New powers granted to research gene editing in plants

New legislation will be put in place to cut unnecessary red tape for gene editing, helping our farmers to grow more resistant, nutritious and productive crops.

The rule changes, made possible by the UK's departure from the EU, will mean that scientists across England will be able to undertake plant-based research and development, using genetic technologies such as gene editing, more easily.

The rules will apply to plants where gene editing is used to create new varieties similar to those which could have been produced more slowly through traditional breeding processes and will unlock research opportunities to grow crops which are more nutritious, and which require less pesticide use.

Outside the EU, the UK is able to cut red tape and set better rules and regulations that work in the best interests of British farmers and scientists. The legislation being laid today is the first step towards adopting a more scientific and proportionate approach to the regulation of genetic technologies, which will allow us to further unlock innovation using these technologies.

Harnessing the genetic resources that nature has provided through genetic technologies will create new opportunities for farmers to grow more resilient crops. This will support the development of new and innovative ways to protect the environment, such as significantly reducing, or eliminating the use of pesticides and herbicides – protecting pollinators. Another potential benefit includes making crops more resistant to adverse weather and climate change.

Minister for Agri-Innovation and Climate Adaptation Jo Churchill said:

> New genetic technologies could help us tackle some of the biggest challenges of our age – around food security, climate change and biodiversity loss.
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> Now we have the freedom and opportunity to foster innovation, to improve the environment and help us grow plants that are stronger and more resilient to climate change. I am grateful to the farming and environmental groups that have helped us shape our approach, and I look forward to seeing what we can achieve.

All scientists undertaking research with genetic technologies will have to continue to notify Defra of any research trials. For now, gene edited plants will still be classified as genetically modified organisms and commercial cultivation of these plants, and any food products derived from them, will

still need to be authorised in accordance with existing rules.

The legislation follows the launch of the Government's response to the gene editing consultation last year. The government will never compromise high safety, environmental and welfare standards, and the new rules do not mean that environmental or research standards will be lowered.

Chief Scientific Adviser, Professor Gideon Henderson, said:

> Gene editing is a powerful tool that will help us make plant breeding more efficient and precise by mimicking natural processes that currently take many years to complete.
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> With the new rules now formally in place, scientists will be able to assess new crops in real-world conditions more easily. This will increase our ability to harness the potential of gene editing to efficiently help grow plants that are more nutritious, beneficial to the environment, more resilient to climate change, and resistant to disease and pests.

This announcement comes alongside the Government's wider commitment to supporting farmers and landowners, rewarding them for actions and practices which benefit the environment and support sustainable food production, while driving progress towards net zero and protecting nature. The new legislation will also advance the UK's ambition to become a global science superpower by 2030, and puts the UK in a world-leading position to showcase sustainable climate-friendly farming.

Director of The John Innes Centre, Professor Dale Sanders FRS said:

> At the John Innes Centre we use gene editing to understand and develop crops which are more nutritious and resilient to climate change and diseases. Gene editing is a powerful technique that will play a critical role in helping us address the global challenges of climate change and food security while at the same time ensuring biodiversity.
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> Gene editing provides an opportunity to revolutionise our food systems. However to benefit fully, we have to address the way we regulate this technology. Defra's announcement today is step in the right direction, that will allow researchers to run more field trials of gene-edited crops. I am therefore pleased to see the Government acting to bring these changes in.
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> To make the most of these discoveries, we need to translate our science to benefits for consumers by making products available on supermarket shelves. I look forward to working with Defra as it continues its wider review of regulations around genetic technologies. Getting this right will be essential if we are to fully benefit from this innovative technology.

Case studies:

Gene editing differs from genetic modification, as it allows beneficial traits to be produced without DNA from other species. Instead, the technology enables breeders and scientists to follow processes that mimic natural breeding.

Examples of the potential of gene editing across applications, outcome areas and geographies include:

- Sugar beet resistant to Virus Yellows, which is a group of viruses spread by aphids and controlled using a range of pesticides. These viruses can cause yield losses up to 50%, presenting costs to farmers and reductions in food production. Over the past four years, a UKRI funded study has identified several promising sources of genetic resistance. Precision breeding techniques such as gene editing can rapidly accelerate the time taken to transfer this genetic and other sources of resistance into commercial varieties. Using gene editing to give resistance to Virus Yellows would reduce the need for pesticides and will help protect crops against the virus, helping to protect the environment, increase food production and reduce costs to farmers.

Prof. Mark Stevens, Head of Science at the British Beet Research Organisations says:

> Virus yellows is currently a difficult breeding target because it is a complex of three viruses, so any methods to identify and accelerate the development of commercially viable virus resistant varieties would be widely welcomed by the UK sugar beet industry.

- Gene edited wheat, grown without asparagine – a probable cancer-causing compound formed when heating products such as potatoes, cereals or coffee. In the first gene edited wheat trial in Europe, researchers at Rothamsted Research are testing a wheat that has been gene edited to have lower levels of the amino acid asparagine.

Prof. Nigel Halford, who leads this trial at Rothamsted Research says:

> The use of gene editing could help reduce the risk of acrylamide formation when wheat products are baked and toasted. This has potential benefits for public health and the manufacturing of food products.

- Climate-resilient wheat. Developing wheat that is resilient to climate change will help to increase food production from a crop that 2.5 billion people globally are dependent on. Researchers at the John Innes Centre have used gene editing techniques to help identify and explain the key gene, ZIP4, in wheat which is responsible for maintaining 50% of yield in this global crop. This discovery presents an exciting new

> opportunity to breed high-yield, elite wheat varieties using a novel mutation of the gene, while also allowing the introduction of critically important traits such as resilience [to rising climate temperatures] and disease resistance.

Professor Graham Moore, John Innes Centre said:

> Our research priority is now to identify variations of the ZIP4 gene which maintain fertility under different temperature regimes. We aim to identify variants of the gene with effects that give wheat yield resilience to climate change.

- Mildew resistant tomatoes. Powdery mildew disease is one of the main reasons why UK tomato growers spray fungicides on their crops. Thanks to the work of researchers at The Sainsbury Laboratory, a new resistant variant called Tomelo was created using gene editing. The edited tomato offers the opportunity to dramatically reduce these chemical inputs and benefit farmers and the environment. It took less than 10 months to generate this resistant line and can be introduced to locally adapted varieties quickly, demonstrating the ability of genetic technologies to make the breeding process more efficient and precise.

Professor Nick Talbot FRS, Executive Director of The Sainsbury Laboratory in Norwich, said:

> Genome editing provides the opportunity to achieve the outcomes of plant breeding—which has been so successful in controlling diseases and improving yields—but in a much more precise manner. In this way, we can aim to produce nutritious crops requiring much lower agrochemical inputs and with greater resilience.

- Disease resistant bananas. This 4th largest food crop is increasingly vulnerable to disease and is reliant on costly chemical pesticides. A new variant of Panama disease (TR4) has emerged and is threatening global banana production, because there are no effective means to control it or its spread. Tropic Biosciences has used precise gene editing to develop TR4-resistant banana plants which will be a like-for-like replacement for the plants currently used for production around the world.

Gilad Gershon, Tropic Biosciences CEO said:

> Our use of gene editing will enable more resilient banana production that is less reliant on chemical pesticides, creating benefits for growers, suppliers and consumers without changing the quality and taste of the fruit we all love.

Gene editing explainer videos:

How gene editing can benefit us