Biosafety framework of transgenic organisms and related issues –reviews

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Abstract

Genetic modification (GM) is a major change in agricultural, industrial and medical technologies, genes being transferred between unrelated species, for example from microorganisms to plants. This technology makes it possible to break species boundaries set up over millions of years, with changes passed on to offspring through heredity. GM food is a major modification of existing conventional plant breeding techniques. The areas pertinent to the GMO national biosafety framework for Romania are considered, including the GMO monitoring, traceability elements introduced in Romania through food safety legislation, impact of novel organisms on agronomy and farming practice, means for reducing or managing risk; ecological studies of the impact of novel organisms; food and feed safety evaluation.

Keywords: genetically modified organism (GMO), biosafety, Romania

Introduction

Biotechnology is the name that has been given to a very wide range of agricultural, industrial and medical technologies that make use of living organisms (*e.g.*, microbes, plants or animals) or parts of living organisms (*e.g.*, isolated cells or proteins) to provide new products and services. Genetic modification involves the transfer of genetic material either in the form of DNA or RNA into a recipient organism by artificial means with the resulting organism capable of replicating and/or transferring the modification to other cells or organisms [1, 2]. The resulting organism is referred to as a **genetically modified organism** (GMO). Where the GMO is a micro-organism then the term **genetically modified micro-organism** is used.

Romania has a relatively long history of releasing genetically engineered crops into the environment. Given that the first commercial planting of GM soybean and maize took place in North America only in 1996, Romania started cultivation just 2 years later. According to the Ministry of Agriculture, the 1998 edition of the National Seed List introduced 12 GM hybrids of potato, soybeans, sugar beet and maize.

The overall objective of this review is to provide additional information to favor communication within the international biosafety research community and between this community and all the stakeholders world-wide, including the general public, industry, national and international agencies. There is a need for greater transparency in the area of GMO biosafety research. A **risk assessment** for the activity is needed which will involve a **hazard analysis** of the recipient organism, the gene of interest and any new hazards arising from combination.

WHAT IS PLANT BIOTECHNOLOGY?

Traditional plant breeding is a relatively slow and labour-intensive process: if two parental plants are crossed, the seeds from them must be collected, planted and the resulting plants cultivated before the results of the cross can be seen. Furthermore, plant breeders must work with whole sets of inherited characteristics. Consequently, a cross to introduce a desirable characteristic is likely to introduce one or more undesirable characteristics as well; and these must then be painstakingly 'bred out' [3]. The techniques of biotechnology (including genetic modification) can be used to speed up the process and improve the precision of plant breeding compared with conventional methods such as random genetic changes introduced by radiation [4].

“Genetic modification” is officially defined as the alteration of genetic material (DNA or RNA) of an organism by means that could not occur naturally through mating and/or recombination [5].

WHAT ARE THE MAIN CURRENT APPLICATIONS OF PLANT GENETIC MODIFICATION?

The majority of current plant biotechnology is directed towards the improvement of food plants; the remaining work is concerned with non-food crops such as cotton, tobacco, ornamental plants and pharmaceuticals. The initial emphasis has generally been on the improvement of qualities of value to the farmer. Most of this work has been initiated and funded by the seed industry. The second and third generations of genetically-modified food plants will bring benefits that more directly affect commerce.

The second and third generations of genetically-modified food plants will bring benefits that more directly affect commercial food processors and consumers. Many thousands of field trials of genetically-modified plants have been carried out world-wide [6].

Although several different modified crops are grown, only a handful of GM-derived products have been approved for food use in the EU: processed soy derivatives such as lecithin; oil from oil seed rape; processed tomato purée and maize. No fresh GM products (such as tomatoes, potatoes or unprocessed soy beans) have been approved for human consumption in the EU. The only GM crop currently grown to any extent (and then only in limited amounts) in the EU is maize, which is produced for animal feed [7].

WHAT IS MICROBIAL TRANSFORMATION?

