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GMO COEXISTENCE RESEARCH IN EUROPEAN AGRICULTURE

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Cataloguing data can be found at the end of this publication.

Luxembourg: Office for Official Publications of the European Communities, 2006

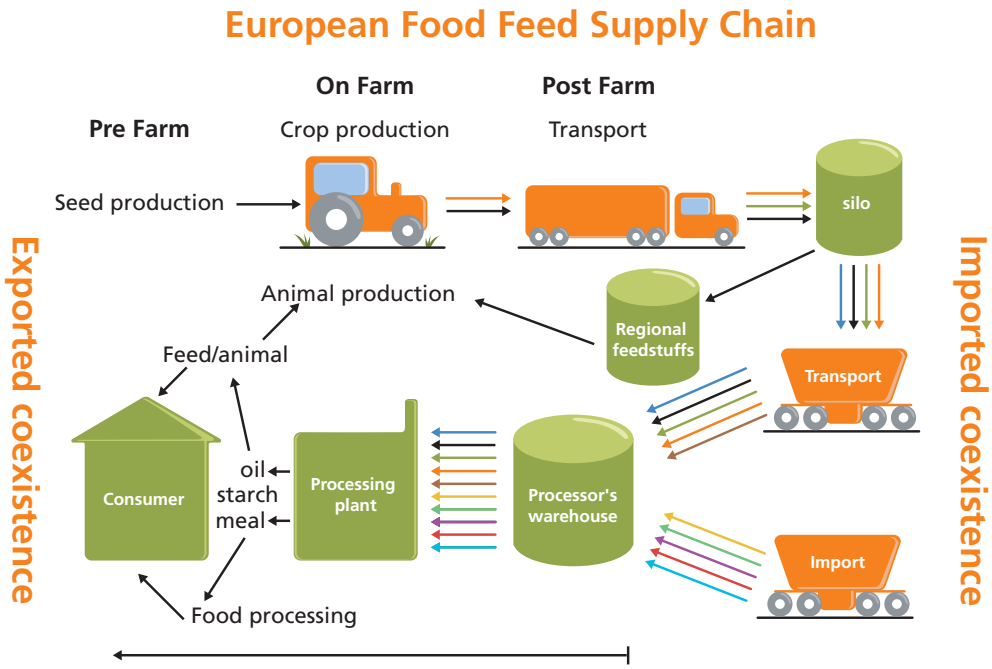
ISBN 92-79-01686-5

Printed in Belgium

PRINTED ON WHITE CHLORINE-FREE PAPER

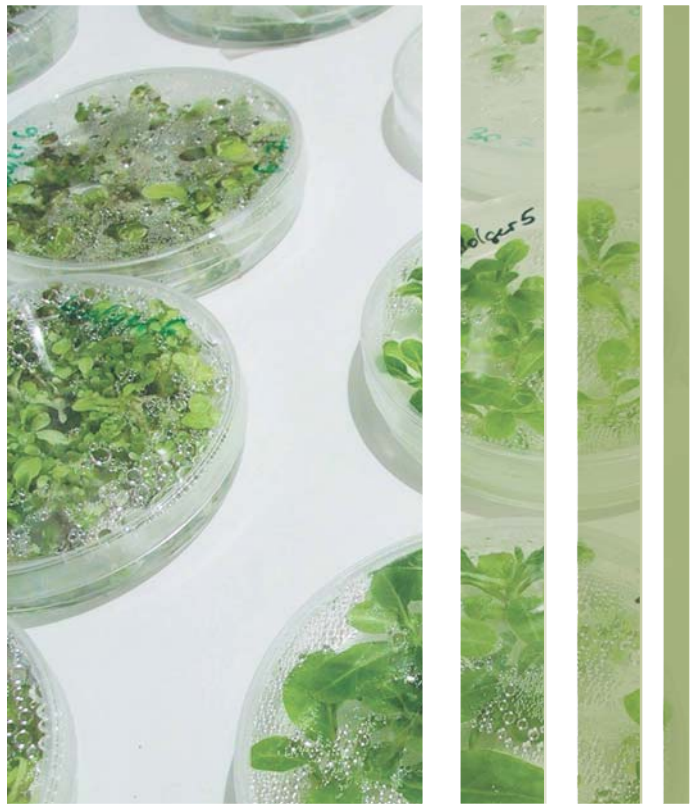
Coexistence

In simple terms, coexistence is a way of allowing farmers to choose between conventional, organic and genetically modified (GM) crop production. Due to its unique multi-step and multi-player nature, the complete farming, food and feed production chain is complex and difficult to control. Traditionally, the integrity of the chain has been protected mainly from chemical and microbial residues, while farmers have used coexistence as a standard agronomical control tool for crop rotations. However, the introduction of genetically modified crops into the food chain and the imperatives of consumer choice have created a further degree of complexity for European farmers and consumers.



With GM maize being cultivated in some European countries and with increasing quantities of imported GM products arriving in our ports, appropriate legislation was introduced in 2003 to control European GM introduction and production (see box). Such legislation calls for tools to allow all players along the chain, from the farmer to the supermarket, and from the field to the kitchen, to make conscious, informed choices. The EU's Sixth Framework Programme for Research (FP6), which ran from 2002 to 2006, addressed these issues by funding research projects which would promote greater understanding of how coexistence could be practically applied and enforced along the chain, and thus help support the existing and any pending legislation and policy.

DG RTD takes action



During FP6, three research projects, described below, were selected. They involved over 105 scientists and institutes from 23 countries – including Argentina, Brazil, China and Russia – with a total EU investment of €20 million:

- the first was SIGMEA which won a call in 2003 for research into the overall role of GM crops in agriculture with respect to the whole-system measurement of socio-economic and ecological effects, including biological indicators for total traceability of GM cultivation in the countryside;
