

# CRISPR - Applications for the agricultural sector

Very few technologies merit being described as a “game changer” – but a new tool known as CRISPR-Cas9 is surely one of them. Much of the conversation about CRISPR-like gene editing techniques has revolved around the potential for treating diseases or developing new promising therapies, but researchers say that its impact goes beyond the biomedical world. CRISPR is now being used to accelerate crop and livestock breeding, develop new bio-based materials and control malaria-carrying mosquitos.



## What is CRISPR?

Put very simply, the CRISPR-Cas9 technology is effectively a pair of ‘micro-scissors’ that cuts DNA in a more precise and directed manner than conventional techniques. It’s like using a word processor to edit the words in a sentence. Once the DNA is cut, scientists rely on the cells’ natural DNA-repair mechanism to adjust the genome as desired.

The newest tool in the gene editing toolbox, **CRISPR**, has since its introduction in 2012<sup>1</sup> become the most popular method by far to adapt genes. In 2015 ‘the number of articles related to CRISPR (1185) almost tripled compared with the combined growth rate in publication output for the other three [TALEN, ZFN, and mega nucleases] gene

<sup>1</sup> <https://www.ncbi.nlm.nih.gov/pubmed/22745249>, retrieved on 12 April 2017.

editing methods (397)<sup>2</sup>. The main reason for this is that CRISPR technology is inexpensive, relatively simple and precise. It is already revolutionizing research to understand how specific genes function and it is poised to make a major contribution to the development of improved crops and livestock.



## CRISPR: feeding the world while reducing environmental impact

With the global population expected to rise from 7.3 billion to 9.7 billion by 2050<sup>3</sup> and climate change resulting in increased risks to food production, there is an urgent need for better and more sustainable crops.

A key question is how we can ensure that EU farmers are equipped to tackle these challenges and how they will be able to produce more but in a more sustainable manner.

Conventional agricultural methods are often inefficient and traditional farming consumes 70% of all available freshwater. Over 80% of the land suitable for raising crops is already in use. Furthermore, climate change is threatening crops worldwide, making environmental conditions (e.g.

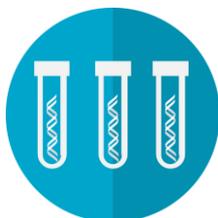
<sup>2</sup> <http://www.nature.com/nbt/journal/v34/n9/full/nbt.3659.html>, retrieved on 14 April 2017.

<sup>3</sup> <http://science.sciencemag.org/content/355/6330/1122>, retrieved on 14 April 2017.

droughts and floods) amongst the leading causes of harvest loss.

Plant breeding technologies such as CRISPR show an enormous amount of potential in helping to address these challenges.

From developing tuberculosis-resistant cows<sup>4</sup>, requiring less use of antibiotics, to mushrooms resistant to browning<sup>5</sup>, resulting in less spoilage, CRISPR is transforming the agri-food landscape. It could be used to design crops that have a higher yield while reducing the need for water, fertilizer and chemical crop protection.



## Conclusions

Tools like CRISPR offer multiple opportunities in various sectors. Early medical trials have been promising for genetic diseases such as haemophilia, sickle cell anaemia and eye disease as well as more common diseases like Alzheimer's, diabetes, osteoporosis, HIV risk and high cholesterol.

These advances are making headlines but opportunities in the agricultural world are just as exciting. CRISPR comes at just the right time when agriculture is striving to meet growing demands due to a changing climate while natural resources like usable water reserves rapidly diminish.

Food security and crop fitness are problems that can be solved by plant breeding innovations. CRISPR technology is one such innovation that could make a major contribution towards solutions in the not-too-distant future.

### About the NBT Platform

The NBT Platform is a coalition of SMEs, large industry representatives and members of prominent academic and research institutes. Its aim is to provide policy makers and stakeholders with clear and precise information on NBTs and to generate awareness about their benefits for the European economy and society as a whole.

<sup>4</sup> <https://phys.org/news/2017-01-tuberculosis-resistant-cows-crispr-technology.html>, retrieved on 12 April 2017.

<sup>5</sup> <http://www.nature.com/news/gene-edited-crispr-mushroom-escapes-us-regulation-1.19754>, retrieved on 12 April 2017.