GlobalResearch
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New GE Wheat to be Tested in UK Field Trials

CRISPR plants reveal the complex risks of genome editing, reports Testbiotech

By GMWatch
Global Research, September 14, 2021
GMWatch 8 September 2021

Region: Europe
Theme: Biotechnology and GMO

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Genetically engineered (GE) wheat with a supposedly reduced concentration of acrylamide after baking is to be tested in field trials in the UK. Scientists there have successfully used CRISPR/Cas to block a gene function involved in production of the amino acid asparagine, which is important for the concentration of acrylamide after baking.

However, as reported by Testbiotech, asparagine is also involved in seed germination, the growth of the plants, their stress responses and disease defences. As scientific publications show, the risks are complex and need to be assessed in detail.

The field trials are being organised by Rothamsted Research. Using CRISPR/Cas, their scientists succeeded in reducing the concentration of free asparagine available in the kernels by up to 90 percent. They did this by knocking out several copies (alleles) of a gene (TaASN2-Gen). However, it was found that some lines of this CRISPR wheat almost lost capacity to germinate. The scientists are therefore planning to also grow a version of the wheat in the trials in which fewer copies of the gene have been knocked out.

For comparison purposes they are also planning to grow a conventionally bred wheat showing some genetic alterations (mutations). The pattern of genetic changes in this particular wheat is very different to the genotype of the CRISPR wheat, and the content of asparagine is reduced to a lesser degree.

The genetically engineered plants also show some unintended characteristics since the concentration of several amino acids was unintentionally changed. Furthermore, the concentration of asparagine in the GE plants fluctuates significantly. Therefore, says Testbiotech, more research is needed to determine whether additional unintended effects were caused in the metabolism of the plants. This should include taking all the steps of the genetic engineering process into account.

The first step consisted of introducing the DNA for the gene scissors and an additional gene for herbicide resistance into the plant genome. This was done using a so-called gene cannon

(biolistic method). This method is used in “Old GE” and is known to frequently cause unintended changes in the genome. The additionally inserted genes are meant to be removed from the plants through further breeding. Nevertheless, even if this is successful, the genome still needs to be screened for further unintended genetic changes caused by the gene cannon.

Gene scissors also cause unwanted effects associated with risks to health and the environment, such as the insertion of additional DNA in the target region of the genome and production of erroneous proteins. A recent publication describes these on-target effects in detail. However, so far, changes in other sites of the genome (off-target) which can be caused by lack of precision of the gene scissors have not been investigated.

The whole genome of the plants would need to be screened in order to identify all these unintended effects. However, this is a complex undertaking due to the huge size of the wheat genome. Therefore, Rothamsted Research can in no way be sure that the CRISPR wheat only inherits the intended genetic changes. In addition, it is not known how the wheat will react to environmental stress, how it will interact with ecosystems or if it may be safe for consumption and the environment.

Testbiotech concludes that this GE wheat clearly shows how complicated the assessment of the specific risks can be that are caused by the processes of New GE. Without detailed examination, no conclusion can be drawn on safety of the plants. Nevertheless, contrary to all findings, industry is demanding that GE plants should be exempted from detailed risk assessment as long as no additional genes are inherited.

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