- the second was Co-Extra which was awarded from a call in 2004 looking for integrated methodologies to trace GM materials all along the food chain and to facilitate the coexistence of genetically modified, conventional and organic crops. It also called for practical systems – suitable for use by all stakeholders in the food chain – for sampling, tracing, labelling and documenting GM content of foods and feeds;
- the third was Transcontainer which received funding under a call in 2005 for the development of efficient and stable biological GM containment systems for important European crops, and allowing for the participation of all players in understanding and appreciating the technologies developed by the seed companies.

EU-funded research into coexistence demonstrates how FP6 has addressed the most pressing RTD support needs related to existing or pending legislation. These wide networks and the active involvement of farmers, industry, retailers, consumers and policy-makers in the projects guarantee high visibility. They also illustrate perfectly the 'fork to farm' philosophy of FP6's priority 5, where the needs of consumers are being directly met by EU research policy.

More to do

However, not all aspects of coexistence have been addressed here and successive programmes, such as FP7 (2007-2013), will need to tackle outstanding issues, such as the effects on biodiversity, including gene transfer, changes in indicator species, recommendations for possible mitigation measures, and strategies for long-term monitoring of potential environmental effects of released GMOs

EU regulatory framework

The entire body of GMO legislation has recently been amended, leading to the creation of a new legal framework. The main legal instruments are as follows:

Regulation (EC) 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed.

Regulation (EC) 1830/2003 of the European Parliament and of the Council of 22 September 2003 concerning the traceability and labelling of genetically modified organisms and the traceability of food and feed products produced from genetically modified organisms, and amending Directive 2001/18/EC.

Commission Regulation (EC) 65/2004 of 14 January 2004 establishing a system for the development and assignment of unique identifiers for genetically modified organisms.

Commission Regulation (EC) 641/2004 of 6 April 2004 on detailed rules for the implementation of Regulation (EC) 1829/2003 of the European Parliament and of the Council as regards the application for the authorisation of new genetically modified food and feed, the notification of existing products and adventitious or technically unavoidable presence of genetically modified material which has benefited from a favourable risk evaluation.

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.

