

Impact of biotechnology on trade: The European viewpoint concerning animal feeds

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ABSTRACT: Europe, in particular the European Union (EU), is far from self-sufficient in its requirements for animal feedstuffs. Any eventual improvement in yield, quality, and nutritional balance of foods and feeds using genetic modification would be of interest to animal producers. A special EU directive has been in place since 1990 for the assessment of the safety of plants and plant products with novel traits. Under the recommendation of the Scientific Committees of the General Directorate on Health and Safety of the Consumer, the European Commission recommended the

release of several plants and plant products into the environment and their use for feeding humans and farm animals up to 1999. However, consumers' attitudes are presently far from unanimous with regard to accepting these decisions. This leads to a cautious and diversified situation between countries in the application of the decisions on authorization, cultivation and use of these new products. A description of this situation, the moratorium initiated in 1999, and the expression of public concern is presented in this article. The response and the role of research is also discussed.

Key Words: Animals, Europe, Feeds, Transgenic Plants

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J. Anim. Sci. 79(E. Suppl.):E86–E90

Introduction

Biotechnology has gained the attention of a very diversified audience with diverse opinions about the subject during recent years. As in the United States, numerous questions and promises have been expressed in the European Union (EU). Scientists, policy makers, and consumers are directly and indirectly concerned about the safety of the resulting products for humans and the environment. Scientists believe that a revolution has been taking place in the life sciences, particularly in plant breeding, since kanamycin-resistant tobacco appeared in 1983 (Chesson and Flint, 1999). In addition to the resistance of plants to herbicides and major pests, resistance to diseases, particularly to fungi that produce mycotoxins, would be of utmost importance to nutritionists. Animal nutritionists are particularly aware of and confident in the potential modification of the chemical composition of plants and plant products in the near future to fit them to the nutritional requirements of animals. Oil content of grains such as corn and oil resistant to oxidation are of direct interest to those who study nutrition of nonruminant farm ani-

mals such as pigs and poultry. Modifications in the content of proteins and their amino acid balance are of importance to the future of animal feeding (Molvig et al., 1997). Improvement in vitamin content and, to a lesser extent, iron content in genetically modified (GM) plants could also offer potential advantages over classic varieties of plants. However, the most important and urgent issue is the experimental demonstration of the safety of the new plants and their derivatives for their use as raw and processed food in the human diet or as raw or processed feeds for farm animals. The evaluation of the safety and the acceptance of the product by European consumers will be developed in this article.

Assessment of the Safety of New Plants as Food and Feed in Europe

In the EU, several national agencies such as the UK Advisory Committee on Novel Foods and Process (UK ACNFP) and the Biomolecular Engineering Commission (CGB) in France, were first created in the middle of the 1980s to assess the safety of genetically modified organisms (GMO). The official authorities of the Commission of the European Communities later took a stance by preparing a general regulation that is still in operation (EC Council Directive, 1990). This directive concerns the deliberate release of GMO into the environment. The new terms GM and GMO are now widely used, probably without sufficient explanation or trans-

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Received July 24, 2000.

Accepted April 5, 2001.

lation for the general public. A special Commission on Health and Protection of the Consumer (DG XXIV) has been created to support the Commission on Agriculture and its Direction General (DG VI), the Commission on Industry (DG III), the Commission on Environment (DG XI) to take charge of the health and safety of the consumer (DG XXIV). Eight specialized scientific committees have been created, reshaped, or reorganized to express independent opinions on the assessment of the safety of GMO for humans and the environment.

Consumers became progressively aware of but insufficiently informed about the existence and the presence of GMO in food and about the absence of consequences for human health. Consumers are presently expressing their concerns of the unknown, sometimes responding to the fear created by organizations acting nationally and internationally. The effect of several events concerning the safety of food for human and feeds for animals in Europe and the risks of food-borne diseases have recently increased consumers' concerns. These events, considered scandals, have had direct effects on trade. Various consequences of the decision of the European Commission on the authorization or on the ban of the release and cultivation of new plants have recently appeared in the EU. This article will focus on the consequences of biotechnology as applied to plant breeding by using genetic modification for the production of animal feeds. A tentative summary of the different regulations and processes issued and used to evaluate their safety will be developed.

