Ethics of GE Plants: Towards a Better Informed and Balanced Debate

Lucy Carter

Introduction

Public debate about the ethical acceptability of genetically engineered (GE) plants in general, and food in particular, is highly polarized. Proponents of GE products passionately argue that novel gene technologies have the potential to contribute to more efficient agricultural processes, promote environmental sustainability, and curb malnutrition in the developing world. Opponents of novel plant biotechnologies counter with equal vehemence that GE products are unnatural, potentially harmful to humans, and capable of catastrophic injury. As more uses for GE products are realized and investment in plant biotechnologies continues to grow, both groups have stepped up advocacy of their respective views in academic and public forums. Both sides continue to be at loggerheads with one another, in trying to force the public to choose between their two opposing views.

At times, an unfortunate casualty in the debate has been well-reasoned and independent argument. Recent advances in novel gene technologies across several disciplines, most notably medicine and agriculture, have fuelled optimism about the potential benefits of genetic engineering and have led some biotechnologists to make ambitious projections about its potential impact. In response, various green lobby groups have wasted no time in marshalling public support for anti-GE campaigns that have tended to overstate the potential risks of GE products in their support for organic farming practices. Such campaigns have consequently influenced governments in continuing moratoriums in Australia and elsewhere.

Several food-related health scares in Europe and Britain in the 1980s and 1990s have also provided the public with a reason to be suspicious of regulatory authorities who are responsible for assessing food safety. Given this climate, it is not surprising that the debate about the ethics of genetic engineering has not advanced beyond the usual emotive and ill-informed objections typically offered in opposition to novel biotechnologies.

This article provides an overview of the most prominent arguments put forward in favor of, and in opposition to, the development and use of novel plant biotechnologies. In doing so, it summarizes the findings of a study conducted by the author, in which the quality of arguments used in the debate was tested. The conclusions made here offer some practical points of departure for moving past the traditional impasse that ethical and policy debates about GE often find themselves.

The debate so far

For the most part, the potential benefits postulated by advocates of genetic engineering are at least theoretically conceivable. Genetic modification of plants (particularly, crops) confers several advantages over traditional agricultural methods. Improvement in agronomic traits such as pest resistance, herbicide tolerance, salinity tolerance, and viral and fungal resistance have the potential to improve or increase yield quantities while significantly limiting the amount of toxic pesticides currently used in conventional agricultural practices worldwide.

A primary aim for biotechnologists and agriculturalists alike is to enhance a plant's phenotypic characteristics for the purpose of improving a plant's ability to withstand biotic and abiotic stressors. Examples of desirable traits in plants include increased growth rate, plant architecture, and stress tolerance. More advanced applications of genetic engineering include the fortification of food crops through the introduction of novel genes to enhance nutrient content, and the development of plants that express proteins that can be harvested for the manufacture of oral plant vaccines.

Proponents of genetic engineering have long argued that products derived using this technology have the capacity to provide malnourished populations with sufficient nutrients to prevent many of the secondary diseases that commonly lead to death in poverty-stricken countries. Malnutrition in the developing world is a very complex problem and genetic engineering may only provide part of the solution[1]. I have argued elsewhere that provided certain conditions are met, we have a moral duty to facilitate the diffusion of genetic engineering technology to developing countries on the grounds that doing nothing might be worse for the current situation[2].

There are, however, significant political and legal obstacles to overcome before such benefits are realized. Beta-carotene enriched Golden Rice, for example, has been demonstrated to contain significant output potential, yet the widespread dissemination of fortified rice to malnourished populations in Southeast Asia and Africa remains problematic. A lack of basic infrastructure and poor or non-existent regulatory controls continue to hamper access to genetic engineering technology and its benefits. The impact of intellectual property rights regimes on developing world agriculture and the presence of cultural and social inequities are also obstacles to the global diffusion of genetic engineering technology. These impediments reduce the prospect of this technology of being of any real use, irrespective of

a moral duty to provide aid. Such issues have not received the attention they deserve in the debate about the ethics of genetic engineering.

Some proponents have also claimed that functional foods derived from genetic engineering can help to address the various problems caused by *over*nutrition in the developed world. Excessive caloric intake, including a diet high in carbohydrates and saturated fat, has long been associated with the incidence of obesity, cardiovascular disease (CVD), diabetes, and some forms of cancer. Despite the vigorous marketing of such products as 'disease-preventing', there has been little or no direct evidence that consuming functional foods prevents diseases caused by affluence such as CVD or obesity at a population level. This raises serious questions about the ethical acceptability of promoting individual products as being directly beneficial to consumer health. The role of functional foods in the human diet needs to be considered in the context of a healthy lifestyle. Regulators of food derived from both GE and conventional means should be concerned about the continued promotion of putative health benefits of individual food products.

The majority of opponents' arguments to genetic engineering have largely focused on the perception that genetic engineering technology will harm the environment. The potential creation of a so-called "superweed" has been advanced by many opponents of genetic engineering as the most damaging consequence of commercializing GE crops. Pollen travel and subsequent gene flow is dependent on a complex series of factors that impact the likelihood of hybridization and subsequent introgression. Transgene escape can be controlled, monitored, and even planned for[3]. Before particular GE plants are grown, it is possible to make a relatively confident determination of the likelihood of gene flow. There are a myriad of physical, temporal, and genetic measures currently in various stages of development that may serve to reduce or eliminate the potential for gene flow between GE crops and related non-GE species.