SIGMEA: harvesting the fruits of diverse research

In Europe, agricultural landscapes are very diverse: from the vast farms found in Eastern Germany or the Beauce region of France, to the tiny plots of less than a hectare found in Eastern Poland. The analysis of coexistence in the field is therefore a very complex issue. In addition to landscape patterns and size, many variables must be taken into account, including gene flow, and different crop and farming methods.

The EU regulatory system requires strict pre-marketing evaluation, labelling of GMOs, and post-marketing traceability. But the information needed to implement this policy is extremely fragmented. To build an integrated and dynamic decision-support system for assessing sustainable regional farming, we need to process, check and audit the many statistics available in order to bridge the various knowledge gaps.

Strands of coexistence

The SIGMEA project seeks to bring together the different threads needed to create a tool kit for evaluating the ecological and socio-economic impacts of GM crops. To ensure the best synergy on co-existence, SIGMEA's team is made up of researchers from all across Europe and it brings together more than 30 top institutes and research bodies. The project is developing tools and models to predict which crops should be adopted, by what type of farmers, as well as to identify and map coexistence hot spots. For the first time in Europe accurate gene flow data across different farming practices will be analysed to provide practical advice for the various scenarios and stakeholders.

Forecasting flows in the field

The key question concerns cross-pollination and gene crossover which occurs when pollen drifts from fields of GM crops to pollinate conventional crops in other fields. In some cases, farmers growing conventional or organic crops could be penalised due to a loss of market as their produce is no longer 'pure'. To prevent cross-pollination, SIGMEA is developing a structured database which feeds into a Landscape Generator designed to integrate geographically referenced information into the models of gene flow from GM crops. This will deliver real-life simulations of GM and non-GM co-existence in many European countries.

Developing a long-term monitoring strategy, the project will map out scenarios for managing coexistence and will provide essential elements for defining legal liability through identifying the necessary farming practices needed to avoid unintended mixing of GM and non-GM crops.

SIGMEA also supports policy-makers in predicting economic impacts, formulating cost-benefit analyses of GMO introduction, and understanding the insurance liability. Above all, it will ultimately develop simple, fast, reliable and cheap tools that can be used directly by farmers.

Project information

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EU funding: €3 million

Co-Extra: the ability to trace GM products along the entire food and feed supply chain

Consumer interest in the origin and quality of food has been consistently on the rise due to food scares and more discerning consumer attitudes. Ideally, what the consumer wants is to be able to make an informed choice as to whether the food she or he buys contains GMOs or not, along with information on its origin, ingredients and dietary value. Giving consumers such freedom of choice is becoming increasingly difficult. Naturally, it begins on the farm and, from that point on, any foodstuff or ingredient should ideally be able to be traced to its origin and place along the chain in either direction. In Europe, such traceability is legally mandated for food and feed consisting of or made from GMOs, and it is governed by EU Regulation 1830/2003 which obliges every stakeholder, from the very onset, to inform every consumer of the presence of GMOs in their product.

The requirements for documentation, traceability, and labelling will place new demands on stakeholders in the food supply chain. Operators may consider changing suppliers to keep their products free of labelling requirements, spending extra time cleaning machines between GM and non-GM ingredients, or expanding storage to ensure that different products do not mix. All of these activities translate into added costs. Therefore, stakeholders need to plan for the potential economic impact of labelling and traceability.

The Co-Extra Integrated Research Project addresses these economic aspects of coexistence and traceability. In particular, it will look into ways of determining how new demands placed upon producers will reflect on product prices, and how these will, in turn, influence consumers, purchasing decisions. The project will also develop guidelines to help farmers choose the best cultivars and culture practices that will decrease cross-contamination, and determine the best ways of dealing with admixtures and determining liability when it occurs.

Giving consumers a little extra

Co-Extra will, thus, provide the technical tools needed to keep GM and non-GM crops separate on the farm, in transport and on production lines. This will make it clear to all food and feed operators, and ultimately to consumers, exactly what they have purchased. In the end, having a better general understanding of food and feed supply chains will enhance food quality and security in ways reaching far beyond the issue of GMOs.

