

Debate científico sobre Transgénicos

Academia Nacional de Ciencias

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PROS

Regul Toxicol Pharmacol. 2011 Apr;59(3):437-44. Epub 2011 Feb 5.

Proteomic analysis of known and candidate rice allergens between non-transgenic and transgenic plants.

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- Salt-soluble proteins extracted from non-transgenic and transgenic rice were evaluated for the presence of known and potential allergens by proteomic techniques.
- Quantitative analysis of 19, 52, and 63 kDa globulins with protein-specific-animal sera showed no significant differences in the expression of these proteins between the transgenic rice and non-transgenic rice.
- These results indicate that **none of the known or novel endogenous IgE-binding proteins detected in this study appear to be altered by genetic modification**

Safety and nutritional assessment of GM plants and derived food and feed: the role of animal feeding trials.

EFSA GMO Panel Working Group on Animal Feeding Trials. Collaborators (37)

Alink G, Barlow S, Cockburn A, Flachowsky G, Knudsen I, Kuiper H, Massin DP, Pascal G, Peijnenburg A, Phipps R, Pöting A, Poulsen M, Seinen W, Spielmann H, van Loveren H, Wal JM, Williams A, Andersson HC, Arpaia S, Bartsch D, Casacuberta J, Davies H, De Loose M, Hendriksen N, Herman L, Kärenlampi S, Kiss J, Kryspin-Sørensen I, Kuiper H, Nes I, Panopoulos N, Perry J, Pöting A, Schiemann J, Seinen W, Sweet J, Wal JM.

- Many feeding trials have been reported in which GM foods like maize, potatoes, rice, soybeans and tomatoes have been fed to rats or mice for prolonged periods, and parameters such as body weight, feed consumption, blood chemistry, organ weights, histopathology etc have been measured.
- The food and feed under investigation were derived from GM plants with improved agronomic characteristics like **herbicide tolerance and/or insect resistance**. The majority of these experiments did not indicate clinical effects or histopathological abnormalities in organs or tissues of exposed animals. In some cases adverse effects were noted, which were difficult to interpret due to shortcomings in the studies. Many studies have also been carried out with feed derived from GM plants with agronomic input traits in target animal species to assess the nutritive value of the feed and their performance potential. **Studies in sheep, pigs, broilers, lactating dairy cows, and fish**, comparing the in vivo bioavailability of nutrients from a range of GM plants with their near isogenic counterpart and commercial varieties, showed that **they were comparable with those for near isogenic non-GM lines and commercial varieties**.
- **Results obtained from testing GM food and feed in rodents indicate that large (at least 100-fold) 'safety' margins exist between animal exposure levels without observed adverse effects and estimated human daily intake**. Results of feeding studies with feed derived from GM plants with improved agronomic properties, carried out in a wide range of livestock species, are discussed. **The studies did not show any biologically relevant differences in the parameters tested between control and test animals.**

Antioxidant activity and inhibition of lipid peroxidation in germinating seeds of transgenic soybean expressing OsHGGT.

Kim YH, Lee YY, Kim YH, Choi MS, Jeong KH, Lee SK, Seo MJ, Yun HT, Lee CK, Kim WH, Lee SC, Park SK, Park HM.

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- Genetic engineering techniques were used to develop soybeans with enhanced vitamin E levels, including tocotrienols, which are not found in soybean. The gene encoding rice homogentisate geranylgeranyl transferase (HGGT) was overexpressed in soybeans using seed-specific and constitutive promoters.
- Compared with intact wild-type seeds, transgenic seeds showed increases in radical scavenging of 5.4-17 and 23.2-35.3% in the DPPH and ABTS assays, respectively.
- Furthermore, the lipid peroxidation levels were 2.0-4.5-fold lower in germinating seeds from transgenic lines than in wild-type seeds.
- Therefore, it appears that the antioxidant potential of transgenic oil-producing plants such as soybean, sunflower, and corn may be enhanced by overexpressing OsHGGT during seed germination

Shokuhin Eiseigaku Zasshi. 2008 Aug;49(4):272-82.

[A 104-week feeding study of genetically modified soybeans in F344 rats].

[Article in Japanese] Sakamoto Y, Tada Y, Fukumori N, Tayama K, Ando H, Takahashi H, Kubo Y, Nagasawa A, Yano N, Yuzawa K, Ogata A.

