



LIMAGRAIN AND GENOME EDITING (AND NBT) IN 7 QUESTIONS

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1. WHAT DO THE TERMS GENOME EDITING AND NBT MEAN?

The term NBT (New Breeding Techniques) was created by the European Commission in 2007 to refer to a group of recent plant breeding methods whose regulatory status is still under discussion in Europe.

Among these different techniques, those called « **GENOME EDITING** » and in particular directed mutagenesis⁽¹⁾ (type CRISPR-cas9) **MAKE IT POSSIBLE TO PRECISELY TARGET AND INTERVENE IN THE PLANT'S GENOME**⁽²⁾



to obtain the desired trait: disease resistance, adaptation to new weather conditions, improved taste, etc.



⁽¹⁾ Directed mutagenesis is the precise, deliberate act of inducing one or several mutations into a genome.

⁽²⁾ Genome: set of genes, making up the genetic heritage contained in each cell of any living organism, conferring its specific characteristics.

2. WHAT IS THE BENEFIT OF USING GENOME EDITING TECHNIQUES COMPARED TO CONVENTIONAL BREEDING METHODS?



Agriculture has to evolve increasingly faster to meet major challenges: feeding a growing population, reducing its environmental footprint, decreasing the use of agro-chemical products, preserving biodiversity, and participating in the fight against climate change, while at the same time ensuring the long-term economic sustainability of farms.

AT LIMAGRAIN, WE BELIEVE WE HAVE TO EXPLORE ALL AVENUES FOR PROGRESS IN ORDER TO CONTRIBUTE TO MEETING THESE CHALLENGES.



Genome editing techniques are an extension of conventional breeding methods. We believe they are complementary.

THESE NEW TOOLS, WHICH ARE MORE PRECISE AND QUICKER, MAKE IT POSSIBLE TO EXPRESS INTERESTING VERSIONS OF A PLANT'S GENE

such as, for example, versions that allow a plant to resist a disease. They thus allow breeders to make use of the full potential of a plant's favorable traits that may exist in nature, but whose probability of occurrence is very low. These techniques allow us to find the needle in the haystack!



3. WHY ARE THEY A SUBJECT OF DEBATE, ESPECIALLY IN EUROPE?

A regulatory framework exists for bringing any plant variety to market. The varieties obtained using conventional breeding techniques are only subjected to these regulations.



For GMO plants resulting from transgenesis (introduction of foreign DNA into the plant), a supplementary specific framework was established in 1990 and modified in 2001 (Directive 2001/18).

This GMO directive exempts conventional mutagenesis but makes no provision concerning mutagenesis techniques that appeared AFTER 2001. There is therefore a regulatory gap that has split opinion concerning the question: should directed mutagenesis techniques be exempt from the scope of application of the 2001 GMO Directive?

Opponents to these techniques would like the regulations on GMOs to apply to all plants resulting from these new techniques based on a precautionary principle, which represents a de facto ban on growing in most European countries.



On the other side, for seed companies, as well as the large majority of agricultural and scientific associations, plants resulting from directed mutagenesis should not fall under GMO regulations given that

NO FOREIGN DNA IS INTRODUCED INTO THE NEW VARIETY AND THAT IT IS IMPOSSIBLE TO DIFFERENTIATE THE METHOD USED (NATURAL, CONVENTIONAL, OR DIRECTED MUTATION) TO OBTAIN A MODIFIED VARIETY.

4. COULD GENOME EDITING TECHNIQUES HARM THE ENVIRONMENT OR HUMAN OR ANIMAL HEALTH?

The risk of directed mutagenesis techniques to human or animal health, and the risk to the environment, have been widely assessed since 2007 by European and national authorities, and have resulted in many reports and studies.



These reports or studies have concluded that plants obtained by GENOME EDITING TECHNIQUES PRESENT NO GREATER RISKS THAN THOSE PRESENTED BY CONVENTIONAL BREEDING.

Plants obtained through conventional breeding have already demonstrated a **PROVEN HISTORY OF SAFETY WITH DECADES OF EXPERIENCE (CLOSE TO 100 YEARS)**. Plants obtained through genome editing therefore benefit from the same conclusions.

5. WHERE IS EUROPE CONCERNING REGULATIONS ON GENOME EDITING TECHNIQUES?



ON JULY 25, 2018, THE COURT OF JUSTICE OF THE EUROPEAN UNION RENDERED ITS DECISION

concerning the regulatory status applicable to plants obtained through mutagenesis, in particular the new directed mutagenesis techniques (type CRISPR-cas9).

In contradiction to the opinion put forth a few months earlier by the Advocate General, **the Court considers that varieties resulting from these new directed mutagenesis methods must be subjected to the same European legal regime as transgenic varieties (GMOs).**



6. WHAT POSITION HAS LIMAGRAIN TAKEN CONCERNING GENOME EDITING TECHNIQUES?



LIMAGRAIN SUPPORTS RESEARCH ON PLANT BREEDING, WHICH IS PART OF A GLOBAL APPROACH FOCUSED ON INNOVATION AND PROGRESS IN AGRICULTURE.

This progress depends on **the genetic improvement of plants** (whether it results from conventional or more recent breeding methods such as genome editing) as well as **new agricultural practices** that are more sustainable.



Limagrain deplores the decision by the Court of Justice of the European Union which risks depriving Europe of access to tools with a strong potential to contribute to meeting current agricultural challenges (see question 7).

Together with the seeds segment, Limagrain supports the request for a change in the European regulatory framework so that these innovations can be utilized.

Independent of this European context, Limagrain continues to invest in these technologies and pursue the development of its research programs in this area that remains strategic.

The decision by the Court of Justice of the European Union has not changed the main research orientations or the Group's determination to be ready to use them wherever possible, in compliance with each local regulatory context.



7. WHEN SHOULD WE EXPECT PLANTS RESULTING FROM GENOME EDITING TECHNIQUES TO BE DISTRIBUTED?

WORLDWIDE, THERE ARE APPROXIMATELY ONE HUNDRED VARIETIES OBTAINED THROUGH GENOME EDITING THAT ARE CLOSE TO BEING BROUGHT TO MARKET.



Several countries (including the United States, Argentina, Brazil)

CLARIFIED THEIR REGULATIONS

concerning varieties obtained through genome editing techniques and have granted authorizations to bring them to market that are similar to those granted to conventional varieties.



IN EUROPE,

THE MARKETING OF VARIETIES OBTAINED THROUGH DIRECTED MUTAGENESIS IS NOT ON THE AGENDA,

given the regulatory consequences (prohibitive costs and ban on GMO growing in the majority of countries) following the decision of July 2018 by the Court of Justice of the European Union.