With 52 partners in 18 countries, Co-Extra is studying and validating biological containment methods and modelling supply chain organisations. It will enable the tracing of transgenic products along the food and feed chains, will survey practices and legal regimes both within and outside Europe, and analyse the costs and benefits of implementing traceability and coexistence systems.

Cooking up better recipes

The project will create innovative techniques and guidelines to overcome the limits of current detection methodologies. It will develop and validate cost-effective, fit-for-purpose methods for sampling and detecting GMOs. It will produce proposals for reliable, complete and cost-effective traceability information management throughout the food and feed chains. Co-Extra plans to assess the reliability, in the field, of some bio-confinement methods and the large-scale effects of certain culture practices. It intends to develop mathematical models of pollen emission and long-distance dissemination, as well as models of supply chain organisations, taking into account economic and other critical factors.

Project information

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EU funding: €13 million

Transcontainer: genetic control

The issue of coexistence is actually as old as agriculture itself. Over numerous generations, the genetic make-up of farmed plants varies significantly from their wild relatives, and cross-pollination is usually regarded as undesirable. In the case of GMOs, there is also the need to ensure that modified genes do not accidentally migrate to conventional, organic or wild plant species, particularly in the case of genetically modified non-food plants.

There are a number of possible biological approaches to limiting such undesirable gene flows, including sterilising GM plants, preventing flowering, and controlling the pollination process. The uncertain risks of agri-biotechnology have remained a source of divergent views among regulators, innovators and public-interest organisations. As with many other technologies involving certain hazards, this requires careful consideration of the benefits and risks.

Transcontainer will test the coexistence of GM and non-GM (including organic) agriculture in Europe by developing the most stable, environmentally safe and viable biological containment strategies in economically relevant European crops. Stakeholders interested in these issues include biotechnology companies, seed firms, food and feed manufacture retailers, conventional and organic farmers, consumers, and environmental groups and regulators.

Reining in genetic flows

With 15 partners from universities, research and government institutes, as well as industry, the overall goal of Transcontainer is to lift a major obstacle to fulfilling the promises of agricultural biotechnology in Europe, and thus increase the competitiveness of that sector. Transcontainer will investigate and develop a number of strategies for biological containment, such as plastid transformation, the prevention of flowering, and controlling transgenic transmissions through pollen and seed.

Transcontainer will perform an environmental assessment that targets the efficiency of containment schemes, as well as the potential impact of the new genes that will be employed on non-target organisms, such as the wild relatives of domesticated crops, beneficial animals, as well as their effects on human health. Environmental effects will be explained and assessed based on our current knowledge of plant biology, metabolic pathway integration and interconnectivities.

The project will also seek to identify how these strategies affect food safety and consumer choice and how they can be complemented with tightly controllable switches to restore fertility where necessary. It focusses on a number of representative crops, such as oil rapeseed for seed plants, tomato and aubergine for fruit, as well as sugar beet, rye grass, red fescue, poplar and birch for vegetative plants.

Finding consensual views

Transcontainer's goals also go beyond the biological means of GM control. The project is will communicate the results of the technical, biosafety and socio-economic research to parties interested in (regulatory) policy and public debates on the coexistence of GM and non-GM crops and 'outcrossing' from GM plants to wild plants. The overall goal of such communication is to facilitate informed policy and political debates on the potential of biologically contained GM crops. It is up to governments and society as a whole to decide whether the existing risks of transgene spread of GMOs are at an acceptably low level, in order to allow their release in the field.

Project information

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EU funding: €4 million

European Commission
GMO Coexistence Research in European Agriculture
Luxembourg: Office for Official Publications of the European Communities
2006 — 9 pp. — 17.6 x 25 cm
ISBN 92-79-01686-5

KI-75-06-291-EN-C

Publications Office
Publications.eu.int

ISBN 92-79-01686-5