Department of Environmental Health and Toxicology, Tokyo Metropolitan Institute of Public Health. Tokyo, Japan.

- A chronic feeding study to evaluate the safety of genetically modified glyphosate-tolerant soybeans (GM soybeans) was conducted using F344 DuCrj rats
- Body weight and food intake were similar for the rats fed the GM and Non-GM soybeans.
- Gross necropsy findings, hematological and serum biochemical parameters, and organ weights showed no meaningful difference between rats fed the GM and Non-GM soybeans.
- In pathological observation, there was neither an increase in incidence nor any specific type of nonneoplastic or neoplastic lesions in the GM soybeans group in each sex.
- These results indicate that long-term intake of GM soybeans at the level of 30% in diet has no apparent adverse effect in rats

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CONTRAS

Proc Natl Acad Sci U S A. 2008 Mar 4;105(9):3640-5.

Microarray analyses reveal that plant mutagenesis may induce more transcriptomic changes than transgene insertion.

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- We found that the improvement of a plant variety through the acquisition of a new desired trait, using either mutagenesis or transgenesis, **may cause stress and thus lead to an altered expression of untargeted genes.**

New Phytol. 2011 Mar 28. doi: 10.1111/j.1469-8137.2011.03706.x. **Glyphosate-drift but not herbivory alters the rate of transgene flow from single and stacked trait transgenic canola (*Brassica napus*) to nontransgenic *B. napus* and *B. rapa*.**

Londo JP, Bollman MA, Sagers CL, Lee EH, Watrud LS.

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Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Western Ecology Division, 200 SW 35th Street Corvallis, OR 97333, USA

Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701, USA.

- **Transgenic plants can offer agricultural benefits, but the escape of transgenes is an environmental concern.** In this study we tested the hypothesis that glyphosate drift and herbivory selective pressures can change the rate of transgene flow between the crop *Brassica napus* (canola), and weedy species and contribute to the potential for increased transgene escape risk and persistence outside of cultivation.
- Most notably, glyphosate-drift increased the incidence of transgenic seeds on nontransgenic *B. napus* by altering flowering phenology and reproductive function. •
- The findings of this study indicate that **transgenic traits may be transmitted to wild populations** and may increase in frequency in weedy populations through the direct and indirect effects of selection pressures on gene flow

Int J Biol Sci. 2009 Dec 10;5(7):706-26.

A comparison of the effects of three GM corn varieties on mammalian health.

de Vendômois JS, Roullier F, Cellier D, Séralini GE.

CRIIGEN, Paris, France.

- **We present for the first time** a comparative analysis of blood and organ system data from trials with rats fed three main commercialized genetically modified (GM) maize (NK 603, MON 810, MON 863), which are present in food and feed in the world.
- **NK 603** has been modified to be tolerant to the broad spectrum herbicide Roundup and thus **contains residues of this formulation**. **MON 810** and **MON 863** are engineered to synthesize **two different Bt toxins used as insecticides**.
- **Our analysis clearly reveals for the 3 GMOs new side effects linked with GM maize consumption, which were sex- and often dose-dependent.** Effects were mostly associated with the **kidney and liver**, the dietary detoxifying organs, although different between the 3 GMOs.
- Other effects were also noticed in the heart, adrenal glands, spleen and haematopoietic system.
- We conclude that these data highlight signs of hepatorenal toxicity, possibly **due to the new pesticides** specific to each GM corn. In addition, **unintended direct or indirect metabolic consequences of the genetic modification cannot be excluded**

Environ Sci Pollut Res Int. 2009 Mar;16(2):120-6. Epub 2008 Dec 3.

Dispersal and persistence of genetically modified oilseed rape around Japanese harbors.

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- We identified unintended dispersal and persistence of GM OSR around Japanese harbors that import OSR from Canada and other countries.
- Both glyphosate- and glufosinate-tolerant feral *B. napus* were discovered. The cause of volunteer OSR is spillage of the seeds during transportation by truck to oil factory.
- The feral GM OSR sometimes showed perennial growth in Japanese phonological conditions which are not observed for domestic Brassicaceae. In addition, we confirmed an alteration of generations by feral GM OSR in Japan.
- The possibility of cross pollination and GM gene introgression to domestic varieties can occur in these environments. To improve the situation, each responsible organization, company, administration, or government should establish measures how to stop the dispersal and persistence of GM OSR in nature. Also, the GM plant developers are responsible for revising this situation.