In the general context, work falling within the scope to involve the 'transformation' of microorganisms, the introduction of DNA into microorganisms by 'artificial' means. This almost always involves the use of plasmid DNA [8]. Plasmids are small rings of DNA comprising just a few genes, that are found in bacteria and yeasts. They are not normally essential for the microbes, but they may help them to survive in rare and exotic environments. For instance, some plasmids enable the bacteria that carry them to resist the toxic effects of heavy metals or antibiotics, or to live on particular nutrients. Sequences of DNA can be 'spliced' into plasmids, allowing them to be used as vectors for transferring genes between organisms [9,10].

What is 'Self-cloning'?

Microbial transformation in which DNA (or RNA) is returned to a species in which it could naturally occur is known technically (and rather confusingly) as 'self-cloning'. In this context 'cloning' means making copies of plasmid DNA within an organism [11]. Because the plasmids used are made entirely from DNA that could occur naturally within the species

involved, the work is called "self-cloning'. The official definition of self-cloning runs as follows:

" ... the removal of nucleic acid sequences from a cell ... followed by the re-insertion of all or part of that nucleic acid ... into cells of the same species or into cells of phylogenetically closely-related species with which it can exchange genetic material by homologous recombination" [12].

In other words, if the transfer of genetic information is largely confined to that which could naturally occur within a single species, the work is regarded as 'self-cloning'. The nucleic acid may have been subject to modification by enzymatic, chemical or mechanical steps so as to produce a novel order of genes / bases, to remove sequences, to produce multiple gene copies, *etc*.

Self-cloning, where the resulting organism is unlikely to cause disease in humans, animals or plants, is exempt from the 'Contained Use' regulations. Schools and others may undertake such work without licensing their premises or setting up a GMSC. However, somewhat unusually (since these microbes could in theory be found in nature) the organisms produced *are* covered by the 'Deliberate Release' regulations.

WHAT IS CONTAINMENT?

Under current legislation it is an offence to release any GMO into the environment or to allow it to escape without prior consent. It is therefore essential that even 'self-cloned' organisms and adequately contained and that a 'release' does not occur. A key point is that an accidental release of a GMO might be considered to be deliberate if the steps taken to ensure containment are deemed to have been inadequate. If a GMO cannot survive in, or transmit genes to other organisms in the environment, it is regarded as being 'biologically contained', and an accidental escape is not regarded as a 'release' [13]. Containment can be ensured simply by following good microbiological practice and good occupational safety and hygiene, coupled with the careful selection of suitable host organisms and plasmids [14]. This would usually involve, for example, using host strains that are weakened and 'non-mobilisable' plasmids that cannot transfer their genes into the host's chromosome, or be transferred into other organisms by natural means such as bacterial conjugation.

It is important to distinguish between *contained* use of transgenic organisms and their *release* to the environment. Contained use occurs inside a physical facility designed to prevent escape into the open environment. It can be controlled, in principle, and made as safe as possible (though the current regulation of contained use is far from adequate). Release of transgenic organisms to the environment, by contrast, cannot be controlled nor recalled, which is why great care must be taken in advance of release.

The production of transgenic varieties – which features most prominently in genetic engineering agriculture – is a new departure from conventional techniques including selective breeding, mutagenesis (induction of gene mutations by chemical or physical means such as X-rays), cell fusion and tissue culture 15]. It raises safety concerns different in kind from those of conventional techniques, and which are inherent to the processes used in creating transgenic organisms. Typically, genes of one or more donor-species are isolated, and spliced into artificially constructed infectious agents, which act as *vectors* to carry the genes into the cells of recipient species. Once inside a cell, the vector carrying the genes will insert into the cell's genome. A transgenic organism is regenerated from each *transformed* cell (or egg, in the case of animals) which has taken up the foreign genes. And from that organism, a transgenic variety can be bred. [16, 17]. In this way, genes can be transferred between distant species which would never interbreed in nature.

The artificial vectors are typically made by joining together parts of the genomes of natural viruses that cause diseases and other genetic parasites, *plasmids* (pieces of usually circular DNA found in bacteria and yeasts, replicating independently of the chromosome(s)) and *transposons* (mobile genetic elements, or 'jumping genes' found in all species), which carry and spread genes for antibiotic and drug resistances, as well as genes associated with diseases. Most, if not all of the disease-causing genes will have been removed from the artificial vectors, but antibiotic resistance genes are often left in as 'selectable markers', so those cells which have taken up the foreign genes can be selected with antibiotics. While natural viruses and other genetic parasites are limited by species barriers to varying degrees, the artificial vectors made by genetic engineers are especially designed to cross species barriers and to overcome mechanisms in the cell that destroy or inactivate foreign DNA [18].

