

converted into lumber and lost forever. The new law, which will soon go to the Brazilian Congress, provides support and benefits to those that collect, characterize and conserve *in situ* species to be used as drugs. For example, they will receive royalties and participate in the profits from commercialization, access to technology transfer, co-authorship in intellectual property and investments in R&D. It provides the kind of 'bioprospectors' rights' originally proposed 12 years ago⁶.

We believe that these new incentives to private investment can galvanize Brazilian life science entrepreneurship. Together with validated examples of biotech applications that provide tangible solutions to real health problems, these incentives can provide the momentum needed to spur

further development of the health biotech sector in Brazil.

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(refs. 6,7). This time around, it was harder to find a field site—a problem I had little to do with, fortunately. It was impossible to find a suitable site in North-Rhine-Westfalia, so we looked south. We found a suitable site and hospitable hosts in Bavaria, a southern federal state of Germany with a government very progressive on the future role of GM plants in agriculture (back then at least). Everything went well over the next 3 years of research, although the number of field-release and other field experiments in Germany being destroyed by activists gradually increased as time passed, and we even had to spend an entire weekend out in the field because of fears it might be paid a visit by 'field liberators'. Driving the 800 km to and back from the field site was strenuous. Over the course of the project, I spent three whole months driving eight hours every working day.

I recently finished my PhD and I am still doing research on *Bt* corn. Again in a consortium with a grant from the BMBF, we are assessing the potential ecological impacts of MON89034 × MON88017. Finding a site for the field release was outstandingly difficult; eventually, we were accommodated by a German federal institution. Now, we are traveling 420 km every time we drive to or from the field.

The change of locality was necessary because our original plans to remain in Bavaria were shattered when the *Bavarian State Ministry of Agriculture and Forestry* decided that this kind of research was no longer wanted in Bavaria. Since elections were held last September and public opinion was decidedly against plant biotech, the ruling Christian Social Union (CSU) thought it was best not to invite us again to do our research in Lower Franconia. Allowing us to continue would definitely have compromised their reputation as being 'close to the people'.

This was regrettable on several levels, especially as the local officials who had been directly working with us there were eager to continue the collaboration. They saw the scientific research we were doing, and planned to do, as a prerequisite for public acceptance of plant biotech.

The fact is, at the moment, there is currently no public acceptance of plant biotech in Germany. The reason is simple: fear, uncertainty and doubt (FUD)⁸. Fear that some unforeseeable major disaster will definitely come true. Uncertainty over the social and economic consequences of the large-scale cultivation of GM plants and over

German GM research—a personal account

To the Editor:

As a junior scientist in Germany working for nearly 6 years on biosafety research, I wholeheartedly agree with the correspondence in your September issue from Henry Miller, which lamented the decision of the president of Justus Liebig University in Giessen for having pressured his faculty to cease field experiments on genetically modified (GM) corn¹. I would like to share with your readers some of my personal experience—working as I have on the potential impact of the cultivation of genetically modified (GM)

Bacillus thuringiensis (*Bt*) corn cultivars on arthropod nontarget organisms—on the issues Miller so frankly addresses.

In 2002, I started working as a student assistant on a 3-year project dealing with the assessment of the environmental impact of the *Bt* corn variety MON810 (ref. 2). The project was financed by the German Federal Ministry of Education and Research (BMBF). The field site was only 100 km away from Aachen, which was a very practical arrangement. From the onset, I was fascinated by the myriad possibilities that agbiotech holds for the future, making agriculture more efficient, more sustainable, more environmentally compatible and

potentially safer for those working in agriculture. But there was also the other side, of course, the multi-faceted possibilities in which GM plants can interact with the environment in unintended and unforeseen

ways. Also, the field of biosafety research was quite young, with very different opinions on what should be assessed, how this should be done and how results should be interpreted. And there was new European Union (EU; Brussels) legislation^{3,4} coming forward. Back then, this seemed a reasonable subject to choose for research as there were already many ideas on possible and

promising applications of recombinant DNA technology in crop plants. What's more, there also seemed to be a future demand for scientists working in that field. Ideologically opposing the possible benefits of plant biotech seemed unreasonable (and today it does even more), so I presumed there would be plenty of opportunities for upcoming, young researchers such as myself.

In 2005, I finished my diploma—on the fate of the Cry1Ab protein in agricultural biogas production facilities⁵, an economically interesting issue—and immediately started my PhD work in another project financed by the BMBF with a field-release experiment on MON88017



whether we can actually assess and foresee every possible way in which a GM plant could do harm. And doubt over whether the benefits are real possibilities or just marketing propaganda. These are the main motives driving people to oppose green biotech and which are strategically and successfully used by nongovernmental organizations (NGOs) with an anti-biotech agenda.

