

This response was submitted to the Call for Evidence held by the Nuffield Council on Bioethics on Genome editing between 27 November and 1 February 2016. The views expressed are solely those of the respondent(s) and not those of the Council.



Agricultural Biotechnology Council (abc) response to the Nuffield Council on Bioethics' call for evidence on the ethical issues arising in relation to genome editing.

The views expressed in this submission are those of the Agricultural Biotechnology Council (abc) - the umbrella organisation for the agricultural biotechnology industry in the UK. Comprising of six member companies, abc works with the food chain and research community to invest in a broad range of crop technologies – including conventional and advanced breeding techniques, such as genetic modification (GM). These are designed to promote the sustainable intensification of agriculture by tackling challenges such as pests, diseases and changing climatic conditions, whilst reducing water usage, greenhouse gas emissions and other inputs. The companies are BASF, Bayer, Dow, Monsanto, Pioneer (DuPont) and Syngenta.

Executive Summary

abc welcomes the Nuffield Council on Bioethics' request for stakeholder views on the ethical issues arising in relation to genome editing.

Technological advances linked to genome editing have great potential in agricultural biotechnology. To support this field of science and the millions of people who could benefit from it, Europe needs a predictable regulatory approach based on sound science.

PERSPECTIVES ON GENOME MODIFICATION

1. To what extent can the development of genome editing techniques be regarded as distinct from or continuous with existing techniques? In what way are the differences significant?

Genome editing is not linked to a specific trait or use but should be viewed as additional valuable options in the repertoire of breeding approaches that may be applied to develop superior plant varieties. The use of genome editing techniques makes the breeding process faster and more targeted, which lowers the production costs and speeds up innovation.

CURRENT RESEARCH

2. What is the current state of the art in the field? What are the current technical limitations and constraints/ bottlenecks?

NA

3. What are the main directions of travel? What are the envisaged endpoints/ applications?

Although development of new products and applications is ongoing, some products which are currently under development include apples which do not turn brown after peeling, which leads to less food-waste; products with decreased allergens or anti-nutritional compounds¹; products with naturally occurring pest resistance, such as mildew-resistant wheat², *Phytophthora*-resistant potatoes³, scab-resistant apples⁴, etc.

These products may lead to a more sustainable use of pesticides, which in turn leads to less environmental impact or deliver lower post-harvest losses and cost reduction for growers as well as for consumers.

Additionally, there is also potential for genome editing to develop products for bio-based applications, decreasing the industrial dependence on oil-based products. These examples show just a fraction of the beneficial traits that genome editing can help us achieve in a shorter time frame when compared to conventional plant or seed breeding.

It is worthy of note that gene editing will not replace all forms of genetic modification, since the former will not normally allow the transfer of genetic material across species. Hence this series of new technologies should not be seen as a panacea but rather an important addition to the many tools that should be made available to the plant breeder's tool kit.

4. What is the rate of travel? What are the expected timescales for realising the envisaged endpoints?

NA

5. Are gene drives an area of particular interest or concern and, if so, why?

NA

¹ Low-allergen soybean could have high impact, available online at: <http://www.sciencedaily.com/releases/2015/05/150504094434.htm>

² Wheat with Improved Powdery Mildew Resistance (University of Zurich), available online at: <http://www.agroscope.admin.ch/biosicherheit/06948/06951/07260/index.html?lang=en>

³ BBC, Genetically modified potatoes 'resist late blight', available online at: <http://www.bbc.co.uk/news/science-environment-26189722>

⁴ Mapping of the apple scab-resistance gene Vb. (Plant Pathology, Institute of Integrative Biology (IBZ), ETH Zürich, Switzerland), available at: <http://www.ncbi.nlm.nih.gov/pubmed/17213905>

CONDITIONS OF RESEARCH AND INNOVATION

6. What are the main 'drivers' and 'obstacles' for plant genome editing in relation to envisaged endpoints?

The lack of necessary regulatory clarity continues to be an obstacle for plant genome editing. Technological advances linked to genome editing have great potential in agricultural biotechnology. To support this pioneering field of science and the millions of people who could potentially benefit from it, Europe needs to take a clear position on what, if any, additional regulatory oversight is required for the products of the technology

7. What direct or indirect influence does historical public discussion surrounding genetic modification of plants have? What is (and what should be) the current level and focus of public debate?

