

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

Czech Republic

January 2010

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Introductory note:

The questionnaire was sent to the following stakeholders:

Farmers:

- The Agrarian Chamber of the Czech Republic (central office) + 14 regional subdivisions
- 176 farmers cultivating GM crops (MON 810), conventional crops and/or organic crops
- beekeepers:
 - o Czech Beekeepers Union
 - o Bee Research Institute at Dol
 - o Secondary Vocational School of Bee Production
 - o 2 bee research stations
 - o 3 bee centres
 - o 192 beekeepers

Seed industry (for GM, conventional and organic seeds)

- Czech-Moravian Association of Plant Breeders
- Czech Seed Trade Association
- 67 companies or research institutions dealing with seed breeding, multiplying, production and / or distribution

Cooperatives and grain handling companies

Czech-Moravian Association of Cooperatives and Grain handling companies (central office + 6 subdivisions)

Food and feed industry:

- Federation of the Food and Drink Industries of the Czech Republic

Transport companies

- o 17 companies dealing with transport of agricultural commodities

Insurance companies

- o 6 insurance companies dealing with agricultural insurance

Consumers

6 NGOs dealing with consumer and environment protection

Laboratories, Innovation and research, Public administration.

40 experts for GM plants:

members, collaborators and/or consultants of the expert advisory body to the Ministry of the Environment - Czech Commission for GMOs and GMO Products (researchers from the plant research institutes)

UNEP/GEF Biosafety Project National Coordination Committee members

Ministry of the Environment of the Czech Republic

Ministry of Agriculture of the Czech Republic

Ministry of Health, GMO detection laboratories

Central Institute for Supervising and Testing in Agriculture

Czech Environmental Inspectorate

In total 526 stakeholders were addressed but only ca 12 % responded the questionnaire.

The consultees were as follows:

- 34 farmers incl. those cultivating MON 810, conventional and /or organic crops, beekeepers (incl. the Czech Beekeepers Union), farmers transporting agricultural commodities – natural persons, companies, cooperatives
- 6 representatives of seed industry (incl. both natural and legal persons)
- cooperatives, companies
- Czech-Moravian Association of Cooperatives and Grain handling companies
- 4 insurance companies providing agricultural insurance
- Members of Consumers Defence Association
- natural persons

Generally said, the feedback from the public sector incl. farmers, beekeepers, seed industry, NGOs and consumers was very low. The reasons could be as follows: lack of interest to respond any questionnaires coming from authorities, lack of interest in GMOs (in principle) or lack of interest in socioeconomic aspects of GM crops cultivation as they are hardly to understand (or not important) for most stakeholders..

- Laboratories, Innovation and research, Public administration: 14 members, collaborators and/or consultants of the expert advisory body to the Ministry of the Environment - Czech Commission for GMOs and GMO Products (Institute of Botany, ASCR; University of South Bohemia, Faculty of Agriculture; Czech University of Life Sciences Prague; Institute of Experimental Botany AS CR; Research Institute for Fodder Crops; Biology Centre of the Academy of Science of the Czech Republic; Institute of Chemical Technology Prague; Agricultural Research Institute Kromeriz; Crop Research Institute Prague)
Authorities: Ministry of the Agriculture, Central Institute for Supervising and Testing in Agriculture, Czech Environmental Inspectorate

It is necessary to note that the views expressed by the researchers and the officials in the research institutes, universities and authorities who were consulted are not necessarily the same as the formal positions of the Czech government.

Lead questions per area and stakeholder

1. - Economic and social implications

Upstream

1.1. Farmers

Note: many experience of the Czech farmers cultivating MON 810, the only approved GM crop for cultivation in Europe, were summarized in the publication of the Ministry of Agriculture “Current experience with the Bt maize cultivation in the Czech Republic in the period from 2005 to 2009” (in Czech), which could be therefore considered as the relevant source of information for this report. The English summary of the publication that also contains basic data on coexistence rules in the Czech republic could be found at the following address:

[http://www.mzp.cz/www/webdav_biosafety.nsf\\$files/Biosafety/pdf/coexistence.pdf](http://www.mzp.cz/www/webdav_biosafety.nsf$files/Biosafety/pdf/coexistence.pdf)

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

- Farmers’ revenues (output prices and agricultural yields):

20 responses obtained, related only to MON 810

Majority of stakeholders (90 %) estimated yield increase in MON 810 maize for ca 10 %.

10 % of consultees did not record any difference between yield of conventional and GM maize.

The Czech Central Institute for Supervising and Testing in Agriculture has regularly carried out MON 810 hybrids variety testing since 2005. The recent results indicate that differences between Bt and conventional maize hybrid yields vary according to the occurrence of corn borer in a given year. In the years with high occurrence of corn borer (i.e. 2005 and 2006) Bt hybrids reached increase in yield for up to 30 % in comparison with conventional maize hybrids, in the years with low occurrence of the pest (i.e. 2007 and 2008) Bt hybrids reached increase in yield from 0 to 15 %. The reasons for higher yields of Bt hybrids are as follows: lower plant brittleness, longer assimilation time and lower harvest losses.

- Farmers' production costs

22 responses obtained, 21 related to MON 810, 1 research institute reports its experience with HT crops

77 % of consultees recorded equal or lower production costs when planting Bt maize – savings mainly resulted from lower (or none) insecticide treatment, lower handling and mechanization wear. On the other hand, 23 % of consultees mentioned increased production costs due to higher price of GM seed.

Some representatives of organic farming mentioned that initial lower costs might raise if HT resistant weeds or Bt resistant pests develop and spread widely.

Reference:

NAVRÁTIL, Vítězslav. Importance of agricultural biotechnologies for the Czech Republic and the European Union, EuropaBio conference, Prague, 2.12.2008.

- *Example of Bt maize cultivation costing in Rostěnice cooperative (Rostěnice cooperative belongs among biggest growers of MON 810 in the Czech Republic):*

Difference in production costs between GM and conventional maize is rather small, higher price of GMO seed (+45 € per ha) is compensated by savings in insecticide treatment (- 60 € per ha). Nevertheless, good health of GM plants allows later harvest and therefore savings in post harvest measures (kernels drying) 20-24 € per ha. Increase of yield (10 %) brings 100 € per ha. In total, the definite economical benefit of Bt maize cultivation is minimally 120 € per ha. What is more, the stock fed by feed made of Bt maize is healthier due to lower content of mycotoxins, and thus savings in veterinary care could be also taken into account.

- Labour flexibility

14 responses obtained, related only to MON 810

All consultees recorded either lower labour flexibility demands while cultivating MON 810 or did not notice any difference between GM and conventional maize cultivation in this regard.