Strengths and Weaknesses of the Animal Feed Industry in the EU

The European animal feed industry is flourishing, producing 125×10^6 t (Mt) of compound feeds per year in addition to forages in 15 countries of the EU. These feeds sustained a herd of 34.4×10^6 dairy cows and the production of 35 Mt-equivalents of carcasses including beef, pork, poultry, and rabbit in 1998/1999. Constant changes are generally observed in the average composition of compound feeds between times and countries depending on the availability and prices of raw materials. The most dramatic change was observed after the General Agreement on Tariffs and Trade (GATT) in 1993 associated with the revision of the Common Agricultural Policy (CAP) and the limitation of subsidies offered to farmers to produce protein-rich feeds. The production of oilseeds and proteagineous feeds has been considerably affected by the regulations. Thus, the area of rapeseed or canola production has stopped increasing and sunflower and pea production are stagnating or decreasing. Soybean production is limited to 1 Mt of seeds per year, compared to an average requirement of almost 25 Mt. Soybeans and soybean meal represented the major sources of protein for manufacturing compound feeds, with a wide range between countries, amounting to 47 to 75% of the protein supply in the average formula of compound feeds in The Netherlands

Table 1. Protein feeds produced and used in animal feeds in the EU 15 in 1997/1998 (million tons per year of protein equivalent)

Feed	Production	Consumption
Soybean meal	0.601	12.314
Sunflower meal	0.525	1.502
Rapeseed meal	1.887	1.952
Legume seeds	0.827	1.276
Fish meal	0.6	0.826
Meat/bone meal	1.277	1.051
Dehydrated forages	0.601	0.601
Corn gluten feed	0.525	1.502

and Spain, respectively. Because of the importance of soybeans and in the absence of a significant development of alternative sources of proteins, the self-sufficiency of the EU for protein (Table 1) remained chronically limited to 30% average and required the importation of 15 Mt/yr of protein equivalent from soybeans and soybean meal, mainly from North and South America. Similar large deficits exist for corn gluten feed and dried citrus pulp, almost all imported from non-EU countries.

Conversely, the self-sufficiency for grains is nearly 100% as long as the average importation of corn grain for animal feeding is negligible; it has decreased from 3.4 Mt in 1990 to 1.6 Mt in 1999. The recent increase in the ratio between the price of soybean meal and that of corn or wheat could enhance the tendency for an increase in the use of cereals in pig and poultry diets. A large availability of soft wheat on the market amounting to 91 Mt of wheat compared to 34 Mt of corn per year leads to the use of a large proportion of soft wheat in compound feeds. A strong tendency for an increase in the amount of wheat in pig and poultry diets is consequently expected in the near future. In the absence of GM corn presently cultivated in Europe and in the absence of GM varieties of wheat, there can be no discussion for these sources of energy in concentrated feeds. The problem is different in the case of the importation and use of protein sources and corn gluten feed, which are mostly imported from North America. Similarly, the use and cultivation of GM corn for multi-purpose forage and grain production is under discussion.

Statement of Policy on Food Derived from New Genetically Modified Plant Varieties in Europe

The initial activity of the national agencies (e.g., UK ACNPD and CGB) has always been focused on the safety assessment of GMO before their release into the environment (Kahn, 1997). The EU has issued a general Council Directive on the conditions of spreading of GMO, EC 90/220 (EC Scientific Committee on Animal Nutrition, 1996). Other recommendations considered in the EU are the Directive of the Federal Register (1992) in force in the United States or the one issued by Agriculture and Agri-Food Canada (1995).

Strength	1 - Requirements for environmental assessment of GMO (90/220 EEC) 2 - Evaluation of potential adverse effects of the GMO (90/220 EEC)				
	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Human health</td> <td style="text-align: center;">Direct / Indirect</td> </tr> <tr> <td style="text-align: center;">Environment</td> <td style="text-align: center;">Immediate / Delayed</td> </tr> </table>	Human health	Direct / Indirect	Environment	Immediate / Delayed
Human health	Direct / Indirect				
Environment	Immediate / Delayed				
	3 - Recommendations for Novel Food (258/97EC)				
Weakness	4 - No equivalent regulation on Novel Feed				

Figure 1. Strengths and weaknesses of the EU regulation for approval of new genetically modified varieties of plants.

Thus, only the European Commission is qualified to authorize the release of new GM plant varieties on the basis of appropriate information prepared under the special requirements listed in the Council Directive and its annexes. Fully detailed applications for the marketing of a new plant variety must be sent to the European Commission. General Directorate DG XI in charge of the environment is acting as a coordinator. Details on the requirements are given in Annex II of the Directive 90/220. This information is required in the notification listed in Annex II A (Figure 1). Additional information relating to marketing and type of expected use is listed in Annex III of the Directive. On matters concerning health and consumer protection, the European Commission (EC) has created a successful General Directorate on Health and Consumer Protection (DG XXIV) in charge of the evaluation of risks (risk assessment) associated with the safety of humans, animals, and the environment. The Scientific Committee for Animal Nutrition (SCAN), then the Scientific Committee for Plants (SCP) in agreement with the SCAN, are responsible for the assessment of the safety of new varieties of plants on the basis of the work done by a special Working Group on GMO composed of plant geneticists, animal and human nutritionists, and toxicologists (Figure 2).

