GM-free soy prices increase and choice decreases. Furthermore, due to asynchronous approvals, there will be a price premium for EU-authorised GMO soy compared to GM soy not authorised.
- Transport companies: avoiding adventitious presence implies high segregation costs.
- So far no insurance company has proposed a product targeted on GMO cultivation. However some companies have exempted damages on biological diversity from their agricultural liability insurances. No information on existence of insurances for organic farmers who lost organic label. The "Tort" liability act is applicable for economic damages suffered by farmers due to GMO cultivation.
- Research is more and more done outside the EU because of opposition to GMOs. The cost for development, patent protection and authorisation of GMOs can only be afforded by major breeding companies. Moreover, future decision on what falls into the GMO regulatory framework will have a large impact on research and innovation.
- Public administration: 10 agencies are involved in GMOs but current cost was not assessed. If GMO cultivation increases, cost would increase for administration and information to the public.

Economic context

- Sweden highlights the worldwide competition context with third countries having more relaxed approaches on GMOs, hence contributing to impact negatively the competitiveness of the EU agricultural sector (e.g. asynchronous approvals).
- GMO market is monopolistic but no difference with the current seed market.
- If socio-economic criteria are introduced in the regulatory framework, it could hinder internal market by having different national criteria applied.
- In regions with traditional/small scale production, GM-crops are assumed to have negative effect on brands and image.

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6 72% - Eurobarometer 2008

7 Study on cheese: Lähteenmäki, et al. 2002

Agronomic sustainability

- The assessment of agronomic sustainability and negative impacts on the environment are dealt with in the risk assessment of GMOs, according to the current legislation.
- Agricultural input: effects on the use of pesticides, crop growing patterns, fertilizers, tilling, water needs should be analysed for an estimation of input.
- Impact on biodiversity will depend on crop and trait and there is no general science based information on how Sweden's biodiversity could be impacted.
- Impact on renewable and non renewable resources is difficult to estimate. The current GM crops will not be cultivated on a large scale in Sweden. The potential of the next generation may be higher such as vegetable oil for technical use or plastics.
- CO_2 emissions of the Swedish farming sector represent 12% of the total CO_2 equivalent emissions. Technologies that could change the tilling practice and the soil microflora may positively impact the field capacity to act as a carbon sink (more research is needed). Crops designed to improve the climate impact of ruminants are of interest.

Other implications

- No Answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Slovenia[1]

1. ABOUT SLOVENIA

- No cultivation of GMOs[2].
- No research activities on GMOs[3] related to plants.
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- Answer elaborated with the input of the 39 stakeholders consulted (NGOs, associations, industry, insurance companies, institutes, faculties, and government)
- Regarding the discussion on socio-economic criteria, reference is made to the work done by COGEM. The presented themes and associated criteria amongst others could serve as starting point for discussion in the EU.
- No cultivations of GMOs in Slovenia, so the answers are assumptions, based on stakeholders' input and review of the literature.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- Prices and yields could be impacted. Possibly: higher yield, higher input prices, possible loss of income in the "organic" farming sector and potentially also in "conventional".
- Possible impact on farmers' production costs: reduction of costs by reduction of pesticide use and consumption of fuel, increase of costs because of higher input prices.
- Possible impact on labour flexibility: increased flexibility and labour saving.
- Quality of the harvest: improvement of the grains quality from reductions in the levels of mycotoxin, no GMOs with improved nutritional values (whereas organic grown fruits and vegetables are richer in beneficial components).
- Possible appearance of resistant weeds in case of cultivation of HT crops which could imply an increase of the amounts and the toxicity of herbicides used.
- Prices discrimination between GM and non GM products can be expected.

