



# genome editing

## INVASIVE AND HOLLOWING OUT THE WHOLE

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**Genome editing** *is becoming the latest ‘sustainability’ mantra but there is hesitation abroad about using the words out loud.*

**For example, in the recent House of Lords consideration of amendments to the Agriculture Bill there were frequent references to ‘precision breeding’, ‘new plant breeding techniques’ and ‘modern breeding methods’ for plants and livestock – all of them are euphemisms for genome editing but the term itself was systematically avoided.**

This was in line with the character of one highly controversial amendment which sought to change the definition of GMOs in UK law through a piece of underhand regulatory chicanery<sup>2</sup> which even the government couldn’t bring itself to swallow. Backed by the biotech lobby and the research establishment, several peers sought to change the definition of GMOs, which is set out in the existing Environmental Protection Act, to one which would exempt genome editing, thereby removing all requirements for monitoring, labelling and safety assessments of the technology post-Brexit.

The government refused to back the amendment and it was withdrawn after ministers confirmed their commitment to ‘freeing’ the technology from regulatory constraint. Yet, they know this is not enough. They need to make it acceptable to the market and consumers. To do that they have to remove the taint of GMOs and genetic engineering and to repackage it as something progressive, sustainable and wholly environment and health friendly.

Of course, it is genetic engineering and the European Court of Justice ruled in 2018 that it should be fully regulated as a GMO – a decision which launched<sup>3</sup> a paroxysm of indignation, outrage and activity from the industry and research establishment.

This latest incarnation of genetic engineering technology is not one particular method. It is a whole suite of them with differing characteristics. But you wouldn’t know that from the sweeping generalisations

made about this ‘game-changing’ technology which, it is claimed, is ‘akin to natural processes’ but ‘more precise’ and has such benefits and negligible risk that it should immediately be freed of regulatory oversight where it will lead the way in a transformative ‘bioeconomy’.

### **Surprising support for genome editing**

In the past, such claims for GMOs have been met with incredulity, a healthy dose of scepticism and more than a little bit of ridicule from NGOs and civil society. Not now. There is an increasing willingness in some quarters to accept that genome editing has – at least the potential – to advance the cause of ‘sustainable’ food and farming, have animal welfare benefits and more speedily tackle some of the difficult issues caused by climate change.

Some have begun to accept the claims that genome editing impacts in a way that is similar to natural processes and could be accepted



in regenerative, agroecological and even organic farming. Beyond GM, has been running a programme called 'A Bigger Conversation' exploring the claims, perspectives and attitudes surrounding genome editing. Some of the findings have been surprising – from all sides.

The latest event in this programme was a webinar which started out to explore the broader issues of 'sustainability' – whatever that means nowadays<sup>4</sup>, which all the panellists agreed isn't very much.

But when the conversation got down to the potential benefits of genome editing some really controversial things emerged.<sup>5</sup>

Compassion in World Farming CEO Philip Lymbery was concerned that adoption of genome editing could entrench industrial farming systems but he nevertheless, supported its use in some circumstances. He asked: *'What if, chickens were successfully gene edited so the only eggs with female embryos are viable... If successful, this technology could be a revolution, ending at a stroke, the killing of birth of 5 billion sentient creatures a year.'*

In an earlier Bigger Conversation meeting<sup>6</sup>, support had been expressed for the use of genome editing to deal with dehorning cattle. Lymbery also voiced support for cell-based meat analogues. While not all of these involve genome editing some of them do.

Organic farmer Guy Singh-Watson also offered some support for gene

editing, noting: *'I'm not adamantly against the technology'* and that *'If you could give us a blight resistant potato, I would find it very hard to argue against.'* He nevertheless expressed real concerns around the system, which seems to go hand in hand with GM technology.

As the 'Bigger Conversation' programme has revealed<sup>7</sup> these perspectives are becoming more widely held. It seems that the industry propaganda about the potential benefit and absence of risk claimed for the technology is undermining the long-standing coalition for precaution.

This has caused immense frustration amongst scientists such as The European Network of Scientists for Social and Environmental Responsibility (ENSSER)<sup>8</sup>, who are committed to the application of the precautionary principle. The team at GM Watch, who are ENSSER members, have produced a scientific briefing<sup>9</sup> summarising evidence that genome editing is not precise, not natural and creates food safety and environmental risks akin to and possibly greater than those caused by 'traditional' GMOs.

**The briefing highlights:**

- Gene-editing techniques are not precise. A large and growing number of scientific studies<sup>10</sup> show that they give rise to numerous unintended effects, including mutations (DNA damage) at both off-target sites in the

genome and at on-target sites (at the desired editing site). These unintended effects will change gene function, which in turn will lead to compositional changes in the plants. Potentially these could include the production of new mRNA molecules and new proteins, which could prove to be toxic and/or allergenic.

- Genome editing is a laboratory-based artificial genetic modification procedure, which in no way resembles natural breeding. And its products, if examined carefully, appear very different from naturally bred products. No one has ever produced a gene-edited crop or food, sequenced its entire genome, and found an identical organism existing in nature. The type and frequency of mutations caused by genome editing are completely different from what can happen in nature.

