



Letter to the Editor

Response to Lotz *et al.*: Genetically modified crops and sustainable agriculture: a proposed way forward in the societal debate

1. Introduction

Nowadays, the ethical, ecological, and economic aspects of the production of our food and feed are strongly debated, not in the least in the Netherlands, where the contribution of primary production to the national product is so large, the ethical aspects of industrial animal husbandry is so prominent, and the ecological footprint of agriculture is so tangible. Surprisingly, some of the hottest issues in this ongoing debate are the use of genetically modified (GM) crops and the role multinational breeding and seed companies play in developing, promoting, and commercializing GM crops. The number of field tests with GM crops is declining in Europe. The Marches against Monsanto have illustrated and underlined what was already known for decades: there is a lot of distrust in profit-driven multinationals among the general public. What is new is the fact that so many are willing to demonstrate their dislike and this fact cannot be ignored by politicians, or scientists depending on public funding for research money.

Sometimes I find myself being labeled as someone who is “against” genetically modified (GM) crops. However, I am not “against” GM crops, when proven safe and grown in conventional farming systems. I can see that some GM crops can have significant benefits and can be grown with risks that can be considered negligibly small and thus acceptable. On the other hand, I sympathize with important groups in society which are against the use of GM crops and can understand why these groups feel overwhelmed by the strong lobby from multinationals and scientists. Multinationals and scientists alike try to safeguard their interests (profit, research funding, etc.) while arguing that they are acting in the best interest of humanity, for example by claiming that they help to produce enough food for the burgeoning world population. Some even go as far as claiming that it is immoral to be against genetic modification, because GM crops are needed in the battle against hunger and climate change. Such argumentation is beside the truth as genetic modification did not substantially increase actual yields so far and because there are more important barriers to access to food than productivity *per se*. Therefore this argumentation triggers both strong position and agitation. On the other side, the risks of uncontrolled effects of GM crops on human health over generations or risks of ecological disasters are grossly exaggerated, certainly in the light of the long-term cropping of large areas with GM crops without any problems that are directly caused by the technique of genetic modification itself. Such forceful arguments are not helping the debate and both proponents and opponents have become deaf or insensitive for sensible arguments a long time ago.

The debate is complicated by the unchallenged observation that there are indirect problems associated with the introduction of GM crops, such as the decline in populations of singing birds (shortage of weed seeds as a consequence of successful weed control), impact on conservation of crop genetic diversity, increased use of herbicides, increased resistance to glyphosate in weed populations, etc. But these are not caused by the GM technique itself.

Without taking a stance for or against genetically modified crops, I will argue that - in my view - there are three elements in the debate on GM crops that deserve some additional attention: a. the role of science; b. facts and values; and c. rights.

2. The role of science

During the last decades, the general public seems to have gradually lost faith in science. As T. Fagerström in his Letter to the Editor is already pointing out, science is no longer considered the only and authoritative source of knowledge, insight or educated opinion; in other words, science is no longer considered producing an objective truth upon which non-scientists can rely to make decisions on technologies, to assess the risk of adopting such technologies, or to make moral judgments on the acceptability of such technologies. Path dependency, (alleged) dependency on funding agencies, tremendous progress in insight that falsifies even very recent discoveries and theories, the arrogance of scientists, and long-lasting controversies among scientists themselves undermine the general public's trust. In many cases, scientific findings are therefore being considered an opinion by the general public, an opinion that might have merit but should not have more weight in the debate than other opinions based on other types of deliberations and argumentations. The authority of the scientist or the expert no longer goes without saying; it must be earned, recreated, proven, and maintained over and over again. In a debate with eloquent laymen scientists often lose the battle, at least in the eyes of the public.

It might come as a shock, but we scientists have to get used to it: NGOs, policy makers, politicians, journalists, donors and, indeed, citizens and consumers all have their own truths and perspectives. Moreover, many of them master the techniques and have the resources to translate their own truth into policy and action. That translation can go hand in hand with selective use of science or creative interpretation of scientific findings, a consequence of the democratization of science, which in itself should be wholeheartedly welcomed but has its negative side-effects. However, certainly in the debate on GM crops, science itself is partly to blame for this loss of authority, for example by promising a lot and not delivering on time, by paradigm shifts, or by excluding the general public in early moral debates because it is deemed too ignorant to judge.

In conclusion: in an area that is so important for the everyday life, i.e. our food and feed production, scientific rationality and factual argumentation not always win and we, scientists, will have to live with that.