Significant differences in labour flexibility are in the seasons with strong occurrence of a corn borer as an intensive chemical treatment is necessary to be carried out in conventional maize fields.

- Quality of the harvest (e.g. mycotoxines):

22 responses obtained, related only to MON 810

All consultees (i.e. farmers cultivating GM and / or conventional maize) recorded higher quality of the harvest and following final products (i.e. kernels, silage and its following circulation in food chain) as regards mycotoxines content. Representatives of organic farming did not express their opinion.

This phenomenon was also experimentally verified in the Czech Central Institute for Supervising and Testing in Agriculture. According to their field trial results reached in recent years, *Fusarium* sp. contamination (and thus potential mycotoxin contamination) did not exceed 10 % in Bt maize regardless a corn borer infestation level in different years. In conventional maize it reached 15 –25 % in the season with low occurrence of a corn borer (i.e. 5-12 % of conventional maize ears infested with a corn borer) and exceeded even 40 % in the seasons with high occurrence of the pest (i.e. 30 – 60 % of conventional maize ears infested). Not even chemical treatment assured the comparable plants' health level in such years.

The other results from the Czech research:

Slezáková L., Remešová J. & Kocourek F. (2006): Toxigenic micromycetes and their mycotoxins in grains of transgenic Bt-maize hybrid and nontransgenic hybrids. -In: IOBC/WPRS Bulletin, GMOs in Integrated Plant Production, 29(5): 159-164, ISBN 92-9097-188-0.

In 2002-2004 we have studied the efficacy of Bt-maize to control the European Corn Borer (ECB) and grain infection by toxigenic micromycetes in comparison with biological control by the introduction of *Trichogramma* wasp and untreated control hybrid in two localities in the Czech Republic (Praha-Ruzyně and Ivanovice na

Hané). Injury of plants caused by ECB differed according to locality. At locality Ivanovice na Hané, higher occurrence of pest and toxigenic micromycetes species was recorded. Bt-maize showed a high level of resistance to ECB, there were no injured plants during our survey. In grain samples, a total of 15 taxa of the genus *Fusarium* and 9 taxa of the genus *Penicillium* were identified. A similar complex of micromycetes was recorded on Bt maize and the non-transgenic hybrids. But the frequency of *Fusarium* species was significantly reduced in Bt-maize when compared to the mean of all non-transgenic hybrids. Reduction in frequency in Bt-maize was 35.3% for *Fusarium oxysporum*, by 86% for *F. proliferatum*, for *F. sporotrichioides* by 61,6%, for *F. subglutinans* by 32,4% and for *F. verticillioides* by 77,6%.

The consultees drew the attention to the following relevant references:

Barros G., Magnoli C., Reynoso M. M., Ramirez M. L., Farnochi M. C., Torres A., Dalcero M., Sequeira J., Rubinstein C. & Schulze S. (2009): Fungal and mycotoxin contamination in Bt maize and non-Bt maize grown in Argentina. – *World Mycotox. J.* 2(1):53-60.

Abstract

A Bt maize hybrid and its non-transgenic counterpart harvested during 2002/2003 and 2003/2004 harvest seasons from different locations within the maize-growing area in Argentina were compared for fungal and mycotoxin contamination. *Fusarium* species were the most prevalent on both genotypes with an isolation frequency >60% across all locations. The percentage of infection was lower in Bt maize than in non-Bt maize ($P < 0.05$). There were no statistical differences in infection percentage due to genotype, fungicide treatment and their interactions. Fumonisin were detected in all of the samples from all locations and genotypes. Total fumonisin levels (fumonisins B₁, B₂ and B₃) in the Bt and the non-Bt hybrid were significantly different ($P < 0.001$), with lower toxin levels in the Bt maize in all locations but one evaluated during the two harvest season. There was no significant difference in deoxynivalenol levels between Bt and non-Bt maize. Application of the fungicide tebuconazole did not alter either the infection or the toxin levels in the Bt and non-Bt maize hybrid.

Tatli F., Güllü M. & Ozdemir F. (2004): Determination of fungi species, relationship between ear infection rates and fumonisin quantities in Bt maize.- In: Romeis J. & Bigler F. [eds.], *GMOs in integrated production, Ecological impact of genetically modified organisms*, 27(3): 161-164.

Abstract

Field trials were conducted in Cukurova (East Mediterranean region of Turkey) during 2001 and 2002 to analyse the fungal species as well as the relationship between maize ear fungal infection rates and fumonisin quantities in conventional hybrids (DK-626 and P-3394) and insect-protected (DK-626 Bt) Bt maize. Each year, the trial included 8 blocks, 4 of them receiving 3 insecticide treatments and the other remaining untreated. The lowest fungal infection index was obtained for the insect-protected DK-626 Bt maize, with average values ≤ 1.50 in both 2001 and 2002, compared to values ≥ 2.41 for both the control groups over the two years. *Fusarium moniliforme* [*Gibberella moniliformis*] was found to be the most prevalent fungal species, present in 69% or more of the infested grain analysed in the study. Over the duration of the study, the mean fumonisin concentrations in the conventional maize hybrids DK-626 and P-3394 ranged from 15.6-18.1 and 12.7-17.7 ppm for 2001 and 2002, respectively, whereas values ranged from 2.5-2.6 and 0.63-0.78 ppm in DK-626 Bt maize for those two years. Overall, mean fumonisin concentrations in Bt maize were therefore 6 to 7 times lower than in the conventional maize in 2001 and 15 to 20 fold lower in 2002.

Clements M. J., Campbell K. W., Maragos C. M., Pilcher C., Headrick J. M., Pataky J. K. & White D. G. (2003): Influence of Cry 1Ab protein and hybrid genotype on fumonisin contamination and *Fusarium* ear rot of corn. – *Crop Sci.* 43(4): 1283-1293.

Abstract

Fusarium ear rot of corn (*Zea mays* L.) is associated with feeding damage from the European corn borer (ECB), *Ostrinia nubilalis* Hübner, and the corn earworm (CEW), *Helicoverpa zea* Boddie. Specific transformation events encoding for Cry1Ab protein from *Bacillus thuringiensis* Berliner (Bt) may reduce *Fusarium* ear rot and fumonisin concentration in grain by minimizing damage from certain insects. The objective of this study was to determine if effects from Cry1Ab protein in kernels and silks on fumonisin concentration in grain vary depending on the genotype of the hybrid or the predominant insect species. Four Bt corn hybrids and their corresponding

nontransgenic, near-isogenic hybrids were compared for ear rot severity and fumonisin concentration in grain in four environments. Treatments included inoculation with *F. verticillioides* (Sacc.) Nirenb. (Syn = *F. moniliforme* J. Sheld.) and *F. proliferatum* (Matsushima) Nirenb., infestation with ECB larvae, infestation with CEW larvae, and controls. Cry1Ab protein from the Mon810 transformation event was associated with reduced ear rot severity when hybrids were not inoculated with *Fusarium* spp., regardless of whether hybrids were infested or not infested with insects. Cry1Ab protein was associated with reduced fumonisin concentration in grain when ECB was the predominant insect, but not when CEW was the predominant insect. Cry1Ab protein was not associated with reduced fumonisin concentration in grain for the most resistant hybrid pair in this study. Results suggest that Bt hybrids can reduce fumonisin concentration in grain during seasons when ECB is favored, but not during seasons when CEW is favored. Hybrid genotype was an important factor in reducing fumonisin concentration in grain.

