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UK Government Misinformation on Gene Editing. Johnson Government's Plan to "Deregulate Gene Editing"

GMWatch Analysis: DEFRA's evidence-free leaflet is a wish list for GMO boosters which misleads the public

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UK farm and environment ministry DEFRA published an "Explainer" document on gene editing as a guide for members of the public who want to respond to the UK government's consultation on its plan to deregulate gene editing. It may also have been meant to assist the media, as parts of the text also occur in DEFRA's press release for the launch of the public consultation.

Just over three weeks into the consultation the "Explainer" suddenly seemed to disappear from DEFRA's website, possibly as a result of complaints.

There is certainly plenty to complain about. The "Explainer" is packed full of false assertions and reads like a "wish list" for the GMO lobby, presenting hypothetical "benefits" of gene editing as fact. The Cabinet Office Consultation Principles stipulate that "Consultations should be informative. Give enough information to ensure that those consulted understand the issues and can give informed responses". They should "include validated impact assessments of the costs and benefits of the options being considered when possible".

But the information presented in the "Explainer" is extremely biased and only presents one side of the issue. No mention is made of any risks or downsides to the government's plan to deregulate gene editing.

The "Explainer" also contains no scientific evidence at all. Quite the contrary: It flies in the face of existing evidence. That's ironic, since the consultation itself takes the form of a call for evidence. In other words, the government doesn't have to provide any evidence in support of its plan to deregulate gene editing, but members of the public are expected to provide evidence in support of their opposition to the plan!

GMWatch, with the help of other campaigners, has compiled this mythbuster to help the public avoid having the wool pulled over their eyes. We begin with a summary of the main points of our rebuttal of DEFRA's leaflet, and then follow it with a word-for-word presentation of Defra's leaflet interspersed with our rebuttal of each point.

We downloaded the “Explainer” when it first appeared and have published it on our website for your reference.

Summary of our response

* Gene editing does not mimic natural breeding. It is an artificial laboratory-based technique in which genetic engineers directly intervene in the genome to alter the DNA.

* Gene editing is a genetic modification technique and gives rise to genetically modified organisms (GMOs), as confirmed by the European Court of Justice ruling of 2018.

* Gene editing can be used to deliberately introduce foreign DNA or whole genes – and sometimes foreign DNA is introduced into the genome by accident during gene-editing procedures.

* Even where no foreign DNA has been inserted, the process of gene editing remains inherently risky. It has been found to result in major genetic errors (mutations), which could lead to alterations in the plant’s protein and biochemical composition, potentially including the production of toxins or allergens.

* Weakening the GMO regulations to exempt gene editing will not benefit research, which can already be done. But it will pose risks to England’s food and farming standards, as gene-edited organisms will be allowed onto our dinner plates and into our fields without safety checks, traceability, or GMO labelling.

* If the UK goes ahead with its planned deregulation of gene editing, the EU may ban or restrict food imports from the UK, since without labelling of gene-edited foods it will not be able to tell which foods meet its current safety standards and can legally be sold there.

* No gene-edited crop has been shown to be resistant to diseases. Meanwhile there are many conventionally bred crops that do have such resistance.

* No gene-edited crop has been shown to reduce pesticide use. The first gene-edited crop to be commercialised is a herbicide-tolerant canola, which will enable more herbicide to be sprayed without killing the crop.

* Resistance to disease and pests are genetically complex traits. Gene editing can only manipulate one or a few genes at a time and is not well suited for developing crops with desirable complex traits.

* Animal gene editing raises serious ethical and welfare issues because significant numbers of non-viable and deformed animals result from these programmes.

* The best way to reduce pesticide use and keep crops and livestock animals healthy is to choose from the many available high-performing, disease-resistant, and climate-adapted crops and livestock breeds – and adopt proven successful agroecological farming methods that work with nature rather than against it.

* Gene editing technologies and their products are patented, with the patents already largely controlled by the big agrochemical companies, led by Corteva (part of DowDuPont) and Bayer (which took over Monsanto). So gene editing will not democratise agricultural innovation but is a way for the big companies to further consolidate their power over

agricultural seeds, crops, and livestock animals.

