The strategy of COEXISTENCE

The latest Eurobarometer survey on science and technology shows that a third of Europeans are hostile to GMOs, another third are favourable and the rest do not know what to think. Faced with this divided public opinion, neither a radical ban nor total freedom without a safety net is the answer. Hence the EU's democratic option of giving the consumer freedom of choice. For this to be a real choice, however, there must be contained but transparent coexistence of the 'genetically modified' and 'conventional' agri-foodstuff chains. This is the challenge researchers on the Co-ExTra project are currently seeking to meet. *

Co-ExTra is a four-year project involving over 200 scientists from 18 countries with a budget of €24 million, €14 million of which comes from the European Commission. Coordinated by Yves Bertheau of the Institut National de la Recherche Agronomique (INRA - France), this is the latest in an already long line of European GMO research projects.(1) Its aim is to develop a rigorous approach to supply chain separation as this is an essential condition for the coexistence of genetically modified organisms and other products. Unfortunately, it is an almost Herculean task.

The reality is that food production processes are becoming increasing complex and international, while the consumer is rarely aware, on purchasing an oven-ready dish – an ordinary pizza, for example – of the diversity of ingredients it contains and the issues this raises. The solution lies in a single word: traceability. It is only this that can guarantee a hermetic separation between modified and non-modified produce, from the crops in the field to the end product.

Tracing the origins

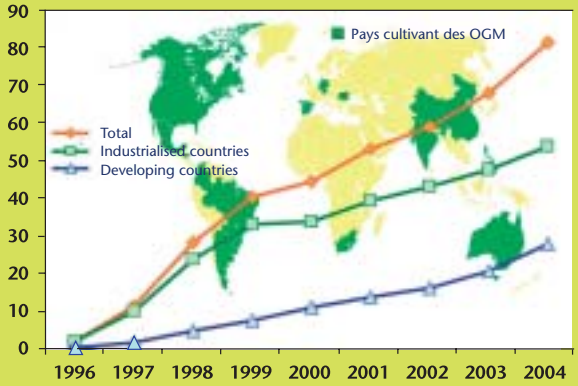
Traceability must make it possible to know exactly what colza oil – genetically modified (GM) or not – was used to produce the oil the pizza was cooked in, what maize (GM or non-GM) the starch was extracted from and where the tomatoes were grown. All of which becomes even more complicated when it comes to animal products as, in principle, it implies knowing what the pigs ate that were slaughtered to produce the ham, or even what the cows ate that were milked to make the cheese.

Mission impossible? "GMOs are not alone in posing problems of traceability," points out Yves Bertheau. "Learning how to manage GMOs will help us resolve other problems. For example, from 2006 we will be obliged to label all potentially allergenic products sold in the EU. This is because certain people can react very violently to seafood, to peanuts, or to mustard, for example. In some cases, simply inhaling their dust can be enough to trigger a serious attack. So in any event we are going to have to learn how to separate the supply chains, if only for health reasons. Then there is the question of quality assurance. Whilst it seems that the consumer is prepared to pay the price for a given origin or production process, that consumer must not be duped."

* *GM and non-GM supply chains: their CO-EXistence and TRAceability*

(1) In particular, the Entransfood (www.entransfood.nl/) initiative, the QPCRGMOFOOD (GMO detection by DNA extraction) projects, GMOCHIPS (www.gmochips.org/) and SIGMEA (see following page).
See also: EC-sponsored Research on Safety of Genetically Modified Organisms, Luxembourg, 2001, ISBN:92-894-1527-4.

GLOBAL GROWTH OF GMOS
(in millions of hectares, between 1996 and 2004)



20% increase in global surface area given over to GMOs between 2003 and 2004, reaching 32.9 million hectares worldwide.

More countries are growing more GM crops. The European Union, together with Japan and South Korea, are notable exceptions. Even Brazil, historically one of the EU's principal suppliers of non-GM soya, is no exception to a trend that could bring supply problems for Europe.
Source: Clive Jame, 2004

Agricultural challenge

To carry out this delicate exercise successfully, Co-ExTra has put into place a policy of strict separation of tasks between its various working groups.

One team is responsible for field studies and the systems of bio-confinement that make it possible to restrict the gene flows. Coexistence that avoids the risk of contamination between genetically modified plants and natural plants through the spread of pollen is one of the most sensitive aspects of the GMO issue. While avoiding any overlap with certain aspects of the SIGMEA project (see p23) or the upcoming Bio-Container project, this first team will look at the varieties, species and growing methods that make it possible to minimise the environmental impact of GMOs. The researchers will develop pollen-dispersion models and then compare these models with the reality of the agricultural landscapes in various European countries (the United Kingdom, France, Bulgaria and Germany).

Identifying the critical points

The second team will investigate a very different but equally critical field. This involves describing the supply chains and identifying the critical points – or, in other words, the stages that present a risk of contamination. Examples are the ports of arrival for the soya that comes both from the United States – soya that is almost certainly classed as GMO – and from Brazil, where GM crops are only produced on a very small scale. Then there are the silos into which whole wagons of maize are dumped and that may come from France (fewer than 1 000 ha under GMOs in 2005) or Spain (60 000 ha under GMOs). These are all sites where there is the risk of accidental mixing or other handling errors. Further upstream, there are the many processing plants that are supplied by different countries. It is the job of the scientists not only to identify these critical points but also to make proposals for a production organisation that is safe and acceptable for both consumers and industrialists.