- Cost of alternative pest and/or weed control programmes

22 responses obtained, related only to MON 810

There is no homogeneous opinion on the issue in the Czech Republic. 50 % of consultees believed that Bt maize cultivation did not have any impact on the issue simply because above mentioned control programmes need to be sustained regardless Bt maize existence as they are environmentally friendly and it is possible to use them only if pest occur (i.e. farmers reduce their costs for Bt maize seeds in the years with low occurrence of the pest).

However, 50 % of consultees (mainly farmers cultivating MON 810) recorded the overall reduction in cost of alternative pest control programmes due to Bt maize cultivation. The biological pest control programmes were recognized as very laborious, expensive and variable in its efficiency, and insecticide treatments were assessed as expensive and unfriendly to the environment.

- Price discrimination between GM and non-GM harvest:

17 responses obtained, related only to MON 810

There is no homogeneous opinion on the issue in the Czech Republic. Majority (65 %) of consultees experienced the price discrimination of GM harvest; the rest either did not experience any difference or did not know.

Permanent different opinions exist between farmers cultivating Bt maize who are not satisfied with the status quo and organic farmers who consider it desirable.

- Availability of seeds and seed prices:

17 responses obtained, related only to MON 810

Farmers did not experience limited seed choice, the availability of both conventional and GM seeds was therefore considered as good or sufficient in the Czech Republic. However, GM seed is more expensive than the conventional one (ca 45 € / ha, see the above mentioned text).

- Dependence on the seed industry:

15 responses obtained, related only to MON 810 (13 farmers and 2 research institutes responded)

Majority (74 %) of consultees experienced a direct dependence on a few main seed industry companies. The rest of stakeholders never considered the issue.

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

10 responses obtained, related only to MON 810

Only 50 % of consultees realized that using of farm-saved seeds is not possible in case of GM plants.

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

15 responses obtained (14 related only to MON 810, 1 takes into account also herbicide-tolerant crops)

93 % of consultees experienced the reduction in the use of insecticides as well as fuels due to Bt maize cultivation (no need for insecticide treatment, a reduction in tractor trips across the field for pesticide applications). No changes in fertilisers or water resources use were recorded in comparison with conventional maize cultivation.

Ecological benefits from reduced pesticide use were also acknowledged by the Czech Beekeepers Union.

A risk of weed resistance development to the herbicide in the case of HT technology and subsequent gradual rise of herbicide use was mentioned by one researcher from the Institute of Experimental Botany.

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

18 responses obtained, related to MON 810 and HT crops (16 farmers and 2 research institutes responded)

Majority of consultees (72 %) experienced a positive impact of Bt maize cultivation on health of labour due to lower direct exposure of farm workers to pesticides (no need for insecticide treatment in case of Bt maize).

28 % of consultees stated that GM crops cultivation did not have negative impact on health of labour in comparison with conventional maize cultivation. The effects of pesticides on human health are minimized provided that all labour protection instructions on the pesticide' labels are being kept properly.

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

14 responses obtained, related only to MON 810 (12 farmers, 2 research institutions)

All consultees were aware of the obligation to keep the coexistence rules. Only 28.6 % of them did not consider these rules as restrictive while majority of responding stakeholders (i.e. 72.4 %) stated that GM maize cultivation had a negative impact on their farming practices. The necessity to keep the isolation distance and non-adequate (too restrictive) GM laws were recognized as the main burdens for farmers growing GM maize. On the other hand, representatives of organic farmers assess the cultivation of GM maize in close vicinity of the organic farms as potential threat for their activities. A representative of seed industry

mentioned a potential risk of contamination of conventional seed production with a GM reproduction material.

- Cost of coexistence measures

13 responses obtained, related only to MON 810 (11 farmers, 2 research institutions)

Currently only the farmers cultivating Bt maize bear the cost of coexistence measures, which are particularly formed by the costs for organisation of work and complicated evidence.

- Conflicts between neighbouring farmers or between farmers and other neighbours

18 responses obtained, related only to MON 810 (16 farmers, 2 research institutions)

There is no homogeneous experience on the issue in the Czech Republic.

44.4 % of consultees did not experience any conflicts between neighbouring farmers or between farmers and other neighbours.

However, 55.6 % of consultees experienced such conflicts or they realized the threat of a conflict occurrence. Possible transboundary conflicts with countries with national ban of GM maize cultivation in place were also mentioned. One of the responding research institutes mentioned that the conflicts could also arise from insufficient knowledge and low public awareness.

- Labour allocation- insurance obligations

12 responses obtained (11 farmers, 1 research institution)

Consultees either did not see any impact of GM crops cultivation on the issue (75 %) or did not know (25 %).

- Opportunities to sell the harvest due to labelling

18 responses obtained, related only to MON 810 (16 farmers, 2 research institutions)

There is no homogeneous experience on the issue in the Czech Republic. 22.2 % of consultees evaluated opportunities to sell the GM maize harvest due to labelling as good or equal to non-GM harvest. However, majority of consultees experienced significantly worse opportunities to sell the GM maize harvest due to the following reasons: restricted export opportunities to GM free countries, low demand for the GM harvest (therefore used as a feed in the own farm) and administrative discrimination.

- Communication or organisation between the farmers

13 responses obtained, related only to MON 810 (12 farmers, 1 research institutions)

There is no homogeneous experience on the issue in the Czech Republic. 53,8 % of consultees stated that GM maize cultivation had a direct impact on a communication between the farmers – such an individual communication must exist and run smoothly. Mutual cooperation agreements could result e.g. in direct sale of GM production as a feed.

46,2 % of consultees stated that GM maize cultivation influenced neither mutual communication between the farmers nor establishment/termination of mutual cooperation.

- Farmer training

13 responses obtained (11 farmers, 2 research institutions)

Majority of consultees (77 %) stressed that farmer training in the area of GMOs was in place in the Czech Republic, it reached a good level and was even necessary for both further GM crops cultivation and proper understanding the issue.

15 % of consultees believed that GM crops cultivation did not have any impact on farmer training. Only individual consultees evaluated the farmer training in the Czech Republic as insufficient.

