TESTBIOTECH Background 07 - 02 - 2025

10 questions and answers: Why the EU Commission should withdraw its proposal for the future regulation of NGT plants

A science point of view on the current discussion

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Summary

Testbiotech published a new background paper in January 2025 on current findings from research on plants obtained from new genetic engineering (new genomic techniques, NGTs). The findings clearly show that the European Commission’s proposal for the future regulation of NGT plants is inadequate, and would be outdated even before it could be implemented.

The proposed regulation is based on the fundamental misconception that there is a risk-free threshold of 20 mutations, below which no risk assessment would be necessary. However, current scientific publications have shown that there is no such thing as a “magic threshold”.

In the recent backgrounder, these findings are exemplified in particular by experiments aiming to produce ‘technically tuned' NGT plants. ‘Technical tuning’ involves the modification of small, powerful regulatory elements in the genome of plants that influence gene expression. This new approach is often powered by artificial intelligence (AI) and the development of new gene scissor variants.

There is no doubt that even small changes in sections of the genome involved in gene regulation can drastically alter the composition of plant components as well as plant architecture and responses to

the environment. These changes go beyond what is known from conventional breeding and create risks that need to be examined. However, the Commission proposal completely ignores this aspect.

Furthermore, the Commission proposal also ignores current technical developments, such as the use of new variants of gene scissors, new methods of introducing gene scissors into cells (e.g. via the use of viruses) and the use of AI in the development of NGT plants.

If the Commission proposal is implemented, hundreds of different NGT plants could be released into the environment or brought to market, without any requirements for risk assessment, traceability or monitoring, even if their (intended or unintended) traits exceed the spectrum of known properties in conventionally-bred plants.

Against this backdrop, the Commission should withdraw its already outdated proposal made in 2023. The EU should instead make use of the inbuilt flexibility of current GMO regulation and adapt it to the new developments.

1. What has the Commission proposed and what has been adopted by the Parliament?

The European Commission put forward a proposal that is currently being discussed by the European Council.[1] It introduces a threshold below which NGT plants could be approved without having to undergo any specific GMO risk assessment. The Commission (in short) has proposed a threshold of 20 genetic changes, each of which may have alterations in up to 20 nucleotides and deletions / inversions without any limitation in size.

These plants would all be categorised as NGT 1 plants, which means they would be seen as equivalent to conventionally-bred plants and, therefore, not subject to specific GMO risk assessment requirements.

In 2024, the Parliament accepted the concept of introducing a threshold below which NGT plants could be approved without having to undergo any specific GMO risk assessment.[2] However, the Parliament adopted different criteria - instead of 20 genetic changes, it (in short) adopted a proposal stating that NGT plants should be exempted from risk assessment if they do not produce any new or chimeric proteins.

These plants would also be categorised as NGT 1, and thus enjoy a fast tracked market approval process without mandatory risk assessment.

2. Is there a scientific basis for the proposed regulation?

The European Food Safety Authority (EFSA) never suggested a threshold in any of its opinions. EFSA (in short) simply stated that some genetic changes resulting from NGTs would be similar to those in conventional breeding – it did not suggest a threshold for the number of genetic changes. Neither is there any empirical evidence available that would support this number of mutations.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023PC0411
[2] https://www.europarl.europa.eu/doceo/document/TA-9-2024-0067_EN.pdf

Therefore, it is no surprise that there is no other regulation worldwide that is based on this kind of threshold.

The Commission has defended its proposal by stating that applications of random mutagenesis result in much higher numbers of mutations. However, the actual number of mutations says very little about their effects, as these will depend on the specific site of the mutation and the resulting genetic combinations (see also Point 4).
According to the Parliament, any changes in regulatory genomic units would not require risk assessment. However, as shown in the recent backgrounder, these are the target regions that are the most relevant for more recent NGT applications on plants. Remarkably, the criteria proposed by the Parliament are based on the opinion of just a single expert, who was invited to an Agricultural Committee shadows' meeting in December 2023.[3]

The fact that both the Commission and the Parliament have proposed very different criteria for Category 1 NGT plants indicates that the criteria are simply arbitrary. The same is true for a proposal put forward by the Council, which involves raising the threshold from 20 to 40, or even 80 mutations, depending on the size of the plant genome.[4]

Moreover, several competent authorities, e.g. in France (ANSES), Germany (Federal Institute of Nature Conservation, BfN) and Austria (Environmental Agency Austria, UBA), published opinions fundamentally questioning the scientific basis of the Commission's proposal. So far, none of these opinions have been taken into consideration.