As an aside, most German citizens know little about the basic aspects of agriculture and biology and are therefore quick to oppose GM crops as something they do not understand. They also do not see that there is no such thing as a 'risk-free' technology. Every human activity carries a multitude of risks for a large array of possible harms. Risk perception seems not to be a strength of the human mind, however. A case in point is the Large Hadron Collider at Cern⁹.

I have had several long discussions with people who identify themselves as biotech opponents in a German online forum dedicated to informing the general public and providing a platform where lay people and scientists can meet¹⁰. From these discussions, I have gathered two other motives for the failure of agbiotech in Germany: mistrust and anger. Mistrust relates to mistrust of 'scientists'—all people somehow involved in, or connected to, scientific research are taken into *Sippenhaft* (that is, collective responsibility of a whole group of people, as defined by the circumstances, for the actions of a few people, or even a single individual, belonging to this group). Anger relates to the corporate world, the increasing influence of the 'agri-industrial complex' (similar to the military-industrial complex referred to by US President Dwight D. Eisenhower)¹¹, a perceived lack of personal influence on public policy and the way society deals with certain issues.

Although FUD are strongly issue related (that is, they can be addressed with results from scientific research), mistrust and anger are directed against institutions, companies and ultimately people. From my own experience, arguing against them with scientific reasoning takes a lot of effort and peer-reviewed literature on the side of the scientist because overexaggerated and unrealistic horror scenarios are very much embedded in the thinking of many active opponents of plant biotech. Ultimately, it is possible to win ground in these discussions, however.

Mistrust and anger are much harder, and in most cases, actually impossible, to overcome. They are often deeply rooted in, or at least intricately intertwined with, a general rejection of the corporate world, the capitalist economic system, disenchantment with politics, a pinch of new-age mythology and conspiracy theories. Which meme is the most important varies highly between individuals and demands that arguments and the course in which the discussion is steered has to be adapted to every discussion partner.

Scientists, such as myself, and politicians can play an important role in educating the general public over the risks and benefits of plant biotech for the society at large. It is especially important for the research community to understand that judgment calls about the value of GM crops are taken by society as a whole, not just on the basis of science¹². Adopting such an independent stance could in fact boost the trust of the general public in scientific research.

As for politicians, they need to be clear and honest about their views on whether plant biotech is an option for the future. Until now, dishonesty and backtracking by politicians, particularly in Europe, has merely aggravated public perception problems. How can politicians expect public opposition against agbiotech to wane when they are so eager to exploit its potential threat as a rallying cause in election campaigns, reacting to the whims of the electorate in the hunt for votes? How do they think it is possible to educate the general public about the risks and benefits of plant biotech when they so blatantly render scientific research nearly or even totally impossible? How can they be taken seriously on these issues when on the one hand they boast about funding for research and on the other hand condemn the GM products that the research produces?

As Miller relates, what counts in the case of Justus Liebig University is that zealots brought a German University to its knees and that reason succumbed to a lack of common sense and decent judgment. It is disappointing that the university president permitted intimidation to compromise academic freedom and the freedom of faculty to carry out their research.

But that is easy for me to say as none of my experiments has ever been vandalized, and the first year of the current field-release experiment has so far suffered no harm.

The only damage I have suffered over the past years has been to my reputation: as a researcher who has not found any negative impact of *Bt* corn, despite all the years of research, I must have been bribed to publish only positive results pleasing to corporate sponsors (most probably St. Louis, Missouri-based Monsanto). That I have been continually funded to this day by the BMBF on short-term contracts and therefore am actually an employee of the taxpayer is a counter-argument that often falls on deaf ears. But this illustrates the public perception mountain that needs to be climbed: if members of the general public already have trust issues with me—a researcher funded with public money—there seems little hope for colleagues on the pay-roll of companies and corporations in the plant biotech industry. They will always be perceived as dishonest. And their results will probably always be discounted as being biased.

Looking to the future, I am also confronted by FUD: fear for the intactness of my group's experimental field and the potential threat that vandalization poses to my students' theses; uncertainty over whether we will still be able to do this kind of research after the general elections in Germany this September 2009, for instance; and doubt over whether GM research was a reasonable subject to pursue. It looked that way only 6 years ago. Now, I am not quite so sure.

COMPETING INTERESTS STATEMENT

The authors declare competing financial interests: details accompany the full-text HTML version of the paper at <http://www.nature.com/naturebiotechnology/>

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