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1 This compilation was prepared by the Commission on the basis of the information provided by Slovenia, and was validated by Slovenia.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

- Farmers should have possibility to choose their type of production.
- Contamination of non-GM crops could hinder farmer's privilege to use farm saved seeds.
- Farming practice (incl. co-existence measures): Lend holding and parcel structure are exceptionally dispersed and fragmented. Hence high risk of cross contamination, with consequences on liability and marketability of the harvested products (in particular organic products).
- Coexistence measures are not yet applied in practice. A compensation fund is envisaged, and it will be filled with special fees for unintentional presence of GM crops in other products.
- Considerable conflicts between neighbouring farmers are anticipated because land ownership is highly fragmented. The legislation envisages an agreement among neighbouring farmers with the GM crop production.
- Freedom of choice for consumers should be respected.
- Farmers' training is foreseen in the coexistence legislation (for GM farmers).
- Beekeeping is an old tradition, beekeepers are sceptical on coexistence, marketability of contaminated honey could be jeopardized.
- Long tradition of seed production, almost self sufficient for cereal seeds but not for maize and rapeseed. A priori, production of GMO would not be interesting for SL producers, who are too small to cope with the constraints related to GMO, in particular isolation distances, separate mechanisation for cultivation, transport and storage.
- More controls would be necessary on conventional seeds to ensure absence of cross contamination.

Impacts on downstream operators

- Consumers advocate for non GM products, freedom of choice must be preserved.
- Food and feed industries, transport companies must design their production process to allow segregation and traceability between GM and Non GM.
- Laboratories: the cost of monitoring would increase due to coexistence measures and need for constant improving or introduction of new detection methods.
- Innovation and research: no experience. However, it is presumed that investment would increase if the attitudes towards GMOs were more relaxed amongst Europeans. On the other hand, absence of GMO could stimulate research investment in conventional practices.
- Public administration: costs would rise up (management of the authorisations, co-existence and possible registration of GMO free areas, compensation fund, research projects…)

Economic context

- No experience, but increased demand for agriculture inspection should happen.
- Possible impact on the size of the farms, production practices, influence on reputation of regions.

Agronomic sustainability

- Agricultural inputs: lack of experience.
- Lack of experience on impact on biodiversity. However, possible crossing appearance of GM crop-wild hybrids which may become agricultural weeds and compromise weed management system and invade natural habitats, changing their biodiversity value and replace wild genes (genetic assimilation) and reduce diversity of recipient population. Lower fitness of these plants may drive wild population to extinction (demographic swamping). Contrary higher fitness may lead to increased invasiveness replacing wild populations and other species, while gene flow from GM crops may contaminate seed pools and reduce seed quality to be expected.
- No Answer
- GMOs could help lowering level of greenhouse gas emission (reduction of fuel consumption, use of no-till and reduced-till farming systems).

Other implications

- No Answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by Slovakia[1]

1. ABOUT SLOVAKIA

- Cultivates MON810 Maize since 2006 (875 ha in 2009)[2].
- Research activities: 1 notification for field trials between 2002 and 2007[3].
- Coexistence rules adopted[4].

2. GENERAL COMMENTS

- The exercise of data collection is considered important by the authorities.
- Difficulties to answer due to the limited experience of Slovakia with GMO cultivation.
- No study on socio-economic impact has been performed so far. However, two impacting elements could already be identified:

  - Obligation of labelling generates more expenses for each product produced from GMOs, and the consumers will not buy the product.

  - Some processing companies have very low adventitious presence thresholds (0.02%), so conventional producers near to GMOs fields have problems to sell.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

- No answer

Impacts on downstream operators

- No answer

Economic context

- No answer

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1 This compilation was prepared by the Commission on the basis of the information provided by Slovakia, and was validated by Slovakia.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

5 For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

Agronomic sustainability

- No answer

Other implications

- No answer

Socio-economic implications of GMO cultivation
Non exhaustive compilation of the contribution by United Kingdom[1]

1. ABOUT THE UNITED KINGDOM

- No cultivation of GMOs[2].
- Research activities: 6 field trial notifications between 2002 and 2007[3].
- No coexistence rules adopted[4].
- The Government has changed since the contribution was sent. UK agreed to transmit their contribution in the context of a request for access to document, on the condition that a disclaimer makes clear that the contribution represents the views of the previous Government.