3. Is there a scientific basis for criticising the proposals?

The main justification provided by the Commission for choosing the threshold of 20 genetic changes is that it is seen to be much lower in comparison to the number of mutations resulting from random mutagenesis.

However, this simplified concept is based on pseudo-science. The following analogy illustrates this very well: if, for example, a book with 500 pages contains 1000 random typing errors, then this would average two per page. Even with the typing errors, this would not change the story. However, if 20 changes (with each up to 20 letters) are inserted into the title of the book, or into crucial paragraphs, or repeatedly into specific words, the impact would be quite different.

In other words: it is not sufficient to just count the number of mutations. Clearly, the proposal made by the Commission fails to take account of the 'context' of the changes, e.g. the site of mutations, insertions, deletions and inversions, the function of the altered parts of the genome, the overall genetic combination and the resulting phenotype.

Indeed, dozens of recent studies show that small changes (below the proposed thresholds) can have significant effects going beyond the range of plant traits known from conventional breeding, especially if these small changes are introduced into regulatory elements. Therefore, the number of mutations cannot be used to qualify the risks or declare equivalence to conventionally-bred plants.

[3] Prof. Ing. Jaroslav Doležel, Centre of Plant Structural and Functional Genomics, Czech Republic
[4] https://data.consilium.europa.eu/doc/document/ST-16443-2023-INIT/en/pdf

Furthermore, NGT plants can exhibit drastically altered phenotypes, even if they do not produce new proteins. It can be assumed that, if new or chimeric proteins are expressed in the plants (intentionally or unintentionally), this would certainly be another valid reason to perform in-depth risk assessment. However, in most cases, NGT plants are not supposed to produce any new proteins at all, but still can show extreme and unknown traits. Whatever the case, the absence of newly produced or altered proteins says nothing at all about whether the plants are safe for health or the environment.

Up to now, empirical data on environmental or health risks are not available, but published risk scenarios show that plants which escape the planned regulation still pose substantial risks.

4. What new research has to be taken into account?

In recent years, several NGT plants have been identified which are unlikely to be equivalent to conventionally-bred plants, but would, nevertheless, be exempt from the future regulation proposed by the Commission.

Recent studies show that a large group of NGT applications aimed at ‘technical-tuning’ can be regarded as a whole for the purpose of considering differences to conventionally-bred plants. They provide additional evidence that there is no ‘magic threshold’ of a certain number of mutations allowing conclusions to be made in regard to safety, or equivalence to plants obtained from conventional breeding. Key targets are small, regulatory elements that impact gene expression, e.g. promotors, enhancers or repressors. Gene scissors and transformation processes are specifically tailored to achieve a defined number of changes within these short sequences of the plant genome.

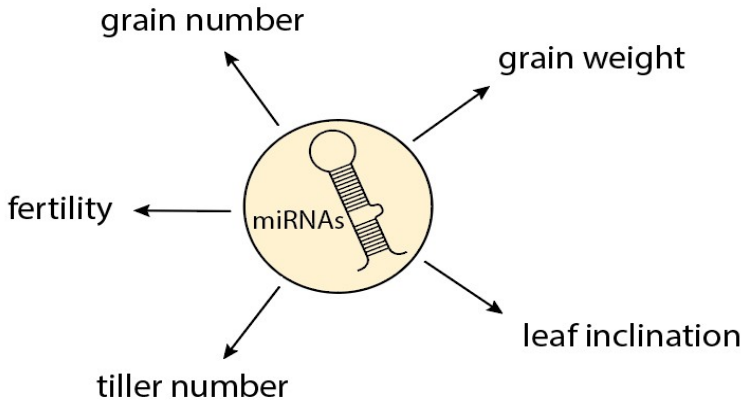

Figure 1: MicroRNAs (miRNAs) regulate various complex functions related to growth, development and stress response in plants and animals. The regulatory networks often affect several hundred genes whose expression is differently regulated.