- Beekeeping industry

17 responses obtained, related only to MON 810 (15 farmers incl. beekeepers, 2 research institutions)

There is no homogeneous opinion on the issue in the Czech Republic.

53 % of consultees did not experience any impact of GM maize cultivation on the beekeeping industry.

18 % of consultees stated that GM maize cultivation positively influenced the beekeeping industry due to reduced use of insecticides having an adverse effect on bees (also appreciated by the Czech Beekeepers Union). Nevertheless, they highlighted the necessity to monitor a long-term pesticide use development in GM crops.

29.4 % of consultees stressed the lack of verified information as well as the need for further research of impact of GM crops cultivation on bees (among others a possibility of toxin secretion into a pollen collecting by bees). The Czech Beekeepers Union drew the attention to a possible consumers' reluctance to buy honey products contaminated with GM pollen.

- Any other impacts

Positive economical effect of GM crops on livestock – healthier plant production (lower mycotoxins content) finally resulted in lower costs for veterinary care.

Significantly higher quality of GM plant production as regards human and animal health means higher and thus cheaper production, which is ready to be competitive to export from the countries cultivating GM crops in a big scale.

However, most farmers cultivating MON 810 experienced production-marketing problems and therefore often used all GM production as a feed for livestock in their own farms.

1.2. Seed industry

Only very few consultees responded the following questions. That is why the responses could not express the position of the Czech seed industry as a whole.

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

- Employment, turn over, profits

No relevant answers obtained.

- The production of seeds (easiness/difficulty to find seed producers, easiness/difficulty to find areas to produce these seeds...)

Consultees highlighted the possible threat of significant restriction of areas suitable for conventional seed production due to the risk of GM contamination if the areas sown with GM maize significantly enlarged.

- Marketing of seeds:

Seed producers expressed their concerns about possible negative impact of GM crops on seed marketing and threat of monopoly development.

- The protection of plant breeders rights

No relevant answers obtained.

- The protection of plant genetic resources

No relevant answers obtained.

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.

- Plant breeders, seed multiplication and seed producers:

Consultees stated that the marketing of GM seeds could negatively affect the seed industry as GM crops are trendy at present and plant breeders or producers might be discriminated if they do not provide GM seeds. This effect could result in the reduced number of plant breeders and seed producers.

- The availability of conventional and organic seeds

According to the consultees the risk of reduction of conventional and organic seeds spectra would raise if GM crops spread widely.

- Creation/suppression of barriers for new suppliers

No relevant answers obtained.

- Market segmentation.

Consultees admitted that GM seeds represented a special-purpose product for a particular segment of the market.

Any other impact

Producers of organic seeds recognised a risk of possible contamination of their production as GM pollen spread for long distances from large fields with GM crops.

Producers of both organic and conventional seeds expressed their concerns about the reduction of areas suitable for the seed production due to risk of contamination with GM material.

Downstream

1.3. Consumers

Generally, only few consumers from the public or the consumer protection association responded. Majority of responses come from the GMO experts and farmers.

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

- Consumer choice (regarding quality and diversity of products)

Majority of consultees stated that GM production contained less mycotoxins and therefore the quality of products could be higher. However, some consultees believed that the diversity of products could decrease if the areas with GM crops enlarged.

The price of the goods

No homogenous opinion on the issue in the Czech Republic. 20 % of consultees assumed that GM products were cheaper while 20 % of consultees state that non-GM products were of lower price. The rest of consultees believed that GMOs did not have an impact on the price of goods.

- Consumer information and protection

Majority of consultees (80 %) was of the opinion 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.

20 % of consultees assumed that consumer information on GM crops was insufficient in the Czech Republic.

- Any other impact

Responses differentiated according to the different consumers' attitude to GM crops:

Positive impact: significantly better plant's health, increase in yield
Negative impact: unproven impact on the environment, conventional agricultural production and consumer's health.
mass distribution of inaccurate and/or alarming news often lead to the public misunderstanding the issue

1.4. Cooperatives and grain handling companies

Only several farmers (cultivating GM, conventional and the organic crops) and the Czech-Moravian Association of Cooperatives and Grain handling companies expressed their experience with the impact of GM cultivation regarding following topics.

- Work organisation

Consultees believed that GM crops cultivation had an impact on the work organization regarding separate storage of the GM products and their labelling. Therefore a work organization became more complicated if GM products appeared together with the conventional production in one cooperative or grain handling company.

- Handling and storage

Consultees stated that GM production brought additional requirements for its separate storage and transport. What is more, GM production storages must be separately cleaned after the GM products have been dispatched.

- Transport

Consultees stressed a negative effect - obligation to separate transported GM and non-GM production as well as following cleaning of transport machines could bring increase of transport costs.

Administrative requirements on business or administrative complexity

GM crops cultivation and GM production processing had the following impacts on stakeholders:

Cooperatives and grain handling companies were obliged to: (i) keep the records of GM crops, (ii) label all GM food and feed, (iii) carry out the transport and production line controls. These factors represented an extra administrative load for stakeholders handling GM crops.

1.5. Food and feed industry

Only very few stakeholders responded the following questions. That is why the responses cannot express the position of the whole Czech food and feed industry.

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

- Range of products on offer

Wider range of products on offer due to GM products and a proper labelling system was experienced in the Czech Republic. On the other hand, organic farmers claimed a rise in costs for marketing of non-GM products.

- Employment, turn over, profits

No relevant response obtained.

- Work organisation and crop handling (drying, storage, transport, processing, etc...)

Consultees experienced more demanding work organisation and crop handling due to obligation of separation of GM and non GM production. On the other hand, savings in drying of Bt maize were experienced (see the Farmers' production costs on page 6)

- Administrative requirements on business or administrative complexity;

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1.6. Transport companies

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

Higher price of GMO overseas shipments insurance could lead to higher prices of imported feedstock.

Possible rise in costs for transport could be among others caused by the obligation to separate transported GM and non-GM production as well as following cleaning of transport machinery.

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?

The crop insurance (the main insurance product available for the Czech farmers cultivating any crops) does not include any special provisions for GM plants. So far the main insurance companies offering the crop insurance in the Czech Republic did not register any special client's requirement for the insurance of GM production. Therefore, no special insurance product focused on GM crops is being developed at present. However, according to the Ceska pojistovna a.s. (the main crop insurance provider in the Czech Republic) potential clients' interest can positively affect the possible development of such insurance product in future.

1.8. Laboratories

Two Czech GMO reference laboratories and several researchers from the plant research institutes and universities expressed their experience on the following topics.