Over the past 20 years, the UK (and more widely Europe) has seen polarised coverage of genetic modification science, overwhelmingly focused on a small number of reports claiming negative effects of the technology. Yet the use of GM crops has continued to increase in other parts of the world with products from these crops imported to Europe, along with high-profile research into crops engineered to produce medicinal drugs or beneficial vitamins. As a result, some Europeans have been left feeling confused and lacking the impartial information needed to come to an informed view. Nevertheless scientists, leaders and farmers from around the world have become increasingly vocal in calling for a rational, evidence-based debate on crop technologies using scientific data and years of experience in the field. One of the limitations faced by such a debate is that highly complex new science can rarely be explained in a soundbite, and this can be frustrating to the public and scientists alike, while providing an attractive area for campaign groups who can exploit public uncertainty.

OUTCOMES

8. What are the main anticipated benefits and costs (including safety and other risks) of genome-edited plants? In what ways, if any, are they significantly different from alternative GM technologies?

Genome editing plants can provide solutions for societal problems that are linked to our food supply, for instance by the decreased use of natural resources, reduced dependence on chemical crop protection, contribution to biodiversity, resources for bio-based industries, and faster adaptation to changing environmental conditions.

On top of this, the agri-food chain, and ultimately the consumer, benefit by the development of products with beneficial traits in a much shorter timeframe and in a more precise manner. These benefits include higher quality products (resistance, shelf life, ease of processing), more diversity in products (market robustness, changing demand) and improved nutritional contents.

The European plant breeding industry is a world leader in terms of innovation, representing a market value of more around EUR 8,6 billion⁵. Additionally, of the more than 7000 companies in the EU seed sector, a significant portion (in some Member States up to 90%) are Small-to-Medium-Size Enterprises (SMEs), which are widely recognised as a major driver of innovation and economic growth.⁶ Many of these companies depend on innovation and access to technology to remain competitive.

⁵ ISF, International Seed Federation (2013). Estimated Value of the Domestic Seed Market in Selected Countries for the year 2012

⁶ DG Internal Policies, 'The EU seed and plant reproductive material market in perspective: A focus on companies and market shares' (2013), online access: [http://www.europarl.europa.eu/RegData/etudes/note/join/2013/513994/IPOL-AGRI_NT\(2013\)513994_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/note/join/2013/513994/IPOL-AGRI_NT(2013)513994_EN.pdf)

Prof Huw Jones, who is working on applications of the technology at Rothamsted Research, has stated⁷ that “genome editing had the potential to revolutionise plant breeding in Europe, but only if policymakers treat it fairly.”

He further warns that “if it is seen as a non-GMO, it will streamline the approval process and could change how plant breeding is done. If it is seen as a GMO, it will curb future potential and will largely kill the future of the technology for small breeding companies or institutes such as Rothamsted. All the subsequent negativity surrounding GM would effectively prevent them being used in Europe.”

Penny Maplestone, chief executive of the British Society of Plant Breeders echoed the views of Prof Jones but notes that the technology has “enormous potential to really speed up the rate of innovation” but she added: “How the technology develops from here is completely dependent on what happens in the regulatory world.”

9. Are there particular issues raised by genome editing in relation to ecological stability, biological diversity, technology transfer between countries, and equitable sharing of the benefits of research?

NA

10. To what extent, and in what way, does and should the distribution of anticipated benefits and costs of using genome editing in plants influence research and innovation?

NA

11. To what extent are public and commercial interests in genome editing in plants complementary? In what circumstances might they come into conflict?

NA

12. What other important questions should or might we have asked in this section?

Important questions which should be addressed could include:

- Jack Bobo, former advisor at the U.S. Department of Agriculture, has said that ‘the amount of food we need to produce in the next 40 years (is) equivalent to the same amount produced in the past 10,000 years.’⁸ What are the ethical considerations of not using gene editing technologies in plant science?
- Do campaign groups and NGOs have an ethical duty to avoid scaremongering and acknowledge the findings of independent regulators?

⁷ Farmers Guardian Insight ‘GM or not GM? why key decisions on new technology will shape EU plant breeding’, online access: <https://www.fginsight.com/news/gm-or-not-gm-why-key-decisions-on-new-technology-will-shape-eu-plant-breeding--7081>

⁸ Farmers Weekly ‘Food crisis will prompt GM foods rethink, says US aide’ online access: <http://www.fwi.co.uk/arable/food-crisis-will-prompt-gm-foods-rethink-says-us-aide.htm>