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DEFRA claims vs the facts

DEFRA CLAIMS: The way that plants and animals grow is controlled by the information in their genes. For centuries, farmers and growers have carefully chosen to breed individual animals or plants that are stronger or healthier so that the next generation has these beneficial traits. But this is a slow process. Technologies developed in the last decade enable genes to be edited much more quickly and precisely to mimic the natural breeding process. This has the potential to hugely benefit ordinary farmers and unleash UK research.

THE FACTS: Gene editing does not mimic natural breeding. It is an artificial laboratory-based technique in which genetic engineers directly intervene in the genome to alter the DNA. Even if the resulting plant or animal looks the same as its natural counterpart, the process by which it has been produced is fundamentally different and leads to different risks. Gene editing causes many genetic errors (mutations) in the genome of the "edited" plant or animal, which may result in adverse consequences, such as unexpected toxicity or allergenicity of crop plants.[1,2] The claimed benefits of gene editing for farmers are entirely theoretical and unproven.
DEFRA CLAIMS: Gene editing should not be confused with genetic modification (known as GM). Genetically modified organisms are those where DNA from a different species has been introduced into another. Gene-edited organisms generally do not contain DNA from different species, they contain changes that could be made more slowly using traditional breeding methods.

THE FACTS: Gene editing is a genetic modification technique and gives rise to genetically modified organisms (GMOs), as confirmed by the European Court of Justice ruling of 2018.[3] Gene editing can be used to deliberately introduce foreign DNA or whole genes – and sometimes foreign DNA is introduced into the genome by accident during gene-editing procedures, as shown in a study by Japanese researchers.[4] While this study is in mouse cells, gene editing in plants uses the same mechanisms of DNA cutting and repair, and foreign DNA from the gene delivery vehicle could be inadvertently incorporated into the edited plant's genome.

Even where no foreign DNA has been inserted, the process of gene editing remains inherently risky. It has been found to result in major genetic errors (mutations) such as large deletions, insertions and rearrangements of DNA. The edit can also give rise to new gene sequences, resulting in the production of mutant proteins, with unknown health consequences.[1,5] The genetic engineer has no control over these mutations, as they arise from the self-repair mechanisms within the cells. The mutations can affect the functioning of many genes. In crop plants, this could lead to alterations in the plant's protein and biochemical composition, potentially including the production of toxins or allergens.[1,2] Research on first-generation GM crops has found that some such crops have toxic or allergenic effects on experimental animals.[6,7,8]
DEFRA CLAIMS: At the moment, following a European Court of Justice ruling in 2018, gene editing is regulated in the same way as genetic modification. The UK Government is consulting on changing these rules in England, allowing gene editing research to be used to produce beneficial crops and livestock, but with strong health and safety rules.

THE FACTS: The European Court of Justice was correct in saying that gene editing is a genetic modification technique and could pose similar risks to older-style GM techniques. The GMO regulations currently in place in the EU and the UK allow research to take place after gaining the appropriate permits – many research trials have taken place in the UK over many years and continue to this day. They also allow GM foods to be sold as long as they first go through a safety assessment and are labelled as GM. Weakening the regulations will not benefit research, which can already be done. But it will pose risks to England's food and farming standards, as gene-edited organisms will be allowed onto our dinner plates and into our fields without safety checks, traceability, or labelling.
DEFRA CLAIMS: In other countries, including Australia and Japan, most gene-edited organisms are not regulated as genetically modified organisms.

THE FACTS: Even the few countries that have deregulated gene editing have only done so for one type of gene editing (known as SDN-1), which does not use a repair template. The other methods continue to be regulated as GMOs. However, these (SDN-1) procedures should not be assumed to lead to effects that could be found in nature or through conventional breeding. Even SDN-1 procedures have been found to lead to unwanted mutations.[9,10,11] Those responsible for the deregulation of gene editing in certain countries have failed to take these scientific findings into consideration.

In the EU gene-edited organisms are regulated as GMOs. Interestingly, in the only two regions where the question of how to regulate gene-edited organisms has gone to court, New Zealand[12] and the EU,[3] the courts ruled that they are GMOs and must be regulated as such. Perhaps this is because courts deal in evidence and facts rather than theories and assumptions.