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

- Employment, turn over, profits

6 responses obtained

Current impact of GMO cultivation on the above-mentioned factors is lower than expected by the researchers as the areas with GM crops are too limited in the Czech Republic. However, 60 % of responding experts assumed that potential enlargement of areas sown with GM crops could affect operation of the laboratories, e.g. rise in costs for GMO analyses due to increased demand for inspections and enforcement by authorities, need for extension of personal capacities, development and /or of new detection methods etc.

- Feasibility of analyses

7 responses obtained

Analyses of GMOs have to be carried out by the qualified staff in the specialized laboratories. Detections of transgenes or its protein products are carried out routinely in such laboratories. Complexity of product quality analyses from another points of view (e.g. mycotoxin content) does not rely on transgene presence or its expression and therefore it is not connected directly to GMO issue.

The most important problems the laboratories have permanently faced are as follows: high costs of the analyses, rising complexity of the analyses due to increasing number of GM events and stacked genes, missing harmonization of the detection methods, retrieval of quantitative data and result interpretation.

- Time necessary to provide the results

6 responses obtained

Time necessary to provide the results of GMO analysis does not differ from time for evaluation of other agrotechnologies provided that additional redundant tests of GMOs are not required.

- Prices of the analyses

6 responses obtained

Experts responding the question had a different point of view on the issue. 50 % of consultees stated that prices of the GMO analyses did not differ from other routine analyses carried out in the detection laboratories, e.g. analyses of pesticide residues or mycotoxins. Other 50 % consultees were of the opinion that GMO analyses were rather more expensive in comparison with routine tests due to use of special chemicals. Use of expensive quantitative analyses for the determination of GMO content could also raise the costs.

- Any other impact

Specific sampling methods need to be applied to obtain the appropriate samples for GMO detection analyses. However, such samplings raise the costs for the analyses.

From the long-term perspective every technology can have some impact on the environment, humans and/or animals; including agrotechnologies (and GM plants). That is why changes in the agro ecosystems caused by different farming practices need to be monitored and compared.

1.9. Innovation and research

Czech GMO reference laboratories and the researchers from the plant research institutes and universities expressed their experience with the following topics.

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)

11 responses obtained

78 % of responding experts stated that GMOs had a positive effect on investment in plant research and subsequent rising number of patents. The transgenesis is a modern biotechnological method that stimulates research institutes as well as private research companies to innovate their technical equipment and further establish new methods for developmental, experimental and control purposes. However, current extent of investments still does not meet the real needs of science.

22 % of responding experts assumed that GM plant research and the related number of patents were stimulated mainly outside Europe; e.g. China or India have already been developing their own GM crops. European research is restrained due to probable low (or none) utility of the patents in the European agriculture. Administrative burden and the high fees (in case of the field trial applications in the Czech Republic) represent another obstacles for GMO research. The significant impact of GMO on investment is recorded in the industry rather than in academic sector.

- Investment in research in minor crops

11 responses obtained

Consultees assumed that GM crops cultivation had not a significant impact on investment in research in minor crops in the Czech Republic.

- Employment in the R&D centres in the EU

11 responses obtained

Majority of responding experts, i.e. 67 %, experienced a positive effect of GMOs on the employment in the R&D centres (higher employment in the above mentioned centres, e.g. the Plant Biotechnology Centre project proposed as a centre of excellency of the Crop Research

Institute, the Czech University of Life Sciences, Institute of Chemical Technology and the Institute of Botany ASCR, realized in Kladno city).

33 % of responding experts did not know or assumed that the impact of GMOs on employment in the RD centres was not significant so far.

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

11 responses obtained

78 % of responding experts experienced a positive effect of GMO cultivation on use of non-GM modern breeding techniques as the research of GMO accelerated the use of these techniques in plant breeding. Balanced use of both techniques (i.e. GMO and non-GMO) is estimated in the future.

Rest of consultees did not see any significant impact of GMO cultivation on the issue.

- Access to genetic resources

11 responses obtained

The experts stated that cultivation of GM crops did not affect the issue negatively (new genetic resources were needed even for breeding of GM crops). What is more, inclusion of GM varieties into genetic resources could extend their diversity.

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

11 responses obtained

GMO cultivation had a positive effect on access to new knowledge, which must be assured and further disseminated. GM plants were the subjects of detailed analyses and new techniques were often developed for these purposes.

1.10. Public administration

Ministry of the Environment, Ministry of Agriculture of the Czech Republic, the Czech Environmental Inspectorate and several researchers responded following questions:

- 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

Complex administration regarding GMO cultivation burdened the budget with extra costs for control activities of the Ministry of Agriculture (controls aimed at compliance with co-existence rules) for 11.500 EUR/year. Furthermore, the Ministry of the Environment supports the GMO reference laboratories as they provide GM material detection and validation analyses for authorities (ca 22.500 EUR in 2009).

Any other impact

(related to MON 810 only)

The necessity for the separation of products from different agricultural systems (i.e. GM, conventional and organic) resulted in higher production costs for farmers cultivating GMOs. However, higher yields and savings in some post harvest procedures (e.g. drying) compensated these extra expenses. What is more, cultivation of GM crops lead to less use of pesticides unfriendly to biodiversity and human and animal health.

Economic context

1.11. Internal market

Several researchers and officials working for the authorities responded following questions

- 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?

7 responses obtained, related only to MON 810.

There is no homogeneous opinion on the issue.

42 % of responding experts assumed that placing on the market of GMO seeds did not have any impact on the functioning of the EU internal market on seeds or the impact was not significant. It was also because of very limited (and decreasing) areas sown with GM maize.

29 % responding experts were not aware of such an impact or did not feel to be competent to assess the issue.

29 % of the experts assumed that companies dealing with GM seeds would strengthen their market position provided that areas sown with GM crops enlarge.

These experts also stressed that GM seeds could partially raise the production costs of non-GM seeds due to analyses and measures taken to detect GMO admixtures.

- 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?

6 responses obtained, related only to MON 810.

Majority of consultees were not aware of such an impact or did not feel to be competent to assess the issue. Nevertheless, the minimal impact on particular services could be expected, e.g. higher demand for laboratory detection analyses and / or separate processing.

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

6 responses obtained, related only to MON 810.

Recent limited cultivation of GM crops in Europe does not enable a strong business competition; therefore an impact on monopolies cannot be quantified.

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

6 responses obtained, related only to MON 810.

The consultees stated that the impact on cross-border investment is not significant due to limited cultivation of GM crops in Europe.

- Any other impact

GM crops cultivation brings the possibility of choice for farmers and consumers

1.12. Specific regions and sectors

Several farmers and researchers responded following questions.

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

- Agriculture incomes

6 responses obtained, related only to MON 810.