Growers of organic produce have voiced their opposition to genetic engineering on the grounds that pollen flow from GE crops could potentially harm the organic food industry's 'clean-green' image. The last two decades have seen an increase in the demand for both GE and organic crops[4]. Increasingly there has been a need for growers to find mutually acceptable practices in an effort to co-exist successfully. Co-existence is not a new concept and only becomes an issue if there is a distinct demand for non-GE crops, as is the case for the organics industry. The expectation by some organic growers for absolute non-interference from other agricultural growers is unreasonable and unjustifiable given the complexities of modern agriculture and surrounding ecosystems. The principle of justice needs to apply to both systems of agriculture in the spirit of fair enterprise. Conventional farmers have a duty to ensure that the risk of pollution is minimized. Similarly, organic farmers have a right of protection against avoidable gene flow. These expectations should be based on shared norms.

Five years ago the chief argument used against the development and use of GE products was that they offered little in the way of consumer benefit. It was widely held that large biotechnology companies were the primary beneficiaries of genetic engineering. It has now become clear that in some instances, this may in fact be true. The benefits of genetic engineering technology applied to plants are more likely to improve agricultural systems by providing farmers with an opportunity to reduce input and in some cases increase output while improving soil health. These benefits are environmental as well as commercial.

In the quest to continue a more focused and practical dialogue about the ethics of genetic engineering, I offer a number of recommendations that take into account some of my research findings. The following list is by no means extensive but it offers the reader some pragmatic points of departure when discussing the ethics of GE technologies.

Considerations in moving the debate forward

- The public has a tendency to celebrate organic agriculture and demonize genetic engineering agriculture. This belief is driven in part by the conduct of the anti-GE lobby in its efforts to halt the introduction of GE technology, but also in part by a lack of respect afforded to the community by those who believe the general public is not in a position to understand or accept the complexities involved in the development and application of genetic engineering.

- Transparent and open communication processes between biotechnology industries, regulatory authorities, and the general community are essential. Effective risk communication is not always achieved by simply telling the truth to the best of one's ability. It is just as important for governments and industries to be *seen* to be telling the truth.

- Public campaigns orchestrated primarily by anti-GE lobby groups continue to perpetuate myths about the risks and benefits of GE. The majority of these claims are based on misguided or distorted information and some claims continue to foster public fear.

- All disciplines directly and indirectly involved in biotechnology research have a responsibility in moderating the debate about GE technology. Optimism is critical to the pursuit of advanced technologies capable of benefiting key aspects of modern society. So too is informed debate.

- One important consideration in the diffusion of GE technology to the developing world relates to equity of opportunity. Failure to provide the necessary infrastructure to enable farmers in developing countries to benefit from agbiotech advances will threaten food security.

- GE technology is just one tool that we are fortunate to have at our disposal and that has demonstrated to be beneficial to agriculture in both industrial and developing contexts. To isolate the GE debate from discussions about improvements in agriculture generally is misguided and historically has proven detrimental to its advancement. Conventional, transgenic and organic industries are not mutually exclusive and cooperation between them is in some instances even desirable[4].

- With the diffusion of all new technologies we take calculated risks based on informed and reasoned decision-making. There is a consensus in the scientific community that there exists no harm to human health from consuming foods that contains GE ingredients[5]. There is also mounting evidence to suggest that the risk of transferring allergenic proteins to novel foods as a result of genetic engineering is very low[6]. Added to this is the growing confidence in the scientific community that the opportunity for transgene flow and subsequent environmental harm remains low, provided individual plant characteristics and surrounding environments are taken into account. A case-by-case, evidenced-based approach is the best approach when making decisions about genetic engineering applications.

- The ethics debate must now shift. One point of departure in this shift may be to forecast some of the potential social and economic inequities that may present themselves with the uptake of this technology and focus our energies on ameliorating at least some of these.

References

1. Pray CE, Naseem A (2007) Supplying crop technology to the poor: Opportunities and constraints." Journal of Development Studies **43**(1), 192-217
2. Carter L (2007) A Case for a duty to feed the hungry: GM plants and the third world. *Science and Engineering Ethics* **13**(1), 69-82
3. Glover J (2002). *Gene Flow Study: Implications for GM Crop Release in Australia*. Canberra, Bureau of Rural Sciences
4. Byrne PF, Fromherz S (2003) Can GM and non-GM crops coexist? Setting a precedent in Boulder County, Colorado, USA. *Food, Agriculture and Environment* **1**(2), 258-61
5. Zimdahl RL (2006) *Agriculture's Ethical Horizon.* Burlington, Academic Press
6. Lehrer S, Bannon G (2005) Risks of allergic reactions to biotech proteins in foods: the perception and reality. *Allergy* **60**, 559-64

Dr Lucy Carter
Honorary Research Consultant
School of History, Philosophy, Religion and Classics
The University of Queensland, Australia
l.carter@uq.edu.au