If the UK goes ahead with its planned deregulation, the EU may decide to ban or restrict all food imports from the UK, since without labelling of gene-edited foods it will not be able to tell which foods meet its current safety standards and can legally be sold there.
DEFRA CLAIMS: Gene editing will give us the opportunity to ensure that animals, plants and crops can be stronger and healthier, and more resistant to diseases. This will be of real benefit to ordinary farmers and will unleash our research capabilities. Wider adoption of this technology will also benefit the developing world and increase climate resilience.

THE FACTS: This reads like an advertisement. It is unproven hypothesis misleadingly presented as fact. For example, although gene editing has now been around for several years, so far no gene-edited crop has been shown to be resistant to diseases. Meanwhile there are many conventionally bred crops that do have such resistance.[13] Resistance to disease and pests are genetically complex traits. Gene editing can only manipulate one or a few genes at a time and thus is not well suited for developing crops with desirable complex traits.

Animal gene editing raises serious ethical and welfare issues because significant numbers of non-viable and deformed animals result from these programmes, especially where cloning is used, and cloning is a standard part of the production of gene-edited animals. Reviews detail problems such as lameness, gastric problems, lethargy, extra vertebrae, enlarged tongues, increased resistance to antibiotics and reduced ability to deal with stress.[14,15]
DEFRA CLAIMS: Crops could become more resistant to diseases decreasing the need to use pesticides that could potentially damage wildlife and the environment, for example bees. Gene editing research has produced wheat and rapeseed that are more resistant to disease.

THE FACTS: Gene-edited crops are experimental and have not been tested in the field. The idea that farmers who plant these GMOs will be able to use less pesticide is not borne out by the history. The first gene-edited crop to be commercialised was herbicide-resistant canola, with the aim of allowing farmers to apply herbicide more freely without killing the crop.

The first generation of GM crops was also promoted using claims of reduced pesticide use, but the promises proved hollow. GM crops have led to higher pesticide use.[16,17] Tried and tested methods of reducing pesticide use are already available and involve choosing pest-resistant conventionally bred varieties and implementing agroecological farming methods. Conventionally bred disease-resistant wheat varieties are already available.[18,19,20,21,22]
DEFRA CLAIMS: Research has shown that gene editing may help to resist dangerous diseases like Swine Fever in pigs and Avian Influenza in chickens. This is good for farmers, and the welfare of their animals.

THE FACTS: There is no evidence that disease resistant animals can reliably be produced via gene editing. These diseases are largely caused by overcrowding of the animals concerned. This animal welfare issue is the real problem that needs to be addressed, not the genetics. Gene editing animals to make them cope better with inhumane, unhealthy, and crowded conditions is ethically unacceptable. Defra's wording is significant: "may help". It may or it may not. Expressions like "may" and "could" are used throughout Defra's leaflet. The benefits claimed in this document are little more than a wish list, and yet they are presented as solid fact. In addition, note our reply to the previous question, regarding the animal welfare issues raised by gene-editing programmes.
DEFRA CLAIMS: Gene edited crops can produce fruit and vegetables that are healthier to eat.

THE FACTS: There is no evidence that any gene-edited fruit or vegetable has health benefits. And without gene editing, there is already an abundance of healthy varieties of every crop.
DEFRA CLAIMS: In Japan, gene edited tomatoes are available that could lower blood pressure.

THE FACTS: The gene-edited tomatoes have higher concentrations of an amino acid known as GABA, which can act as a sedative and lower blood pressure. However, there is no evidence that eating the tomatoes will lower blood pressure. No safety studies have been carried out to check that the tomatoes are safe to eat and do not contain unexpected toxins or allergens, which is a possible result of all types of genetic modification technologies.[1,2,6]
DEFRA CLAIMS: Research from Rothamsted Research in Hertfordshire is investigating how gene editing in wheat products can be used to reduce the potential for the formation of a carcinogen called acrylamide. This could decrease the risk of cancer.