2. GENERAL COMMENTS

- General statement by the authorities of the United Kingdom:
  - GM applications should be assessed case by case based on the scientific evidence, then the normal operation of the market decides whether a GMO is successful or not.
  - Differing views on GMOs in the United Kingdom: Contrary to Northern Ireland and the central UK Government, Scotland and Wales are opposed to the cultivation of GMOs.
  - The idea of allowing national decision making process and a more explicit consideration of socio-economic factors has potential attraction. But many risks too, so considerable work would need to be done to ascertain the nature of any models for EU or Member States decision making.
  - The United Kingdom has no experience with commercial cultivation on their territory, so no first hand evidence of associated socio-economic impact. .
  - However the impact of not adopting the GMO technology should also be considered: This has potentially deterred research and innovation in the UK, limiting private sector investment and employment opportunities in the crop biotechnology research base.
  - Lack of research and investment can hamper the development of potentially beneficial new technologies which could have an impact on developing countries.
- The UK undertook a written consultation of stakeholders, asking their opinion on the possibility of including socio-economic factors in the decision making process, the impacts which could be assessed, and the expected impacts associated with GMO

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1 This compilation was prepared by the Commission on the basis of the information provided by the UK, and was validated by the UK.

2 Source: Commission report published on 2 April 2009 on the coexistence of genetically modified crops with conventional and organic farming (http://ec.europa.eu/agriculture/gmo/coexistence/index_en.htm).

3 Source: Research project DG Environment Analysis of field trials management in Member States and prevention of accidental entry into the market place – final report November 2008 (http://www.gm-inspectorate.gov.uk/reportsPublications/documents/EUPARTBreview_finalreport_Dec2008.pdf)

4 Source: idem footnote 2

cultivation. 12 organisations responded (which may not represent the whole spectrum of stakeholders).

- Answers were polarised regarding inclusion of socio-economic in the decision making process and possible ways forward. Organisations who believe that the use of GM crops could be beneficial, including industry, trade and conventional farming representatives, were generally concerned that it would be inappropriate to extend the regulatory regime beyond safety considerations. Such a requirement would be disproportionate and inconsistent with other technologies, would breach Internal Market and international agreements, and results would be subjective. Organisations including NGOs and beekeepers who mainly viewed GM crops as a potential threat or problem called to take into account public opinion and the impact of GMOs on the seed/agricultural chain, personal well-being and happiness, cultural identity, physical health, level of political trust and civic engagement, and the community.
- The short paper is complemented with the report "A way forward for GMO cultivation in Europe?" by the Chatham House Institute. This report was produced after an informal workshop discussion involving a key group of UK stakeholders and representatives from the Netherlands, Austria and the Commission.

3. OVERVIEW OF THE ANSWERS TO THE QUESTIONNAIRE[5]

Economic and social implications

Impacts on upstream operators

o No answer

Impacts on downstream operator

o No answer

Economic context

o No answer

Agronomic sustainability

o No answer

Other implications

o No answer

[5] For more details, please see the full answer at http://ec.europa.eu/food/food/biotechnology/index_en.htm

ANNEX 3

Review of the available scientific literature worldwide on the socio-economic dimensions of cultivation of GMOs

Publications listed below are peer-reviewed articles, official reports from governmental organisations or agencies/institutes, official international and national statistics, and conference proceedings in which scientists presented results from their research that were not published elsewhere.

This review of literature is extracted from the final report of the Commission funded project "Assessment of the economic performance of GM crops worldwide" (Ref. ENV.B.3./ETU/2009/0010).

This report is available at http://ec.europa.eu/food/food/biotechnology/index_en.htm

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Acworth, W., Alasebu, Y., Curtotti, R. (2008). Economic impacts of GM crops in Australia, Research Report 08.4 prepared for the Australian Government Department of Agriculture, Fisheries and Forestry, Canberry, May.

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Bambawale, O.M., Singh, A., Sharma, O.P., Bhosle, B.B., Lavekar, R.C., Dhandapani, A., Kanwar, V., Tanwar, R.K., Rathod, K.S., Patange, N.R. and Pawar, V.M (2004). Performance of Bt cotton (MECH-162) under Integrated Pest management in farmers' participatory field trial in Nanded district, Central India. Current Science. 86(12), 1628-1633.

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Barrett, C., Moser, C., McHugh, O., and Barison, J. (2004). Better technology, better plots, or better farmers? Identifying changes in productivity and risk among Malagasy rice farmers. American Journal of Agricultural Economics, 86(4), 869-888.

Barwale, R.B, Gadwal, V.R., Zehr, U., and Zehr, B. (2004). Prospects for Bt Cotton Technology in India. AgBioForum, 7(1&2): 23-26.

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