Field test with a genetically modified grafting stock to protect the vine against the grapevine fanleaf virus for which there is no treatment. To isolate the test plot, it is covered with a a non-woven geotextile sheet that is permeable to water but not to nematodes. France, July 2005.
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This brings us to the question of the economic aspects – the costs and benefits – of implementing this separation between GMO and conventional supply chains. "The costs are what the economists like the best," remarks Yves Bertheau, "because they are the easiest to calculate. You take the existing system – the industrial chain as it is, with its processing, packaging, cooking costs, etc. – and then all the added measures – controls, tests, sampling – are seen as the new costs of coexistence. Traceability is expensive in terms of management. It requires computer programmes and checks on the information processing, for example. But apart from expenditure, there is the difficulty of identifying and calculating the benefits, which are generally hidden. But if we succeed in managing this GMO/non-GMO distinction, we will then be able to apply it to other sorting processes, for allergens, irradiated products, or to improve RDO (Registered Designation of Origin) products." This will be the task for the third working group, coordinated by the Danish Research Institute of Food Economics.

The complexity of detection

Rules mean controls. It is a question of verifying a producer's or a supplier's guarantee 'on paper' that his/her product is GMO-free. Once again, tracking is complex and costly. Since last year, a Regulation (known as Regulation '18-29-03') obliges any GMO producer seeking to market his/her products in the EU to provide, via a Community reference laboratory, details of the detection procedures applied. Although this has considerably reduced the burden on the laboratories,

***In vitro* crop monitoring in an air-conditioned chamber.**
©INRA/Christian Slagmulder

it has not solved everything. For example, how can the presence be detected in the EU of 'unauthorised' GMOs for which identification methods have yet to be communicated?

"It still often happens that we discover on the internet sites of a third country a new GMO that contains a particular promoter, encoding gene or terminator," admits Yves Bertheau. "We just have to make do with these indications, especially as biotechnological industrialists are not necessarily very co-operative. What is more, many mistakes are made. In the P35S promoter, which was used in the first GMOs, we

Experimentation with colza (on the left) and beetroot (on the right) for double resistance research, showing the survivors.
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find up to 20 different sequences, for example, truncated or modified in some way. Then there are the rearrangements that can occur during processing. So we have to be very careful not to miss a GMO."

No fewer than three Co-ExTra teams are looking at these questions, coordinated respectively by the EC's Joint Research Centre at Ispra, the Slovenian National Institute of Biology, and the Norwegian National Veterinary Institute. This brings us to the field of molecular biology and DNA chips, PCR (Polymerase Chain Reaction) in all its forms, hybridisation and, more generally, all the devices that make it possible, using statistics and the appropriate control plans, to track the sequences of suspect nucleic acids, hidden away among the millions of base genome pairs. But effective laboratory techniques are not enough. Tools must be developed that are easy to use, can be integrated in other systems, are compatible with the user constraints and the regulations, and are available at a reasonable cost. The solution can, for example, be to combine simple and inexpensive methods with more precise and costly techniques, depending on the procedures to be validated

Mathematics, law and ethics

Alongside the techniques of molecular biology, mathematics also has a role to play. The aim here is rapidly to improve the methods while also reducing what is known as 'measurement uncertainty', by optimising the calibrations and the number of repetitions depending on the precision required and nature of the information sought. Methods must be developed that present 'acceptable' detection and quantification limits, depending on the nature and intended use of the product in question. "Here too," stresses the Co-ExTra coordinator, "the progress achieved can serve other fields, in particular the detection of pathogenic micro-organisms."

Legal and ethical questions have also been taken on board and are the responsibility of a working group coordinated by Julian Linderlere, professor at the Sheffield Institute for Biotechnological Law and Ethics (Sible). European Directives have not been transposed in the same way into all national legislation, and the GMO issue includes an important international trade element that raises a number of specific legal questions, as demonstrated by controversies over trade flows in soya and maize or the current case where certain third-country GMO producers have referred EU practices to the WTO. It is for this reason that two research institutions from countries that export to the EU are partners in this research project: the Parana Institute of Technology (Tecpar) and the Instituto Nacional de Tecnologia Agropecuari (INTA) in Argentina. The main problem in this field is the liability of the various players in the supply chain in the case of litigation. Few states have really tackled this issue of the legal implications of coexistence and this working group is charged with compiling an inventory of current practices and assessing the advantages and disadvantages of the solutions proposed.

On the information front

These researchers must also submit proposals concerning the concrete organisation of traceability, and regarding information and documentation in particular. The issues here are what information on what regulations and scientific practices must be communicated and at what level – simply between operators, with a European databank or more internationally? These are all crucial questions in ensuring effective supply chain separation.

Finally, a last group of researchers, coordinated by the German communication company Genius GmbH, provides an interface between the programme and the social players, both by making clear information and decision-making tools available to users – especially via the internet – and by taking into account the demands of various operators. This involves gathering the opinions (desires, difficulties and fears) and experiences of all those concerned by these issues, from the seed producers and farmers to the consumers. The experience acquired in some sectors – maize, waxy, colza, double zero, 'non-GMO' supply chains and some distributors – must serve for all so as to limit the price for the final recipient.

Sign indicating the entrance to an experimental culture area.
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Label of ingredients for an industrial bread containing GMO products.
©INRA/Gérard Paillard

Co-ExTra is also a member of the new Coex-Net network that is designed to facilitate the exchange of information between Member States. Many of these are currently seeking to define more precisely the type of measures to be implemented to ensure coexistence. This is why it is vital to have appropriate tools while providing the consumer with what he/she wants at the least cost. "At the end of the day," concludes Yves Bertheau, "it is the market that will decide whether it wants GMOs or not. Our job is to anticipate problems, propose solutions and protect the consumer." ■

To find out more

- www.coextra.org/default.html

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