THE FACTS: Again, note the wording: "could". There is no evidence that normal dietary levels of acrylamide cause cancer.[23] Acrylamide is formed from a natural amino acid called asparagine when the food is cooked at high temperatures, such as in frying. There is evidence that acrylamide levels in wheat bread are low but increase through hard toasting,[24] so those wishing to avoid ingesting high levels simply need to eat untoasted or lightly toasted bread. GM low-asparagine (and thus low-acrylamide) potatoes have been approved in the US, but low-asparagine potato varieties produced by conventional breeding have long been available.[25]

Notably, polyacrylamide, a compound for which acrylamide is a building block, is used in irrigation water for chemical agriculture to stick degraded soil together so that it does not blow away. It is also used in pesticide formulations to make the pesticide stick to the plant[26] (it is not allowed in organic agriculture). If the government genuinely wishes to reduce dietary levels of acrylamide, it needs to look first at agricultural uses of polyacrylamide to check whether they are a source of acrylamide in food.
DEFRA CLAIMS: The UK already has some of the world's leading researchers on gene editing, for example at Rothamsted Research and at the Roslin Institute in Edinburgh. We want to make the UK the best place in the world to conduct this research and to lead the way in producing stronger and healthier plants and animals.

THE FACTS: There is no ban on research on GM technologies (including gene editing) in the UK or the EU, provided permits are obtained from the relevant authorities. Indeed, GMO crop and animal research has been ongoing in the UK for many years, though arguably it has produced little or nothing of value. If gene editing is pursued, there is a danger of yet more money being wasted, of "opportunity cost", and of going down a blind alley.

Moreover, there is no evidence to suggest that gene editing can produce stronger and healthier animals and some evidence that it can cause great animal suffering (see above). Conventional breeding techniques, on the other hand, have succeeded in producing healthy breeds and varieties of animals and plants.

Efforts to produce healthier animals should focus on changing farming conditions, not the genetics of the animals. Overcrowding should be banned and healthy diets and environments prioritised. Similarly, high-performing conventionally bred crops are already available and efforts to further improve crop health must focus on implementing healthy farming systems. This means building soils full of organic matter and minimising chemical inputs to avoid destroying soil microbiomes.

But these kinds of positive changes don't as readily translate into money making ventures as patentable gene-edited plants and animals do. It's this hope of commercial advantage that seems to be driving deregulation in the UK.
DEFRA CLAIMS: At the moment, farmers and producers suffer losses from diseases that damage their livestock and crops or are forced to use pesticides that could be damaging to the environment. Gene editing could mean that this stark choice is avoided as farmers have access to plants and animals that are naturally resistant to diseases. Gene editing is being used to develop disease resistant crops much more quickly and efficiently than would be possible using traditional breeding. These include wheat, rapeseed and sugar beet.

THE FACTS: As mentioned above, there is no evidence of sustainable disease resistance resulting from gene editing. Given that manipulating one or a few genes is not able to confer complex traits such as disease resistance, expansion of gene editing will not address the problem of plant diseases. This problem largely results from abandoning the principles of rotating crops and improving soil health in favour of quick yields boosted unnaturally by chemicals, which make plants weak and vulnerable to diseases.

Agroecological farming avoids the stark choice described above, by controlling diseases naturally through building soil health and using crop rotation, companion planting, agroforestry, and other time-tested methods.[27] Agroecology is not confined to certified organic systems. An increasing number of non-organic farmers are adopting agroecological approaches.

DEFRA CLAIMS: Gene editing makes the same types of changes to plants and animals that occur naturally and through traditional breeding. We are gathering information from this consultation so that we can make sure that gene editing is safe, that food and environmental standards are not relaxed.

THE FACTS: Nobody has produced evidence that the changes arising from gene editing and conventional breeding are the same. If analyses were to be carried out fully using unbiased screening methods it would be clear that gene-edited organisms are significantly different from conventionally bred ones, both genetically and in their molecular composition.

Notably, most analyses of genetic errors caused by gene editing use inadequate and biased screening methods that fail to spot many types of genetic error.[1] And detailed analyses of the molecular composition of gene-edited organisms compared with their non-GM parent organisms (necessary to detect unintended changes in composition) are not generally carried out by developers, or at least they are not published. It is naïve to look only at the superficial appearance of the organism and ignore the way it is produced. The gene-editing process keeps throwing up unforeseen side-effects, which could result in unexpected toxicity or allergenicity.[1]

DEFRA's claim that it is "gathering information from this consultation so that we can make sure that gene editing is safe, that food and environmental standards are not relaxed" is disingenuous in the extreme. Boris Johnson, in his first public speech as prime minister (and in subsequent speeches in the following days) stated that one of his priorities was to "liberate the UK's extraordinary bioscience sector from anti-genetic modification rules".[28] And the UK government's environment secretary George Eustice stated that the government disagrees with the 2018 European Court of Justice ruling stating that gene editing falls under the EU's GMO regulations. Eustice added that it is not appropriate to regulate gene-edited products as GMOs.[29]

The deregulation that the government plans would entail throwing the EU's food and environmental safety rules on GMOs into the bin – the opposite to what DEFRA claims is its intention (to ensure gene editing is safe).

