Scientists' and policy experts' statement: Gene editing is not "precision breeding" and the term is misleading

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We, the undersigned scientists and policy experts, wish to express our opposition to the increasing use of the term "precision breeding" to describe gene editing (or genome editing), both in the UK and the EU.

In the UK, the government has launched a bill to weaken or remove regulatory controls around ("deregulate") gene editing. It is called the Genetic Technology (Precision Breeding) Bill.[1] In the EU, various groups lobbying for the deregulation of gene editing have also adopted the term "precision breeding" to describe and promote the technology.[2]

This term is technically and scientifically inaccurate and therefore misleads Parliament, regulators, and the public. This is because gene editing is

1) not precise, and

2) not breeding

– as explained below.

1) "**Precision":** The only aspect of gene editing that is precise is the initial double-strand cut in the DNA, which can be targeted to a specific site. But different types of unintended damage also accumulate at the various stages of the gene editing procedure, at both the on-target site (the intended gene editing site) and at off-target sites (elsewhere in the genome of the organism). A large number of peer-reviewed studies reveal unintended genetic changes from gene editing.[3] A review of the literature shows that gene editing-induced changes are different from changes that occur in natural breeding (conventional breeding between sexually compatible organisms), including mutagenesis breeding, because gene editing makes the whole genome accessible to changes, whereas in natural breeding, some regions of the genome are protected against mutations.[4] Recent research in plants (not involving gene editing) confirmed that in natural breeding, mutations are not random and that certain regions of the genome involved in important processes are protected from mutations.[5]

The findings of these studies are not contested; they are generally accepted by scientists working in the field and indeed form the knowledge baseline from which scientists are working to improve the precision and predictability of gene editing.

Scientific concerns around the lack of precision of gene editing in plants are focused around the ability of the technology to change gene functioning in ways that could change the plant's biochemical pathways, leading to the production of unanticipated toxins or allergens.[6]

Concerns around gene editing in animals include health risks and welfare issues affecting the gene-edited animals themselves,[7] as well as health risks to consumers of meat and dairy products from the animals.

2) "**Breeding"**: Gene editing is a laboratory-based artificial genetic modification procedure that involves direct human intervention in the genome. Specifically, gene editing is conducted on plant cells grown in dishes, into which the gene-editing tool is introduced to carry out the intended genetic alterations. Whole plants are then grown from those genetically manipulated cells. It is therefore evident that the gene editing process bears no resemblance to "breeding" as the word is normally defined and understood.[8]

Given all of the above, the term "precision breeding" as applied to gene editing is misleading, and its use is often intended to mislead. It appears to have been coined not as a purely descriptive term, but as a marketing term, in order to persuade the public and regulators that gene-editing technology is natural, accurate, controllable, and therefore safe. However, the evidence base for these claims is lacking and on the contrary, there is strong evidence that supports the application of stringent regulations to gene-edited plants and animals. They should include a requirement for thorough risk assessments of effects on human and animal health and the environment, as well as a requirement for full traceability and clear on-package GMO labelling of the end products.

In conclusion, the term "precision breeding" should be deleted from the title of the UK government's bill and replaced with terminology that is accurate and purely descriptive, to form a title such as "Genetic Modification Technologies (Food, Feed and Agriculture) Bill". Beyond the context of this particular bill, governments and regulators worldwide should avoid using marketing terms such as "precision breeding" to describe gene editing and instead use scientifically and technically accurate terms with broadly agreed definitions, such as gene or genome editing, genetic modification, and genetic engineering.

Note: The signatories to this statement are signing in an individual capacity and not as representatives of their respective organisations. There is no suggestion that the organisations do or do not hold these views.

Further signatories are welcome to apply: https://forms.gle/17VAFQvav6Avsi1B6

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[8] Collins Dictionary (2022) has the following relevant definitions of “breeding”:

“1. the process of bearing offspring; reproduction

2. the process of producing plants or animals by sexual reproduction…”