The foreign genes are typically introduced with strong genetic signals, *promoters* and/or *enhancers*, which enable the foreign genes to be expressed at very high levels continuously (or constitutively), effectively placing those genes outside the normal metabolic regulation of the cell, and of the transgenic organism resulting from the transformed cell. The most common promoter used in plants is from the cauliflower mosaic virus (CaMV) [19].

WHAT ARE HOST STRAINS?

The bacterium species that is most commonly-used for cloning work is *Escherichia coli*, strain K12. Unlike the wild type, K12 strains of E. coli are usually unable to inhabit the mammalian gut. This strain's origins can be traced back to work in the USA in 1922. Biochemical and genetic studies by Edward Tatum in the 1940s made the strain popular with researchers, and after many millions of generations of laboratory cultivation, it is now known to have undergone significant changes. These have altered the lipopolysaccharides that comprise the outer membrane of the bacterial cell, so that it can no longer infect mammals. Many strains of *E. coli* K12 have been specially-selected for transformation work. Usually these do not harbor any extra-chromosomal DNA of their own, but can be transformed efficiently by plasmids. Compared to the wild type *E. coli*, these 'cloning strains' are severely weakened and would find it difficult to thrive outside the laboratory. They may have unusual nutritional requirements, and are often susceptible to damage *e.g.*, from the ultraviolet component of sunlight [20].

Plasmids can pass from one bacterial cell to another of the same or a related species by a natural 'mating' process called conjugation. During conjugation, a tube or pilus is formed between adjacent cells, through which the plasmid passes. The genes required for the formation of the pilus are also carried on a plasmid (an F or fertility plasmid). Host strains used for transformation experiments in schools usually have no F plasmid, so that they cannot pass on genetic material by conjugation. They often also lack phages, so that DNA cannot be picked up and passed on by viral infection (transduction). The use of non-conjugative strains of bacteria that lack phages, coupled with the use of non-mobilisable plasmids, significantly reduces the risk of DNA being transferred between microorganisms, and hence the unwanted transfer of characteristics such as antibiotic resistance.

The transformation of bacterial cells with plasmid DNA is very inefficient, and only a small proportion of the cells treated will take up the DNA. Therefore a means of selecting those cells that have been transformed is needed. The incorporation of one or more antibiotic-resistance genes into the plasmid DNA used to transform cells is the commonest method of achieving this. In the presence of appropriate antibiotics, such plasmid-bearing cells thrive while their less well-endowed (untransformed) neighbors perish. In this way, selection

pressure is applied to maintain the plasmid in the population of cells. Without that pressure, the few transformed cells would be swamped by their untransformed neighbors.

Missing genes

For a plasmid to travel through a pilus, two additional requirements must be met. The plasmid must possess a gene encoding a mobility protein (*mob*) and have a *nic* site. The mobility protein nicks the plasmid at the *nic* site, attaches to it there and conducts the plasmid through the pilus. Plasmids for demonstration experiments usually have neither a *nic* site nor the *mob* gene. This means that once it has been introduced into a bacterial cell by artificial means (transformation) a plasmid cannot naturally transfer (by conjugation) into other cells that do not posses it.

Incubation at 37 °C

The delicate strains of *E. coli* used for cloning work often require incubation at 37 °C for speedy growth. Good microbiological practice, coupled with the use of selective growth media will ensure that contaminating human pathogens are not inadvertently cultivated at this temperature.

Physical and chemical containment

In addition to the biological containment measures described above, good microbiological practice must be followed to ensure that the microorganisms are physically contained during the investigation and destroyed afterwards. The law requires that genetically-modified microorganisms must be inactivated after use by a validated means. In practice, this means that any cultures must be destroyed by autoclaving them. The containment and the destruction of cells when such work is undertaken will prevent the spread of antibiotic-resistant populations. In addition, most of the antibiotics used for such work are heat-labile and readily break down when media are autoclaved after use. Together, these methods of physical, chemical and biological containment will ensure that educational exercises demonstrating the principles of genetic modification are as safe as possible [21].

