

Bring more rigour to GM research

The latest furore over GM food highlights the need for good-quality research on highly sensitive topics, says **François Houllier**.

This autumn, a team of French researchers published results showing that rats fed with genetically modified (GM) maize (corn) died younger and showed more organ damage and tumours than usual. The team also observed similar effects in rats exposed to a combination of the GM maize and the herbicide it is designed to tolerate, and to the herbicide alone¹. Not surprisingly, these results sparked debate among the public and many in the scientific community.

The public concern is easy to comprehend. The images of tumour-ridden rodents included in the study tapped into existing controversies over the safety of GM crops going back several decades, especially in Europe. Scientific reactions were intense for the opposite reason: other research on exposure to GM foods has not shown such pathological patterns².

Since the paper was published, members of the scientific community have found weaknesses in the analysis, which, in their view, call the conclusions into question. But some damage may have been done: an opinion poll a few days after the paper's publication — although not specifically mentioning the study itself — showed that 79% of French people were worried about the possible presence of GM organisms in their food, compared with 65% in 2011 (ref. 3).

In my opinion, this episode highlights a major issue: there is a need for extra rigour in research whenever it tackles sensitive topics such as GM crops and food. Until science moves to the forefront, I believe the debate risks remaining mired in confusion and misinformation, no matter what improvements are made in public engagement.

Reactions to this latest GM study were reinforced by an unusual communication campaign. The authors informed a few journalists about the paper in advance, and asked them to sign an agreement saying that they would not interview outside experts until after the story had appeared in a French weekly magazine, *Le Nouvel Observateur*. In the following weeks, two books and a documentary based on the conclusions of the study were released. The effect was immediate: in my view, there was an initial wave of one-sided alarming news reports and increased distrust towards “the system”.

The French government and the European Commission immediately asked national and European food-safety agencies to review the publication. Most have now released preliminary or final reports pointing out weaknesses.



Field trials of a GM grapevine rootstock were destroyed by activists in France in 2010.

These include a lack of relevant statistics — for example, on mortality and tumour incidence — resulting from the use of too few animals per group for long-term studies and a lack of plausible biological mechanisms for understanding the alleged effects. In my view, the paper seems to have failed to convince many in the scientific community, despite asking legitimate questions about long-term toxicity tests and the effects of a herbicide. Study author Gilles-Eric Séralini, of the University of Caen, has agreed that more animals would render the study more robust, but says that his findings are supported by many observations; he has also accused many detractors of conflicts of interest.

How do we address the questions about the impact of GM crops, and how do we prevent this kind of negative reaction? First, I believe that we need to publicly fund more risk-benefit analyses of GM crops. We also need more interdisciplinary studies of GM foods, especially on health impacts in animals and humans. A review² identified 24 papers featuring trials of feedstuffs containing various GM crops, in which the trials lasted more than 90 days or were done in more than one generation. By contrast, more studies have charted the environmental impacts of GM crops, including long-term, large-scale studies and meta-analyses (see, for example, refs 4,5).

Research into GM crops can be difficult. For example, at the French National Institute for Agricultural Research (INRA) in 2005, we launched a programme to test the environmental impact of a GM grapevine rootstock that was supposed to be resistant to grapevine fanleaf virus, which causes large economic losses. The project was funded only by public money; it did not aim to develop a commercial variety. There was a public consultation about it, moderated by specialist

social scientists^{6,7}, and stakeholders were transparently informed. Nonetheless, activists destroyed the crop in August 2010.

Second, research must always follow proper academic standards. In my opinion, any breach in the rigour and traceability of the scientific workflow — stating the research question and hypothesis; designing adequate experiments; using relevant data analysis and modelling techniques; allowing outside experts to comment on the results — could, I fear, lead to a lack of trust.

Publishing a paper is not the end of the story. New data and results should be tested by the scientific community until a convergent corpus of evidence is reached by independent teams. I believe that publicizing and sharing raw data and disseminating new methods are thus extra crucial stages. The more unexpected the results, the more rigorous this workflow should be.

Third, the distinctions between scientific research, risk assessment and risk management must be clearly articulated. This is vital for public trust in the long term. The GM maize case has generated the feeling that research organizations should do risk-assessment trials. I disagree: they should focus on elaborating and testing new methods — such as how we can use metabolomics to get early predictors of metabolic impacts — and on dissecting underlying biological mechanisms. In my view, risk assessment should remain within the province of dedicated agencies using specific guidelines and impartial procedures, albeit informed by the best research, as happened with the chemical bisphenol A^{8,9}.

As scientists, we must champion the multiple concerns of society, even when they make a contradictory call for more innovation as well as more precaution. ■

François Houllier is president and chief executive of INRA, Paris, France.
e-mail: francois.houllier@paris.inra.fr

1. Séralini, G.-E. *et al. Food Chem. Toxicol.* **50**, 4221–4231 (2012).
2. Snell, C. *et al. Food Chem. Toxicol.* **50**, 1134–1148 (2012).
3. IFOP. *Les Français et les OGM*. Available at <http://go.nature.com/upf1cx> (in French).
4. Lu, Y. *et al. Nature* **487**, 362–365 (2012).
5. Marvier, M. *et al. Science* **316**, 1475–1477 (2007).
6. The Local Monitoring Committee, Lemaire, O., Moneyron, A. & Masson, J. E. *PLoS Biol.* **8**, e1000551 (2010).
7. Joly, P. B. & Rip, A. *Nature* **450**, 174 (2007).
8. Arnich, N. *et al. Int. J. Hyg. Environ. Health* **214**, 271–275 (2011).
9. Vandenberg, L. N. *et al. Endocr. Rev.* **33**, 378–455 (2012).