How subchronic and chronic health effects can be neglected for GMOs, pesticides or chemicals.

Séralini GE, de Vendômois JS, Cellier D, Sultan C, Buiatti M, Gallagher L, Antoniou M, Dronamraju KR.

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- Chronic health effects are increasing in the world such as cancers, hormonal, reproductive, nervous, or immune diseases, even in young people.
- During regulatory toxicological subchronic tests to prevent these on mammalian health, prior commercialization of chemicals, including pesticides and drugs, or GMOs, some statistically significant findings may be revealed.
- This discussion is about the need to investigate the relevant criteria to consider those as biologically significant.
- **The sex differences and the non linear dose or time related effects should be considered in contrast to the claims of a Monsanto-supported expert panel about a GMO**, the MON 863 Bt maize, but also for pesticides or drugs, in particular to reveal hormone-dependent diseases and first signs of toxicities

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SYSTEMATIC REVIEW

Environ Int. 2011 May;37(4):734-42. **A literature review on the safety assessment of genetically modified plants.**

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- In recent years, there has been a notable concern on the safety of genetically modified (GM) foods/plants, an important and complex area of research, which demands rigorous standards. Diverse groups including consumers and environmental Non Governmental Organizations (NGO) have suggested that all GM foods/plants should be subjected to long-term animal feeding studies before approval for human consumption.
- In 2000 and 2006, we reviewed the information published in international scientific journals, noting that the number of references concerning human and animal toxicological/health risks studies on GM foods/plants was very limited
- The number of citations found in databases (PubMed and Scopus) has dramatically increased since 2006. However, **new information on products such as potatoes, cucumber, peas or tomatoes, among others was not available.** Corn/maize, rice, and soybeans were included in the present review. **An equilibrium in the number research groups suggesting, on the basis of their studies, that a number of varieties of GM products (mainly maize and soybeans) are as safe and nutritious as the respective conventional non-GM plant, and those raising still serious concerns, was currently observed.** Nevertheless, it should be noted that **most of these studies have been conducted by biotechnology companies responsible of commercializing these GM plants.** These findings suggest a notable advance in comparison with the lack of studies published in recent years in scientific journals by those companies. All this recent information is herein critically reviewed



Peruvian data

Nature. 2011 Feb 3;470(7332):39.

Controversy over GM maize in Peru

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Jorge Enrique Alcántara¹

& Rodomiro Ortiz¹

- Researchers from the Peruvian National Institute for Agricultural Innovation (INIA) — which has been enforcing national and international policy on biosafety in agriculture since 1999 — have investigated claims that genetically modified maize (corn) is being farmed in the Barranca valley north of Lima (see go.nature.com/ijkpkz). The INIA analysed the source and quantity of maize imports, records of seed cultivars, their genetic diversity and planting location. Samples were also tested from the Pativilca River basin — the main river in Barranca and its neighbouring valleys. These came from maize fields, local markets, a local collecting facility and seed companies that sell poultry feed.
- Evidence of transgenes was discovered in only some of the poultry grain samples (full details are available in Spanish at go.nature.com/ikgyqj). This finding is not surprising. Peru imports about 1.5 million tonnes of maize grain annually — mainly for animal feed — from Argentina and the United States, where genetically modified maize is widely grown.
- We believe that the Barranca region today is unlikely to be a primary centre of maize diversity. However, farmers there may be growing maize hybrids and other cultivars that have seeds of foreign origin.

- Because no sources of true resistance to SPCSV are available in sweet potato germplasm, a pathogen-derived transgenic resistance strategy was tested as an alternative solution in this study.
- None of the transgenic events was immune to SPCSV, but ten of the 20 tested transgenic events exhibited mild or no symptoms following infection, and accumulation of SPCSV was significantly reduced.

Plant Mol Biol. 2006 Sep;62(1-2):71-82. Epub 2006 Aug 16.

Self-excision of the antibiotic resistance gene nptII using a heat inducible Cre-loxP system from transgenic potato.

Cuellar W, Gaudin A, Solórzano D, Casas A, Nopo L, Chudalayandi P, Medrano G, Kreuze J, Ghislain M.