WHAT IS THE NATIONAL BIOSAFETY FRAMEWORK FOR ROMANIA?

Romania is facing backbreaking decisions on aligning its agricultural legislation to the EU's and applying it wherever possible. A short look over all notifications submitted on GMOs on EU territory (http://gmoinfo.jrc.it/gmp_browse.aspx) shows most come from US corporations such as Monsanto, Pioneer and Syngenta. Several other local players – state universities (e.g. USAMV Timisoara) and companies covering national territories alone – are also profiled, but in a much lesser measure. Pioneer, Monsanto and Syngenta have submitted documents asking to test GM crops in Romania. If applied, the groups may start putting up crops for testing GM soy, corn and plum trees. Recently, a maize hybrid, submitted for EU approval by U.S. biotech company Monsanto, is known as MON810/NK603. The second GMO maize, a hybrid known as 1507/NK603, is made jointly by Pioneer Hi-Bred International, a subsidiary of DuPont Co., and Dow AgroSciences unit Mycogen Seeds. Pioneer and Mycogen also submitted an application for a third GMO, a maize known commercially as Herculex RW and also by the code number 59122.

They're also claiming that food is already insufficient and that "a solution to this crisis is the use of biotechnology in agriculture", as Clive James put it during a Bucharest conference on March 2, 2007

Romania was one of the first countries in Eastern Europe that put in place its national biosafety framework. In this context, at the end of the year 1999, the Government Ordinance 49/2000 (GO) on the obtaining, testing, use and commercialization of genetically modified

organisms obtained through the modern biotechnology techniques, and of the products resulting thereof, was issued. Two years later, Law no. 214/2002 for the approval of the GO no. 49/2000, with modifications and completions, was promulgated, which at the same time also largely transposed the following Directives: 90/219/EEC, 98/81/EEC and 2001/18/EC. Romania signed on 11 October, 2000, as a Party to the Convention on Biological Diversity, the Cartagena Protocol on Biosafety, which was ratified on 30 June, 2003 by the Law no. 59/2003. The Protocol entered into force on 28 September, 2003, thus Romania had to implement all its provisions and it was expected that before Romania's accession to EU, all EU biosafety regulatory provisions to be transposed in the national legislation. Now, in the post-accession period, new legal acts will be prepared to amend and complete Law 214/2002 addressing other specific Romanian Biosafety Regulatory Systems. At present, new regulations are to be enforced in order to strengthen the National Biosafety Framework (NBF) in accordance with EU Biosafety Policy and the main international instruments in the field to which Romania is a signatory Party.

The current Romanian Government Programme 2005-2008 briefly underlines the development policy and strategy throughout its 27 chapters. Chapter 18 of the Governmental Programme 2005-2008 focuses upon the Environmental Protection Policy of the Ministry of Environment and Water Management. It can be considered that one of the main concerns of Romanian Environmental Policy is biosafety, underlining the importance of implementing the provisions of the Cartagena Protocol on Biosafety to the CBD. At the same time, it imposes complying with the provisions of other international conventions with significant impact upon the conservation of genetic resources and ensuring an adequate level of environment and human health protection.

Romania has great concerns in preserving its natural resources as it is well known that it is possessing one of the richest biodiversity in the region, therefore, this status is supported by the numerous conventions and international Protocols, as well as bilateral and multilateral agreements signed by Romania. Having as main objectives, strengthening the administrative structures, as basic element to build a solid system of environment management and the contribution to a durable development, the activity of Romanian Government will rely on the following biosafety priorities:

1. Improvement in the quality of environment agents within urban and rural areas, in this context, several objectives are mentioned in relation to the management of chemical substances, the monitoring of the *genetically modified organisms* and the forbidding use of those substances that represent a threat for the population health on Romania' s territory, as follows: [i] Developing the Biosafety National Framework in order to implement the Cartagena Protocol (Law 59/2003); [ii] Assuring the legislative framework upon the transport cross border of genetically modified organisms, labeling and traceability of food and feed products obtained from genetically modified organisms; [iii] Constituting a national Catalogue of genetically modified organisms accepted on Romanian territory, accessible to population; [iv] Creating and developing the laboratories specialized in detecting the genetically modified organisms; [v] Participating at the Mechanism upon the Information Exchange within the Biosafety field (Biosafety Clearing-House); [vi] transposing and implementing the legislation on risk assessment and risk control of hazardous chemicals on human health and the environment.