- Genome editing can scramble genomes in many ways and at many locations. In order to avoid serious impacts on health and/or the environment, developers of gene-edited crops and foods must check their products via whole genome sequencing, in-depth molecular profiling ('omics') analyses to identify any potentially toxic or allergenic compounds or proteins, and animal feeding studies such as those required under EU law for old-style transgenic GMOs.

**The antithesis of whole health**

Some people and organisations might be convinced that there can be a role for genome editing in something that is called 'sustainability' but I am adamant that it is the antithesis of a whole system approach to health, which is built on the integrity of the whole living organism, be it soil life, plants, animals and man within a living, functioning ecosystem.

I recently had an online exchange with Hugh Jones, Professor of Translational Genomics for Plant Breeding at Aberystwyth University about these concepts and practices. The discussion can be viewed online on the Bigger Conversation website<sup>11</sup> and from it lots of background references to genome editing, plant



breeding approaches, the wholistic philosophy behind the organic approach to health and perspectives on gene function can be accessed.

During the exchange, I noted that *'The development of the concepts of organic plant and seed breeding has been primarily driven by ideas rooted in, anthroposophical, holistic, socially focussed agroecological perspectives<sup>12</sup>. From these emerge the precept to 'respect the genome and the cell as an indivisible functional entity' and to 'follow the concept of respecting integrity of life.'*

The consequence of this precept for organic plant (and animal) breeding is that: 'any technical or physical invasion into the isolated cell is refrained from and plant specific crossing barriers are respected, irrespective of potential benefit risk assessments.'

Genome editing is clearly invasive and is not wholistic. There have not been enough studies to determine how much of a risk it is to the process of health and well-being. And there are no studies to indicate any benefit to the function of the process of health but as the rationale behind genome editing is to 'cut and paste', 'cut and delete', it is surely reasonable to call it 'hollowing out the whole'.

### Protecting the whole

In her excellent article on genetic engineering in the Summer 2018 edition of Star and Furrow, Alysoun Bolger<sup>13</sup>, rightly pointed out that the biodynamic movement and Demeter standards were clear that genome editing does not conform to biodynamic principles and practice. She also pointed out that some in the organic sector feel that some genome editing could be compatible.

Since then it is clear that this feeling has increased and spread. For example, one part of the Danish organic sector seems to have accepted that genome editing could be accepted in organic standards. It is unclear how many others will follow that lead but there is no doubt that if genome editing is de-regulated i.e. it is no longer defined in law as a GMO, the organic sector will be faced with internal as well as external challenges.

This will happen in the UK before it happens in the EU because genome editing is a technology which is central to the government's post- Brexit agri-tech strategy.

In any event, fully de-regulated or not, genome editing will be promoted and used in the farming and food system in both the UK and the EU in the coming years. Because the technology is so invasive those of us who believe in farming and food systems based on the integrity of whole system organisms can no longer be complacent. Unlabelled, unregulated gene-edited products can be used in open pollinated seed varieties, can be used in traditional livestock breeds, can be used to produce herbal remedies – and if there is enough money in the market they will be.

These may or may not be extreme examples; the more likely scenario is that 'sustainable', 'low-external input', 'pesticide-free' production and products will appear alongside organic and biodynamic causing confusion to farmers and consumers alike.

### It is therefore important to:

- **Campaign to ensure that genome editing technology is regulated and is transparent, with proper and robust labelling and monitoring**
- **Ensure organic and biodynamic systems are evaluated to spot the areas of vulnerability and to strengthen them. Organic systems are more vulnerable than Demeter certified systems but as Alysoun pointed out in her article use of hybrid and conventional seed is a grey area, the use of material from conventional plant and animal breeding is another.**
- **Develop, promote and educate around the narrative of farming for health and whole systems which have lost ground to vague notions of 'carbon farming', regenerative agriculture' and the more flexible ideas of 'agro-ecology'.**

Overall, we haven't developed discrete, stand alone farm and food systems enough over the years and some of the grey areas in the production and supply chain need now to be examined and dealt with.

This is vital for the survival of whole health farming systems and the food that comes from them. And that is vital to protect society from further slippage into a reductionist, technocratic and unhealthy farm and food future.

Lawrence Woodward OBE – is a director and co-founder of Beyond GM and Whole Health Agriculture.

For more on the debate around gene editing see:

- GM Watch: <https://www.gmwatch.org/en/>
- A Bigger Conversation: <https://abiggerconversation.org/>
- GM Freeze: <https://www.gmfreeze.org/>
- Sustain: <https://www.sustainweb.org/>

1. <https://services.parliament.uk/Bills/2019-21/agriculture/stages.html>

2. <https://rb.gy/vxy6ny>

3. <https://beyond-gm.org/we-dont-need-no-regulation/>

4. <https://rb.gy/h51ubc>

5. <https://rb.gy/4a2e8l>

6. <https://abiggerconversation.org/new-report-brings-focus-to-gene-edited-farm-animals/>

7. <https://abiggerconversation.org/category/news/>

8. <https://ensser.org/publications/ngmt-statement/>

9. <https://gmwatch.org/en/news/latest-news/19455>

10. <https://gmwatch.org/en/news/latest-news/19223>

11. <https://abiggerconversation.org/continuing-the-dialogue-on-organic-and-gmos/>

12. <https://www.mdpi.com/2071-1050/9/1/18/htm>

13. Star and Furrow Summer 2018