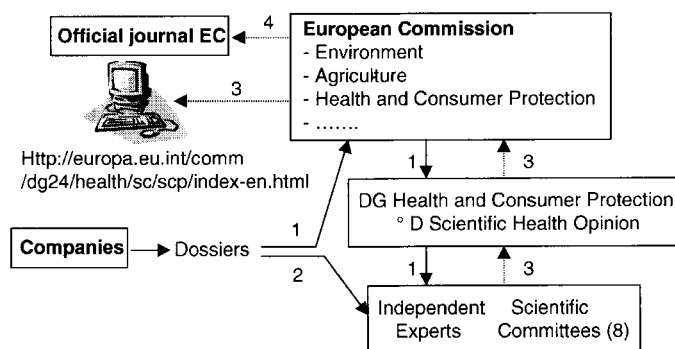


Figure 2. Summary of the procedure for notification and agreement of new genetically modified varieties of plants in the European Union: 1. notification; 2. dossier; 3. expression of scientific opinion; 4. authorization.

The safety of GMO for humans is the special responsibility of the Scientific Committee for Food (SCF). It is in particular in charge of the safety of food from animal and plant origins, including raw products and their derivatives. More recently, the SCF has also delivered opinions on the Assessment of novel foods (EC Scientific Committee on Food, 1996, 1997). Recommendations were based on the following scientific information: 1) information necessary to support application for placing new foods and new food ingredients on the market; 2) the presentation of information necessary to support application for placing new foods and new food ingredients on the market; and 3) the preparation of the initial assessment request on applications for placing new foods and new food ingredients on the market.

Nutritional, microbiological, and toxicological information are the major requirements listed in the recommendations. However, even though decisions are in progress, there are not yet similar official recommendations concerning plants, plant products, and their derivatives destined for animal feeding (Figure 1). In practice, after approval by SCAN and SCP, the information is immediately communicated over the Internet by the commission with explicit support by the Steering Committee, as indicated in Figure 2. Thereafter, the Commission launches the authorization for the release or the import of the product, through publication in the official journal of the EU. Authorizations for launching and using the new product have been delivered by the Commission for several "new plants" and "their derivatives" destined for animal feeding, such as corn, soybean, rapeseed, cotton, beets, and other plants. However, the application of recommendations by the EU member states is still pending because of the public's misunderstanding of the use of biotechnology in plant breeding.

Public Concern and Consequences for Trade of Animal Feedstuffs

Expression of Public Concern and Response

Fueled by the media and the concern of some consumer organizations in Europe associated with health

hazards, including food-borne diseases or toxicity of feeds, there has been a growing awareness in public opinion in the past years. The first issue has been associated with the origin of the genes used in the technology of GMO. Bacterial genes were the first concern, then antibiotic-resistant genes were suspected of deleterious effects on humans and the environment. Even though the possibility of the transfer of a functional bla-gene construct from GM corn into bacteria was considered to be virtually zero (EC Scientific Committee on Animal Nutrition, 1996) and the risk of transfer of any antibiotic-resistant gene used in GM of plants has not been demonstrated (US FDA, 1998), there is a growing concern being expressed. Not only the newspapers, but also controversial scientific publications, have raised doubt about the safety of genetic modification and, in general, its scientific basis.

Strong competition among supermarkets seeking new customers has also raised distrust about the safety of new food, animal products in particular. Even more difficult is the question of the delicate sector of the European and Mediterranean traditional and typical food products (Boyazoglu, 1999). The apparent growing interest for organic food has also led policy makers to develop a moratorium approach in the EU, unfortunately with major divergences between countries. Thus, Austria and Luxembourg have launched an import ban on Novartis insect resistant corn, but other member states refuse to do so. The United Kingdom has a voluntary 1-yr delay on the commercialization of herbicide-tolerant plants and a 3-yr delay on insect-resistant plants. Outside of the EU, Norway has globally refused permission for the introduction of plants bearing antibiotic-resistant genes since 1997. More generally, the European Parliament Environmental Committee in June 1999 called for a moratorium on approvals until Directive 90/220 could be revised. In February 2000, the EC indicated that judging what is an acceptable degree of risk is an eminently political responsibility and that consequently a member state may apply measures based on precaution that would lead to more protection within its boundaries. These recommendations indicate that in a state of panic politics take priority over science, but more generally that individual members states have specific permission to reject a decision made by the Commission. The EU Court of Justice has recently issued a judgment that France has no right to oppose the sale of approved corn but could ask the Commission to do so on the basis of new regulations. Labeling of foods containing GMO ingredients has been recently approved (April 2000) with a threshold of 1% for imported soybeans and soybean meal and corn products. However, this recommendation could be difficult to apply, taking into account the number and the diversity of GMO that can be present in a load of imported feeds and subsequently in a compound diet for animals. Moreover, the number and cost of analysis to control the raw material and the final feedstuffs would also be detrimental to the animal feed industry. Several indi-

vidual initiatives, though limited, are now at an experimental stage to try to avoid the use of GM products in the feeds of animals. In The Netherlands, the oil industry is prepared to produce a limited amount of non-GM soybean meal from soybean imported from Brazil. In southwestern France, a small firm producing quality labeled chickens will launch its production based on animals fed on "home-grown soybeans." However, the success and the persistence of these experimental initiatives is strongly dependent on the availability of guaranteed raw material for a specific, and thus rather narrow, market.