2. Extension of the national network of protected areas and natural reservations, rehabilitation of the coast infrastructure of the Romanian seaside, economic and ecological resizing of the Danube Delta;

3. Strengthening the cross-border and international partnership with similar institutions from other countries in order to monitor the implementation stage of international

agreements by: [i] Signing Conventions, Agreements, Bilateral and multilateral Cooperation within the field of Environment protection at European and world level for the purpose of capitalizing the opportunities and facilities of institutional and financial technical financial assistance and identifying some possibilities to finance the environment reconstruction projects; [ii] Observing the notice and reporting requests undertaken by Romania as part within different Conventions, Protocols and International Agreements; [iii] Assuring the institutional framework established through different bilateral and multilateral agreements, for the purpose of assuring the implementation of conventions that settle the cross-border pollution, its prevention and reducing;

4. Strengthening the partnership with NGOs, in the process of elaboration and enforcement of public policies within the field, by [i] Implementation of the Aarhus Convention requests upon access to information, public participation in decision making and access to justice within the environment issues, by concluding the legislative framework, introduction of an informed system at central, regional and local level, upon management of environment information; [ii] Media coverage of some punctual environment protection issues: GMO-Genetically Modified Organisms, POPs-Persistent Organic Pollutants, PCBs-Polychlorinated Biphenyls, climatic changes, in order to protect not only the environment but also people health from the damaging effect of these substances.

GMO MONITORING ACTIVITY IN ROMANIA

GMO import, release into the environment and placing on the market, as well as contained use are followed by specific biosafety activities. One of these activities is the monitoring of GMO effects on the environment and human health and the identification of unforeseen effects not identified during the risk assessment studies. In accordance with GO no. 49/2000, approved with modifications and completions by Law 214/2002, GMO activities will be subjected to the monitoring procedure with regard to the potential adverse effects on human health and environment. The monitoring will follow certain procedures, clearly stipulated in the law, according to a monitoring plan presented by the Notifier; the scientific information obtained as a result of the application of this procedure will be used for future risk assessment procedures as regards the placing on the market of the same GMO. The monitoring activity can be carried out for contained use and/or after obtaining the approval for GMO release into the environment or placing on the market. The data collected as a result of the monitoring process should provide new information on the impact of GMO release into the environment or on the market, under different conditions. When such new information appears, this should be automatically considered when carrying out the following environmental risk assessment studies. The experience and information collected through the monitoring of GMO for deliberate release in the environment should be the basis for the design of the monitoring system for placing on the market, as such or under the form of different products. The objectives of the monitoring plan stipulated by the law 214/2002 are according to Directive 2001/18/EC: (1) to confirm that assumptions in the environmental risk assessment regarding the occurrence and impact of potential adverse effects of the GMO or its use were correct; (2) to identify the occurrence of adverse effects of the GMO or its use on human health and the environment that were not anticipated in the environmental risk assessment.

According to the Law, the design of the monitoring plan have comply with Directive 2001/18/EC and these requirements are as follows: (1) be detailed on a case by case basis taking into account the results of the environmental risk assessment (ERA); (2) take into account the characteristics of the GMO, the characteristics and scale of its intended use and the range of relevant environmental conditions where the GMO is expected to be released; (3) incorporate general surveillance for unanticipated adverse effects and, if necessary, (case-)