Consultees stated that GMO cultivation had a positive impact on local agriculture incomes due to increase in yields and higher quality of production. Farmers could also benefit from reduced pesticide use that resulted in production cost savings. Individual results were regionally and seasonally dependent.

- Farms' size

6 responses obtained, related only to MON 810.

Majority of responding experts stated that there was none or minimal impact on the issue. However, representatives of organic farming were of the opinion that farms' size predetermines a possibility of GM crops cultivation (farmers cultivating GM crops are obliged to keep isolation distances which are difficult to keep within and between small farms).

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

4 responses obtained, related only to MON 810.

It is not possible to assess the issue as the areas sown with MON 810 are too limited in Europe. Generally, it is necessary to compare possible changes in the farm production practices caused by GM crops cultivation with changes caused by other existing agricultural technologies.

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

5 responses obtained, related only to MON 810.

Majority of responding experts stated that it was not possible to assess the issue as the areas sown with MON 810 were too limited in the Czech Republic and Europe. However, some representatives of organic farmers also expressed their concerns about potential negative

impact of GMO cultivation on the reputation regarding other commercial activities of the region (particularly the commodity or seed purchase).

2. - Agronomic sustainability

The researchers, officials working for authorities, farmers and consumers responded following questions.

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)?

43 responses obtained

Majority of consultees assumed that GM crops cultivation resulted in the decrease in the use of pesticides as two most important pests of maize (i.e. both corn borer and western corn rootworm), which would have to be controlled by insecticides if occurred in conventional maize, spread quickly into new localities. Decrease in the use of pesticides would result in reducing negative effect of pesticides on the environment and non-target organisms. However, representatives of organic farming predicted an increase of pesticide usage in case of pest resistance development.

It should be stressed that the phenomenon of pest resistance development does not relate exclusively to GM crops but it has been commonly recorded in currently prevalent conventional agriculture that uses an intensive chemical treatment (6 480 ha of MON 810 vs. 91 610 ha of conventional maize hybrids sown in the Czech Republic in 2009).

- 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?

42 responses obtained

The majority of consultees (93 %) stated that cultivation of authorised GMOs could reduce the amount of used pesticides. However, it relates only to the limited number of insecticides effective against a corn borer as MON 810 is the only authorised GM crop in Europe. Limited areas sown with GM maize in the Czech Republic further dilute the possible positive impact. In case of HT crops a switch to more environmentally benign herbicides is expected.

7 % of consultees from the research sector stressed that possible increased use of herbicides could occur if HT crops (e.g. HT soybeans) were authorized for cultivation in EU.

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?

39 responses obtained

There is no homogenous opinion on the issue (across the whole spectrum of consultees) in the Czech Republic.

Majority of consultees (74 %) believed that cultivation of GM crops authorised in the EU could not affect the numbers of non-agriculture species or varieties. According to the current knowledge the impact of Bt maize MON 810 on non-agriculture species is highly improbable. It is necessary to compare the impact of other technologies (e.g. intensive agriculture practice) with reasonable cultivation of GM crops.

15 % of consultees had no relevant information in this area.

5 % of consultees believed in the positive impact – the number of non-target organisms in Bt maize vegetation increased due to reduced use of insecticides.

6 % of consultees mentioned the possible negative impact on the issue. The possible risk of resistant pest populations' development should be suppressed by the good farming practice while cultivating GM crops (incl. establishment of new antiresistance strategies).

As regards HT crops (currently in the field trials), the experts mentioned a risk of weed resistance development to the herbicide and subsequent spread and survival of resistant weed at localities under the intensive herbicide treatment (railway stations, railroads, motorway sides etc.) Furthermore, the experts also stated that possible cross of certain HT crops with their commonly occurred wild relatives by pollination could lead to the development of herbicide resistant weed. HT sugar beet and RR oilseed rape were recognized as the most dangerous crops in this regard.

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

40 responses obtained

There is no homogenous opinion on the issue (across the whole spectrum of consultees) in the Czech Republic.

Majority of consultees (77.5 %) believed that cultivation of MON 810, the only GM crop authorised in the EU, could not affect agriculture diversity. The total number of plant varieties did not have to be decreased due to genetic modifications because the similar modifications were introduced into the broad-spectrum of plant varieties. However, scientifically sound risk assessment of any new GM crops has to be carefully carried out.

22.5 % of consultees believed that the impact of GMOs cultivation on diversity was rather positive as the Czech producers had an access to more maize cultivars (about 100).

However, 15 % of consultees assumed that the reduction of agriculture species could occur if the number of plant breeding companies decreased as a result of wide cultivation of GM crops (GM seed is produced by few seed companies that can afford to pay expensive GM crop development).

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

- protected or endangered species

29 responses obtained

There is no homogenous opinion on the issue (across the whole spectrum of consultees) in the Czech Republic.

Majority of consultees (65.5%) did not assume that GMO cultivation had a negative impact on protected or endangered species. The approved modification itself did not endanger the

environment in given region – the real threat for the protected or endangered species presented inappropriate cultivation technology of any crop.

20.7% of consultees had insufficient number of verified information to assess the issue. The total real impact of GM crops would have to be compared with other relevant cultivation technologies, e.g. use of insecticides in conventional agriculture. Some experts plan to monitor possible reappearance of some insect species close to extinction due to excessive use of pesticides if GM crops areas enlarge (e.g. ground beetle - *Carabus cancellatus*).

13.8 % of consultees assumed that GM crops could have a negative impact on the endangered or protected species particularly if the GM plants serving as feed produced some indigestible substances. However, such impact needs to be verified in practice as GM plants could be less attractive than non-modified plants for these species in natural conditions.

- their habitats

27 responses obtained

There is no homogenous opinion on the issue (across the whole spectrum of consultees) in the Czech Republic.

Majority of consultees (64 %) did not assume that GMO cultivation had any impact on habitats of protected or endangered species.

18.5 % of consultees had insufficient number of verified information to assess the issue. The total real impact of GM crops would have to be compared with other relevant cultivation technologies, e.g. use of insecticides in conventional agriculture.

15 % of consultees – representatives of organic farming - assumed that GMO cultivation contributed to soil devaluation and therefore had a negative effect on the issue.

- ecologically sensitive areas

27 responses obtained

There is no homogenous opinion on the issue (across the whole spectrum of consultees) in the Czech Republic.

Majority of consultees (64 %) did not assume that GMO cultivation had any impact on ecologically sensitive areas as no GM crops are cultivated there. These experts anyway believed that the approved modification itself did not endanger ecologically sensitive areas – the real threat presented inappropriate cultivation technology of any crop there.

However, 14 % of consultees believed that GM crops could negatively affect ecologically sensitive areas, if cultivated there.

22 % of consultees had insufficient number of verified information to assess the issue. For that reason some of these experts recommended rather not to cultivate GM crops in these areas.