It is clear from DEFRA's statement, which is made without supporting evidence and flies in the face of much contradictory evidence,[5] that the government has already made up its mind that changes produced through gene editing are no different from conventional breeding. Thus it clearly has no intention of investigating the risks of this technology.
DEFRA CLAIMS: Does this mean that "frankenfoods" are now on the menu? No. Our consultation does not propose to change the regulations controlling genetically modified foods containing genes from another species. Genetically modified foods are subject to rigorous safety testing and are already available in the UK under strict safety rules. There are already more than 60 GM foods in existence that have be thoroughly assessed for their safety and authorised for use in the UK. They must be labelled so consumers will always know what they are buying.

THE FACTS: Gene-edited foods are technically and legally GMOs and should be labelled just like older-style GMOs, so that consumers know what they are buying and farmers know what they are planting in their fields. The potential harm from GMOs comes not just from the insertion of foreign genes, but from the changes that occur within the DNA as a result of the gene editing and DNA repair processes. These include large insertions, deletions, and rearrangements of DNA.[1,5]

Moreover, there are documented instances where foreign DNA and foreign genes have found their way into gene-edited animals.[4,30] Foreign DNA from the gene-editing tool delivery vehicle ("plasmid") can incorporate into gene-edited plants and animals and persist in the final marketed product; this possibility must be checked via strict regulatory processes. If checks are not carried out, potentially unsafe GMOs will indeed be back on our dinner plates – and there won't even be labelling to warn us.
DEFRA CLAIMS: Although gene edited products would not be regulated as Genetically Modified Organisms, they would still be subject to the UK's world class standards that apply to protect the health and safety of people, animals and the environment.

THE FACTS: The standard tests for any new crop do not look at food or environmental safety, only at whether the variety is distinct and stable and whether the crop performs acceptably in the field. These rules do not protect consumers' health or the environment.
DEFRA CLAIMS: There will be no weakening of our strong food safety standards. We set very high standards of food safety, and existing controls on GM crops, seeds and food will continue to apply. The consultation is an opportunity for people to voice any concerns they may have.
THE FACTS: The government wants to exempt gene editing from the existing controls on GM crops, and this would result in a lowering of food standards. See next point.

DEFRA CLAIMS: The government's science-based approach is underpinned by public safety being the number one priority. The government is also clear it will not sign a trade deal that will compromise on our high environmental protection, animal welfare and food standards. The UK is a world leader in these areas and that will not change.

THE FACTS: Deregulating gene editing certainly would lower the UK's food standards, and our vital trading relationship with the EU could be damaged because of this. No EU country will accept food products, commodities, seed or other imports from the UK that might include unauthorised GMOs. If gene-edited organisms are not regulated as GMOs in England, our farmers, food producers and exporters will not know whether or not they are using GMOs. It will become impossible for them to prove that their goods are acceptable for import into the EU, and the EU will be within its rights to reject them.
DEFRA CLAIMS: Will gene editing give big business more control over our food supply? No. Much of the world's leading research into gene editing has been led by pioneering small and medium sized businesses.

THE FACTS: The research may have been done by small and medium-sized businesses, but taking commercialised gene-edited products to market is another matter and will always be out of reach of these smaller entities. This is because gene-editing technologies and their products are patented. Research licenses to use these patented technologies can be gained cheaply or for free, but commercial licenses are extremely expensive.[31,32]

Only very large companies will have the financial resources to take any gene-edited product through the long and costly process of patenting and commercialisation. In practice, the small pioneering researchers will license their products to the large agrochemical companies that already control large parts of the seeds and agrochemicals markets; or a small company with a promising product will be bought out by a large company.[31,32]

The main players are Corteva (part of DowDuPont) and Bayer (which took over Monsanto). These companies already have consolidated power over the use of gene-editing technology in agriculture.[33] Deregulating gene editing will not change this business model, which is

not a cause for lamentation but is viewed as a path to success by many small and large companies.[31,32] But it will put public health and the environment at risk.

Notes:

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