specific monitoring focusing on adverse effects identified in ERA; [i] whereas case-specific monitoring should be carried out for a sufficient time period to detect immediate and direct as well as, where appropriate, delayed or indirect effects which have been identified in ERA; [ii] whereas surveillance could, if appropriate, make use of already established routine surveillance practices such as the monitoring of agricultural cultivars, plant protection, or veterinary and medical products. An explanation as to how relevant information collected through established routine surveillance practices will be made available to the consent-holder should be provided; (4) facilitate the observation, in a systematic manner, of the release of a GMO in the receiving environment and the interpretation of these observations with respect to safety to human health or the environment; (5) identify who (notifier, users) will carry out the various tasks the monitoring plan requires and who is responsible for ensuring that the monitoring plan is set into place and carried out appropriately, and ensure that there is a route by which the consent holder and the competent authority will be informed on any observed adverse effects on human health and the environment. Time points and intervals for reports on the results of the monitoring shall be indicated); (6) give consideration to the mechanisms for identifying and confirming any observed adverse effects on human health and environment and enable the consent holder or the competent authority, where appropriate, to take the measures necessary to protect human health and the environment.

The Ministry of Environment and Water Management (MEWM) Order no. 606/2005 approves the Format for presenting the results of deliberate release into the environment of genetically modified crops, for other purposes than placing on the market. As it has been mentioned the Order fully transposes the Commission Decision no. 2003/701/EC, based on Directive no. 2001/18/EC. Clear procedures are specified: (1) the Notifier submits a final report or a final and intermediary report on post-release monitoring, according to each case. Both types of reports are elaborated in accordance with the Report Format;
(2) the final report can be transmitted after the last harvesting of genetically modified crops. If for a notification no post-release monitoring is required, no subsequent reports are needed;
(3) the final post-release monitoring report is submitted after the completion of the post-release monitoring.

GMOs labelling and traceability are other important elements of the “follow up” phase of a biosafety system. The main legal act that covers these activities is GO no. 49/2000, approved with modifications and completions by Law 214/2002. The foodstuffs on the market that are based on GMOs or that contain additives and flavours that have been genetically modified or obtained from GMOs, is currently regulated by the GD 106/2002, Appendix no. 3, initiated by the National Authority for Consumer Protection (in this case the Minister of Environment and Water Management has no responsibilities in this field). The label should clearly specify whether GMOs are present. It is compulsory that the label should clear specify: “This product contains genetically modified organisms”. GD106/2002 on food labelling, stipulates in Appendix no.3 the Methodological Norms on additional information that should be compulsory specified by labelling in the case of food obtained from GMOs or that contains genetically modified additives and flavours that are obtained from GMOs. This refers to foodstuffs or food ingredients that are fully or partly obtained from genetically modified soybeans, tolerant to glyphosate and to genetically modified maize, tolerant to ammonium glufosinate. The line “product obtained from genetically modified……” will be clearly specified on the foodstuff label or in the list that specifies the ingredients. The products containing more than 0.9 % GMOs will be labeled, complying with the EU regulation. Foodstuffs and food ingredients should not be labelled, according to this decision if they do not contain protein and/or DNA of GMO (i.e. oil, alcohol, starch). Traceability may be achieved only through appropriate labelling throughout the chain for example GMO from the laboratory to plant breeders, to seed producers, to farmers, processors, and

importer/exporters. It will be effective after transposing the Regulation 2003/1830/EC and by ensuring the means of GMO detection and analysis. This responsibility lies with to the National Sanitary-Veterinary and Food Safety Authority (NSVFSA) that will collaborate with the MEWM, the Ministry of Agriculture, Forests and Rural Development (MAFRD), the National Authority for Consumer Protection (NACP) and the Ministry of Health (MH). The transposing deadline, established by the Position Document, was the second semester of 2006. Certain traceability elements have already been introduced by Art. 29, par. 1(c) of the GO 49/2000, approved with modifications and completions by Law no. 214/2002, referring to labelling and packaging.

Traceability elements have been also introduced through the MAFRD Order no. 462/2003 regarding the evidence of farmers cultivating GMO crops. It is specified that in the approval process regarding the deliberate release into the environment and placing on the market of GMO crops in the year 2005, MAFRD approved the GMO imports and deliberate release in the environment for testing or cultivation purposes, only on the condition of complying with the provisions of Order 462/2003, by all the economic operators cultivating GMO crops.