The Role and the Responsibility of Research

Over and above the questions posed and the existing controversy, important research has been conducted by different institutions on the consequences of the use of GMO on human health and on the environment in the EU. As an indication, more than 1,500 summary notifications concerning GMO have been circulated in the EU up to the beginning of January 2000. Among them, those regarding corn for grain and silage production, oilseed rape, sugar beet, and potatoes are numerous, followed by those regarding tomatoes and tobacco. These notifications included experiments on the effect of cross-pollination, transmission of genetic resistance and the impact on unmodified crops and wild plants. Additional impact on nontarget organisms, toxicology of residues, and food and feed safety aspects have been studied. Unfortunately, not enough results have been published in the peer-reviewed scientific literature. It is consequently difficult to convince the public about the safety of these new materials for human foods and for the environment. Moreover, an early and partial release of unconfirmed and sometimes controversial results in 1998 and 1999 is partly responsible for this unclear situation. More critical, the recent destruction of experimental plots or facilities has not always been followed by penalties. A lack of public confidence in the safety of GMO is evident. The OECD Conference on the Scientific and Health aspects of GM food (OECD, 2000) was held in Edinburgh from February 28 to March 1, 2000. Scientists expressing different views, policy makers, consumer representatives, and representatives of international organizations, as well as reporters and journalists, debated with much contradiction from their respective positions for more than 2 d. The rapporteur's draft summary presented to the participants at the final discussion session listed points of agreement, points of disagreement, and uncertainties. As examples, there is agreement that many consumers eat GM foods. No significant adverse effects have yet been detected on human health; there is disagreement about whether GM products in animal feeds present a problem; and it is unclear whether feeding trials in animals of GM products will be useful. The last two points are direct questions addressed to animal scientists, despite the fact that there is no comprehensive international regu-

lation or research and neither is there a common appreciation of the safety of GM feeds for animals, and consequently for animal products. The negation of the usefulness of long-term feeding trials introduces further disagreement and misunderstanding of the arguments debated and of the need for a more scientific approach to the problem. In Europe, everybody seems to agree that food safety is a high priority in the agenda of policy makers also is an imperative prerequisite of scientists involved in public and private research. Independent scientific experts belonging to the different committees can only argue on the basis of investigations conducted under good laboratory practices before the approval of a new product. Consumers must be informed that new foods and new feeds are only accepted after a cautious and multipurpose consideration of the data supplied in the presented dossiers. Guidance for the evaluation (e.g., US FDA [1998]; and EC DG XXIV [1999] of new foods and feeds should only be issued on the basis of independent scientific advice of experts. Data required must be collected in approved experimental schemes, based on officially and internationally recognized methodology in genetics, toxicological, and nutritional investigations before their consideration. Data must also be treated with accurate statistical methods. All these requirements, which will be reinforced in the revised EC Directive 90/220, are already considered by the EU scientific committees.

However equivocal, there is a cautious if not a negative attitude observed in consumers and the general public; in the absence of voluntary acceptance, EU politicians and officials are using science to fit politics and to restore confidence in food. More data on the safety of products evaluated *a priori* and continuously monitored are probably required to restore confidence. The EC and the European farmers are presently in a difficult position with regard to the development and the use of GM products already authorized by the Commission and the authorization of new GMO, particularly GM plants used for feed manufacturing.

It is important that scientists and experts continue their investigations and give their advice on the safety assessment of new plants to restore the confidence of the public and of policy makers for further application of biotechnology to the genetic improvement of plants used in animal feeding. Clarity on antibiotic-resistant marker genes and appropriate testing of the modification of the chemical composition of plants and derivatives and their safety and feeding value would lead to new progress and probably more acceptance by the consumers of the products derived from modern biotechnology.

Implications

The European Union has issued its own regulations to assess the safety of genetically manipulated new

plants for their use in human and animal feeds. Appropriate scientific committees specializing in plant biology and genetics and animal nutrition are issuing recommendations to the European Commission on the approval of the release of new plants, in particular protein plants mainly imported for animal feeding. However, insufficiently informed consumers still perceive this technology to be dubious, or strongly negative, depending on the country of the European Union. This has led to a moratorium on the dissemination and on the cultivation of new plants in Europe. The requirements for labeling, traceability, and monitoring of genetically modified plants and their derivatives have generated important consequences for international trade of feed commodities.

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