3. Facts and values

The change in the role of science is also partly linked to the (interactive) roles of facts and values in the debate. In the discussion on the use of GM crops, there is a continued debate on the facts. One would expect that such a factual discussion could easily be solved and would result in agreement on what the real facts are, what their implications are, and how they will affect the choices on the use of this technology to be made. However, it is not that simple. There are different kinds of facts and their relevance depends on the value system against which and conditions in which they are evaluated: we know that weed control is cheap and effective with Round-up ready corn and soybean, we also know that a very large proportion of the farmers worldwide do not have access to herbicides, making Round-up ready crops irrelevant. It is common in the scientific community to disagree on relevant facts and methods, for example on how to assess the impact of intake of GM products on human health. Science also has a blind spot for the underlying values and thus on the moral framework within which facts need to be interpreted and weighed.

The role of facts and values becomes very clear when we review the reasons why people are against the use of genetically modified crops. There is a common perception of the risks of the technology relating to alleged environmental impact, pollution of on-farm and off-farm organisms, and threats to human health. Many have the opinion that this technology does not match with their own holistic world view or socio-ethical ideals. In that sense, genetic modification is seen as a continuation of the trend towards further industrialization of agriculture, which conflicts with the preferred attitude towards nature; genetic engineering is also seen as a method of breeding in which synthetic gene constructs are forcefully introduced, rather than that genetic changes occur through natural processes in which the self-regulation of organisms is stimulated. Genetic modification also results in a concentration of power in the food chain into the hands of a few profit-driven multinationals, enhances globalization, and causes loss of agrobiodiversity at a regional level, thus reducing diversity which is considered so essential for the evolution of life and for food security. Globalization also works against the ambition for short, local chains and the preference for seasonal products. Moreover, the transgression of species barriers does not respect the intrinsic value or species specific nature of plants and animals as an essential element of naturalness, as indicated in the Letter of Lotz *et al.* Thus, making GM crops violates the integrity of living organisms.

In this value-driven view on agriculture, genetic progress and the role of technology, GM crops do not fit. Even when GM crops offer solutions for serious problems, such as the resistance against late blight in potato through cisgenesis, many will not accept such a technology.

Science has developed techniques where the end product can no longer be recognized as genetically modified but has been created through genetic modification, speeding up the process of creating the new genotype. The new genes are natural but the technique is not. For many people such an approach would make the end product ethically acceptable, but, for example, in the organic movement emphasis is on the process and not on the product. Legislation is still struggling with this contrast and different countries have different approaches in this respect. But designing such techniques

to make the end product more acceptable makes certain groups of opponents even more suspicious.

4. Rights

Intellectual property rights play a crucial role in the debate on GM crops. They are needed to make the use of GM technology economically viable, but hinder the wider use of the products of genetic modification as they unilaterally protect the rights of the breeders and ignore the farmers' rights of multiplying their own seeds. Freedom of choice is also highly relevant in this debate. We cannot impose a technique on everyone, there should be room to choose for GM crops or for GM free crops and therefore every farmer should have the choice to grow GM crops or entirely GM-free material. Consumers should have the choice to buy GM free products or GM produce. We should always allow and enable co-existence of different approaches. The only solution then is to leave room for each other's rights and privileges by designing agricultural systems and food chains in which a GM crop track and a non-GM crop track can co-exist without unacceptable contamination, extreme restrictions or unacceptably high costs. However, in some crops genes can travel far and in some chains a certain level of contamination seems unavoidable. In that respect, genetic contamination will lead to the violation of the right to choose for both farmers and consumers, because of the likely pollution of the gene-pool of cultivated crops, microorganisms and animals, and the unavoidable contamination of the chain.

5. Conclusion

Given the considerations above, the reasoning of Lotz *et al.* to create a stakeholder participatory approach of development of acceptable technology for sustainable agriculture is sympathetic but rather naive at the same time. Their final proposal to catalyze the societal debate on a participatory design of technology development towards a sustainable agriculture, perhaps including genetically modified crops, is too much based on scientific reasoning, ignoring that other forms of truth, other kinds of facts and (partly in interaction with these facts) other norms and values also carry weight. Moreover, there is no equal distribution of rights and privileges.

Especially the divide in underlying values is not easily crossed. In a pluriform society with assertive citizens, choices that interfere with the values of a minority will remain problematic, also when those choices have been made after a participatory and inclusive trajectory.

Moreover, scientists can and should only play a modest role: they can provide solid information, sort out facts, identify problems, help to analyze and value, mediate, in cases even advocate, but cannot solve societal disputes or messy problems characterized by lack of available or commonly accepted knowledge and by differences in norms and values. Even an informed opinion has limited value and scientists have no specific moral authority.

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