The MAFRD, on the basis of this Order, is the competent national authority for the evidence of economic operators that cultivate GMOs. The Order stipulates that it is compulsory for all economic operators (natural or legal persons, non-legal associations) to declare GMOs cultivated plots with and the yields obtained to the County Directorates for Agriculture and Rural Development (CDARD), and to the Directorate of Bucharest Municipality. The statement is filled in two copies: one copy is to be sent to the CDARD in 10 days maximum after the crop cultivation is completed (Appendix 1), after the crop harvesting (Appendix 2); and another copy is kept at the central office of the economic operator for 5 years. Information are collected at the CDARD and electronically transmitted to the Computing Centre of MAFRD (the Record Register of Romanian Economic Operators Cultivating GMO crops). In order to ensure the observance of the Order no. 462/2003 of the MAFRD, the companies provide their clients with the statement Templates, together with the seed selling documents that they have to fill in and send to the Agricultural Directorates. At the same time, the companies should provide information to the MAFRD referring to the client identification data, sold seed quantities, varieties and biological categories. This information is necessary for checking the data received through the Agricultural directorates.

According to Law no. 266/2002, seeds can be imported only after receiving the import approval issued by the MAFRD. The commodity is packed into bags, and on the labels and accompanying documents it should be specified that the variety is *genetically modified*. For a clear record regarding of the seed distribution, the clients are obliged to return the empty packages to the respective companies, after the cultivation season. The MAFRD can forbid the use of a GMO variety in a certain region of the country or on the whole territory, if it is found that the respective variety is harmful for other crop varieties (i.e. outcross pollination) or it endangers the environment or human health. A *genetically modified* variety cannot be tested or registered if the applicant does not prove that this complies with the legal conditions regarding environment and human health protection. So far, a proper record of the imported quantities of GMO soybean for processing purposes could not be kept, as there is no distinct tariff line in the Import Schedule for the genetically modified products. It is necessary to establish, together with the NCA, a recording system. In the same context, the MAFRD, together with the NSVFSA, imposed to the notifying companies the obligation to report the accurate situation of cultivated areas, of the yield obtained and of its use to the MAFRD.

Other traceability elements were also introduced in Romania through food safety legislation, namely Law no. 412/2004 for the modification and completion of Law no. 150/2004 on food safety. This law provides for checking the means by which feed traceability

is carried out by all the operators and agents in the food industry. On this basis, for the year 2005, the notifications of GMO producing companies, regarding GMO imports and deliberate release into the environment for testing as well as for cultivation purposes were approved only on the following condition: the economic operators, authorized natural or legal persons operating in this field, should demonstrate the destination of the GMO seeds, up to the point of their commercialization of GMO as food or feed. At the same time, the labelling of products was imposed. The users of GMO seeds are to be informed by notifiers on the obligations they have in traceability and labeling.

WHEN IS SCIENTIFIC EVIDENCE 'SUFFICIENT'?

When is scientific evidence considered sufficient to indicate that the risk is unacceptable? There are four special safety concerns arising from current transgenic technologies:

1. Effects due to the exotic genes and gene products introduced into the transgenic organisms.
2. Unintended, unexpected effects of random gene insertion and interaction between foreign genes and host genes in the transgenic organisms.
3. Effects associated with the nature of the gene-constructs inserted into the transgenic organisms.
4. Effects of gene flow, especially secondary, horizontal spread of genes and gene-constructs from the transgenic organisms to unrelated species.

Risk is technically the extent of damage multiplied by the probability that the damage will occur. People take risk for a number of reasons: because they have to, or because there is overwhelming moral imperative for doing so, or because the likely benefits are compelling despite the potential damage. That is in accordance with the generally accepted precautionary principle [20, 21].

Conclusions

Developments in genetics and biotechnology over the last 50 years have culminated in the genetic modification of living organisms to produce crops, trees, animals and microorganisms with novel characteristics. Romania has great concerns in preserving its natural resources as it is well known that it is possessing one of the richest biodiversity in the region, therefore, this status is supported by the numerous conventions and international Protocols, as well as bilateral and multilateral agreements signed by Romania. While some products of biotechnology, including genetically modified organisms (GMOs), could be designed to enable more environmentally sustainable management practices, the release of GMOs may pose a number of risks to human and animal health and the environment. The National Biosafety Framework for Romania in an undergoing improvable process.

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