Source

Applied Biotechnology Laboratory, Germplasm enhancement and Crop Improvement Division, International Potato Center CIP, P.O. Box 1558, Lima 12, Peru

- A new plant transformation vector pCIP54/55 was developed including a multiple cloning site and the self-excision system which should be a useful tool not only for marker genes in potato but for any gene or sequence removal in any plant.

Environ Biosafety Res. 2005 Jul-Sep;4(3):179-88.

Potential adoption and management of insect-resistant potato in Peru, and implications for genetically engineered potato.

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- This paper analyzes some important issues surrounding possible deployment of genetically engineered (GE) insect-resistant potato in Peru, based on a large farmer survey held in Peru in 2003. We found that the formal seed system plays a limited role compared with the informal seed system, especially for smallholder farmers. Although 97% of smallholder farmers would buy seed of an insect-resistant variety, a majority would buy it only once every 2 to 4 years. Survey data show that farmers would be willing to pay a premium of 50% on seed cost for insect resistant varieties. Paying price premiums of 25% to 50%, farmers would still increase their net income, assuming insect resistance is high and pesticide use will be strongly reduced. Of all farmers, 55% indicated preference for insect-resistant potato in varieties other than their current varieties. The survey indicates that smallholder farmers are interested to experiment with new varieties and have a positive perception of improved varieties. Based on these findings, and considering the difficulties implementing existing biosafety regulatory systems such as those in place in the U.S. and E.U., we propose to develop a variety-based segregation system to separate GE from conventionally bred potatoes. In such a system, which would embrace the spread of GE potatoes through informal seed systems, only a limited number of sterile varieties would be introduced that are easily distinguishable from conventional varieties.

Nature. 2004 Nov 11;432(7014):222-5.

Environmental biosafety and transgenic potato in a centre of diversity for this crop.

Celis C, Scurrah M, Cowgill S, Chumbiauca S, Green J, Franco J, Main G, Kiezebrink D, Visser RG, Atkinson HJ.

Source

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- The Nuffield Council on Bioethics suggests that introgression of genetic material into related species in centres of crop biodiversity is an insufficient justification to bar the use of genetically modified crops in the developing world. They consider that a precautionary approach to forgo the possible benefits invokes the fallacy of thinking that doing nothing is itself without risk to the poor. Here we report findings relevant to this and other aspects of environmental biosafety for genetically modified potato in its main centre of biodiversity, the central Andes. We studied genetically modified potato clones that provide resistance to nematodes, principal pests of Andean potato crops. **We show that there is no harm to many non-target organisms, but gene flow occurs to wild relatives growing near potato crops.** If stable introgression were to result, the fitness of these wild species could be altered. We therefore transformed the male sterile cultivar Revolucion to provide a genetically modified nematode-resistant potato to evaluate the benefits that this provides until the possibility of stable introgression to wild relatives is determined. Thus, scientific progress is possible without compromise to the precautionary principle

Plant Physiol. 2001 Mar;125(3):1363-79.

B-Bolivia, an allele of the maize b1 gene with variable expression, contains a high copy retrotransposon-related sequence immediately upstream.

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■ **Abstract**

- The maize (*Zea mays*) b1 gene encodes a transcription factor that regulates the anthocyanin pigment pathway. Of the b1 alleles with distinct tissue-specific expression, B-Peru and B-Bolivia are the only alleles that confer seed pigmentation.
- B-Bolivia produces variable and weaker seed expression but darker, more regular plant expression relative to B-Peru.
- Our experiments demonstrated that B-Bolivia is not expressed in the seed when transmitted through the male.
- When transmitted through the female the proportion of kernels pigmented and the intensity of pigment varied.
- Transgenic plants carrying the B-Bolivia promoter proximal region produced pigmented seeds. Similar to native B-Bolivia, some transgene loci are variably expressed in seeds. In contrast to native B-Bolivia, the transgene loci are expressed in seeds when transmitted through both the male and female.
- Some transgenic lines produced pigment in vegetative tissues, but the tissue-specificity was different from B-Bolivia, suggesting the introduced sequences do not contain the B-Bolivia plant-specific regulatory sequences. We hypothesize that the chromatin context of the B-Bolivia allele controls its epigenetic seed expression properties, which could be influenced by the adjacent highly repeated retrotransposon sequence