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

- migration routes, ecological corridors and buffer zones

26 responses obtained

Majority of consultees (77 %) did not assume that GMO cultivation had different impact on the issues than cultivation of any other crop. The approved modification itself did not endanger them, the real threat presented inappropriate cultivation technology of any crop there.

11.5 % of consultees stressed the need for keeping these factors regardless of the agriculture technology that had been used.

11.5 % of consultees had insufficient number of verified information to assess the issues or they did not know.

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

- biodiversity, flora, fauna

29 responses obtained

There is no homogenous opinion on the issue (across the whole spectrum of consultees) in the Czech Republic.

Majority of consultees (52 %) did not assume that cultivation of GM crops authorised in given region had any impact on the issue. The real threat for biodiversity presented inappropriate cultivation technology of any crop.

22 % of consultees had insufficient number of verified information to assess the issue. The total real impact of GM crops would have to be compared with other relevant cultivation technologies, e.g. use of conventional agriculture.

21 % of consultees believed that GM crops cultivation could have a negative impact on flora biodiversity as the plant transgene escape into the environment leading to possible new plant genotype evolution could occur. In this regard, HT crops vs. threat of weed resistance to total herbicide development were highlighted.

The extensive research of the impact of Bt maize on non-target organism carried out in the Czech Republic in recent years indicated positive effect on their diversity.

See also the references as follows:

WHITE BOOK: GENETICALLY MODIFIED CROPS (2009): Editors: **Prof. František Sehnal & Prof. Jaroslav Drobník**, NGO Biotrin, Praha, p. 95, ISBN 978-80-86668-05-3.

(EU regulations and research experience from the Czech Republic.)

- **RESULTS OF A FOUR-YEAR STUDY OF THE IMPACT OF BT MAIZE ON ARTHROPOD COMMUNITIES.** *Habuřtová O., Hussein M. H., Doležal P., Spitzer L., Růžička V.* - We conclude that the presence of Cry1Ab toxin has no adverse effect on the ecosystem.
- **DIVERSITY OF CARABID BEETLES (COLEOPTERA: CARABIDAE) UNDER THREE DIFFERENT CONTROL STRATEGIES AGAINST EUROPEAN CORN BORER IN MAIZE.** *Kocourek F., Saska P., Řezáč M.* - No differences were found in species richness or species composition between treatments, seasons or sites, suggesting no effect of planting transgenic insect resistant maize on the communities of carabid beetles in the study fields.
- **THE EFFECT OF CONTROL STRATEGIES AGAINST EUROPEAN CORN BORER ON EPIGEIC SPIDERS (ARANEAE) AND HARVESTMEN (OPILIONES) IN MAIZE.** *Řezáč M., Pekár S., Kocourek F.* - It can be concluded that Bt maize strategy had no adverse effect on epigeic arachnids, which is in agreement with previous investigations of Bt maize in Europe.

- **Soukup J. (2007):** GM crops as a part of sustainable agroecosystems. In: Czech Republic – your partner in the agrobiotechnology research, Brusel, p. 6-7.

GM crops can contribute to the sustainability of agroecosystems due to simplification of control of harmful organisms, reduction of pesticide usage and increasing of production quantity and quality.

The Czech experts pointed out that also several foreign researchers reached the relevant results:

- **IMPACT OF BT POTATOES ON NON-TARGET ARTHROPODS.** *Nedvěd O., Spitzer L., Kaluškov P.* - We conclude that the presence of Cry 3Aa toxin was very effective against the target pest, Colorado Potato Beetle, and had no adverse effect on non-target taxa of arthropods. Seasonality had always the largest effect on the community structure and abundance of monitored organisms.

- **Kaluškov P. & Nedvěd O. (2005):** Genetically modified potatoes expressing Cry 3A protein do not affect aphidophagous coccinellids. *Journal of Applied Entomology* 129(8): 401-406.

Abstract

Field investigations showed that genetically modified *Bacillus thuringiensis* (Bt) potato plants expressing Cry 3Aa toxic protein were not damaged by the Colorado potato beetle *Leptinotarsa decemlineata* and contained diverse populations of the aphidophagous coccinellids *Coccinella septempunctata*, *Coccinula quatuordecimpustulata*, *Hippodamia variegata* and *Propylea quatuordecimpunctata*. The insecticides, alpha-cypermethrin and fipronil, which were used for control of *Leptinotarsa* in the fields with the non-transgenic standard potatoes caused significant decrease in the abundance of aphidophagous coccinellids. Laboratory experiments revealed that Bt potatoes expressing Cry 3Aa had no effect on the aphid *Myzus persicae* and that the aphids fed on Bt potatoes had no effect on the larval development and mortality of *C. septempunctata*.

- **Zwahlen C., Hilbeck A., Howald R. & Nentwig W. (2003):** Effects of transgenic Bt corn litter on the earthworm *Lumbricus terrestris*. *Molecular Ecology* 12: 1077–1086.

Abstract

A 200-day study was carried out to investigate the impact of transgenic *Bacillus thuringiensis* (Bt) corn on immature and adult *Lumbricus terrestris* in the field and in the laboratory. Another objective of this study was to develop test methods that could be used for standard testing of the impact of transgenic plants on different earthworm species in the field and in the laboratory. For this purpose two different experiments were involved, a laboratory experiment with adult *L. terrestris* and a field experiment with immature *L. terrestris*. No lethal effects of transgenic Bt corn on immature and adult earthworms were observed.

- **Candolfi M. P., Brown K., Grimm C., Reber B. & Schmidli H. (2004):** A Faunistic Approach to Assess Potential Side-Effects of Genetically Modified Bt-Corn on Non-Target Arthropods Under Field Conditions. *Biocontrol Science and Technology* 14(2): 129-170.

Abstract

A faunistic study investigating the potential side-effects of corn (*Zea mays*) genetically modified to express a truncated Cry1Ab protein derived from *Bacillus thuringiensis* subsp. *kurstaki*, on non-target arthropods was carried out under field conditions. The communities of non-target arthropods in the soil, on the leaves and flying in the crop area were monitored throughout the growing season. Water-treated, untransformed corn served as a control, and a spray application of a bacterial Bt insecticide (Delfin WG) and a synthetic insecticide (Karate Xpress) used to control the European corn borer (*Ostrinia nubilalis*; Lepidoptera: Pyralidae) acted as positive reference treatments. Results were analyzed using a principal response curve. Significantly lower infestations by the lepidopteran target species *O. nubilalis* were observed in the Bt-corn plots compared to the control. No effects of Bt-corn on the communities of soil dwelling and non-target plant dwelling arthropods were observed. A trend towards a community effect on flying arthropods was observed with lower abundance of adult Lepidoptera, flies in the families Lonchopteridae, Mycetophilidae and Syrphidae, and the hymenopteran parasitoids

Ceraphronidae. Effects were weak and restricted to two sampling dates corresponding to anthesis. A short but statistically significant effect of Karate Xpress and Delfin was observed on the community of plant dwellers and a prolonged effect of Karate Xpress on the soil dwellers.

- **Timothy D. & Buntin G. D (2005):** Effect of *Bacillus thuringiensis* Transgenic Corn for Lepidopteran Control on Nontarget Arthropods. *Environmental Entomology* 34(5):1292-1301.

Abstract

Field populations of nontarget arthropods in transgenic corn with the MON 810 event expressing the Cry1Ab endotoxin from *Bacillus thuringiensis* variety *kurstaki* (*Bt*) were compared with those in conventional, near isogenic corn. The study was conducted at two locations in Georgia in 2001 and 2002 using visual counts, pitfall traps, and corn ear insect evaluations. Results were analyzed by trial using a repeated-measure analysis of variance (ANOVA) and a combined ANOVA of all trials. The only insect whose numbers were strongly affected by the *Bt* corn was the corn earworm, *Helicoverpa zea* (Boddie), a target insect. When averaged over all trials, larvae and adults of sap beetles, *Carpophilus* spp. (mostly *C. lugubris* Murray), and larvae of the otitid fly *Euxesta stigmatis* Loew were less abundant on *Bt* than non-*Bt* corn ears. Kernel damage caused by *H. zea* was less in *Bt* corn, which presumably made *Bt* corn ears less attractive to these insects. There were no consistent significant differences in nontarget phytophagous and predaceous arthropods in the visual counts and pitfall traps between *Bt* and non-*Bt* corn. One exception was *Nabis* spp., which was less abundant in *Bt* than non-*Bt* corn in the combined analysis. Flea beetles, mostly corn flea beetle, *Chaetocnema pulicaria* Melsheimer, were more abundant on *Bt* than non-*Bt* corn in the combined analysis but presumably were not adversely affected by the *Bt* corn. With the exception of nabids, these results indicate that transgenic *Bt* field corn containing the MON 810 event did not have an adverse effect on populations of nontarget phytophagous or predaceous arthropods in the Georgia corn system.

- **Reuter T. & Aulrich K. (2003):** Investigations on genetically modified maize (Bt-maize) in pig nutrition: fate of feed-ingested foreign DNA in pig bodies. *Eur Food Res Technol* 216:185–192.

Abstract

The passage and fate of ingested DNA in 48 pigs fed with diets containing (n=12) parental or (n=36) transgenic (Bt) maize were examined. Pigs were fattened from an initial live weight of 24 kg to approximately 108 kg. Animals fed transgenic maize were slaughtered in groups (n=6) 4, 8, 12, 24, 48 and 72 h after feeding the last maize-containing diet. Those slaughtered at up to 12 h received no further feed, while those held for longer prior to slaughter received a diet in which maize was replaced by barley and wheat. Control animals were slaughtered at 4 and 8 h. DNA extracted from tissues and gut contents was examined by PCR for the presence of plant DNA and for any transgenic material. Recombinant DNA was detectable in the intestinal contents up to 48 h after the last feeding of a diet containing the transgenic maize. PCR amplification of plant gene spacers produced fragments of different sizes, dependent on feed source. The feed source of rectum samples depended on individual passage rate in the groups and their restriction analysis showed grain species-specific patterns. Recombinant or maize-specific DNA was not detectable in tissue samples of pigs. In contrast, plant DNA fragments were detectable in the investigated pig tissues.

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...)?

30 responses obtained

Majority of consultees (46.7 %) did not assume that GM crops had a negative impact on the renewable resources; these were mostly threatened by wrong farming practices (inappropriate crop rotation, the deterioration of soil structure caused by mechanical pressure caused by intensive soil and plant treatment, row direction and spacing etc.) regardless the used technology (GM vs. non-GM plants). According to some experts reasonable use of GM plants could even save the renewable resources in comparison with conventional farming.

33.3% of consultees believed that GM crops cultivation could have a positive impact on renewable resources as regards increased plant production for biogas and bio ethanol stations.

20 % of consultees did not know nor had insufficient verified information to assess the issue.

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

29 responses obtained

41.5 % of consultees stated that the impact of GM crops on non- renewable resources did not differ from the impact of conventional crops.

38 % of consultees assumed that GMOs could have rather positive effect on non-renewable resources as regards the reduced fosile fuel and energy use particularly if the area with GM crops enlarged. These savings could come from lower fuel usage and reduced production of insecticides.

20.5 % of consultees did not feel competent to assess the issue.

Any other impacts

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?

27 responses obtained

As regards MON 810, the only approved GM crop, majority of consultees (86 %) stated that areas sown with this GM maize were too limited in the Czech Republic and Europe to have any impact on climate change. Nevertheless, if the areas sown with Bt maize raised, some negative impacts resulting from climate change (excessive use of insecticides against corn borer that migrated from warmer regions) could be mitigated.

Other GM plants that could help mitigate and adapt to climate change are still under development. (e.g. plants resistant to salinity and drought stress).

14 % of consultees stated that it is too early to assess the issue since MON 810 was authorised in Europe only 10 years ago.

Any other impacts

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?

32 responses obtained

50 % of consultees experienced lower fuel and energy consumption resulting from MON 810 cultivation (fewer insecticide treatments). There could be also lower costs for pesticide production (energy and fuel for their production, transport, packaging production and their disposal).

47% of consultees stated that areas sown with this GM maize were too limited in the Czech Republic and Europe to have significant impact on energy and fuel needs / consumption.

3 % of consultees did not know.

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

27 responses obtained

52 % of consultees believed that the impact of the MON 810 (the only approved GM crop for cultivation) on the demand for transport was not distinguishable from the impact of the conventional production.

26 % of the consultees stated that the impact of MON 810 on the issue was rather negative. GM production has to be transported in compliance with the Directive 2008/68/EC, on the inland transport of dangerous goods, which provisions increase the costs for transport.

Regarding the transport of GM seeds for field trials, transport companies must have permission for transport of GM material issued by the Ministry of the Environment of the Czech Republic. Few companies entitled to transport GM material increased the price of their services.

15 % of consultees did not have relevant information on the issue.

7% of consultees believed that the impact on the issue was rather positive for transport companies as they could extend their logistics supply.

Any other impacts

- So far, scientifically sound evidence on risks for human and / or animal health was not proved.
- European reluctant attitude to GM cultivation resulted in (i) lower competitiveness to the world biggest GM producers and (ii) dependence on import causing higher prices of feed.

3 - Other Implications