Examples include the alteration of plant composition, plant architecture, first flowering dates, responses to the environment and impact on yield. There is plenty of evidence that the small genetic changes (below the proposed thresholds) are sufficient to result in significant effects that can exceed the spectrum of known plant traits, both in quality and quantity.

Indeed, in many cases, current data do not provide any evidence that these NGT genotypes actually already occur in the natural world, or that the plants could be produced in other known ways of conventional plant breeding. Furthermore, it is very unlikely that the desired genetic changes, such

as a specific combination of several changes within a short regulatory unit, could be obtained from non-targeted methods.

Several of the projects are targeting specific highly conserved genomic regions that very rarely undergo any random or spontaneous genetic changes. However, as most of the resulting plants would fall under the proposed thresholds, these unique genotypes would be exempt from the requirements of GMO legislation.

5. What new technical developments have to be considered?

During the first decade of NGT applications on plants, CRISPR/Cas9 was the most commonly used tool. Current alternative NGT strategies now also use other variants of the CRISPR gene scissors. For example, newly developed nucleases, such as CRISPR/Cas12a, allow the creation of more targeted shorter or longer deletions. Researchers are also looking at the introduction of (larger) targeted inversions, where larger parts of the genome can be inverted and introduced in revised order. Other experiments include the introduction of short regulatory DNA sequences or attempts to exchange base pairs without cutting the DNA ('base editing'). Viral vectors may also be used for the delivery of the NGT tools.

It is already known from previous CRISPR/Cas9 applications that the NGT processes can be associated with specific unintended effects. These findings have to be taken into account when new variants of gene scissors or new NGT processes are applied.

Therefore, all these technical variants need case-specific consideration within risk assessment. However, as most of the resulting plants would fall under Category 1, there would be no requirements for mandatory risk assessment that takes the specific processes and techniques used in the production of the plants into account.

6. What is the role of AI in this context?

Artificial intelligence programs which are able to identify numerous target regulatory units in the genome, and thus generate options for genetic alterations or new gene combinations, could speed up these developments quite considerably. Specific AI-powered programs can be used to search through large databases to identify target regions (such as promoters) and suggest the most effective genetic changes. In addition, AI can considerably enhance the further development of new variants of gene scissors.

Some experts have even suggested that NGT plants may be intentionally designed to avoid risk assessment. For example, AI may be used to identify target regions where small changes could have far-reaching effects.

Without adequate regulation, the speed of these developments will lead to a significant increase in risks. Once the EU decides to open up the flood gates for NGTs, the number of NGT plants released may rise exponentially. Regulatory control mechanisms would then become disabled and also future generations would suffer from our wrong decision making without the possibility to contain it.

7. What are the consequences of implementing the planned regulation?

If the above criteria were to be established in law, then NGT 1 plants with a broad range of non-assessed risks could be brought to market or introduced into the environment. The risks would also include unintended effects resulting from the NGT processes themselves.

In addition, the potential for damage to human health and the environment could increase dramatically over time, as an ever-increasing number of NGT 1 plants would be approved for cultivation and/or marketing in the EU, without these ever having undergone risk assessment.

Furthermore, hybrid offspring produced by breeders, or arising from spontaneous gene flow, would not be subject to any further assessment or approval processes. There would also be no possibility of checking genetic stability in (hybrid) offspring or under specific environmental conditions.

In many cases, the plants will be developed by companies in China, the US or elsewhere, but not in the EU. Thus, EU decisions in relation to market approvals will, in a majority of cases, be based simply on belief rather than real evidence. Moreover, these plants will be introduced into the environment, food production, the breeders' gene pool and propagated in future seeds, without any way of retrieving or removing them if necessary.

8. What are the environmental risks of NGT plants?

As yet, empirical data on environmental risks of NGT plants are not available. However, publications looking at risk scenarios, for example, have shown that NGT plants can enhance invasiveness or outbreeding depression or lead to a threat to pollinators or soil health.[5] One further aspect is that the Commission proposal would allow non-domesticated plants, such as trees, grasses and weeds as well as about 300.000 other wild plant species, to be categorised as NGT 1, which can all easily spread without control in the environment. This would result in a higher level of risk to ecosystems.

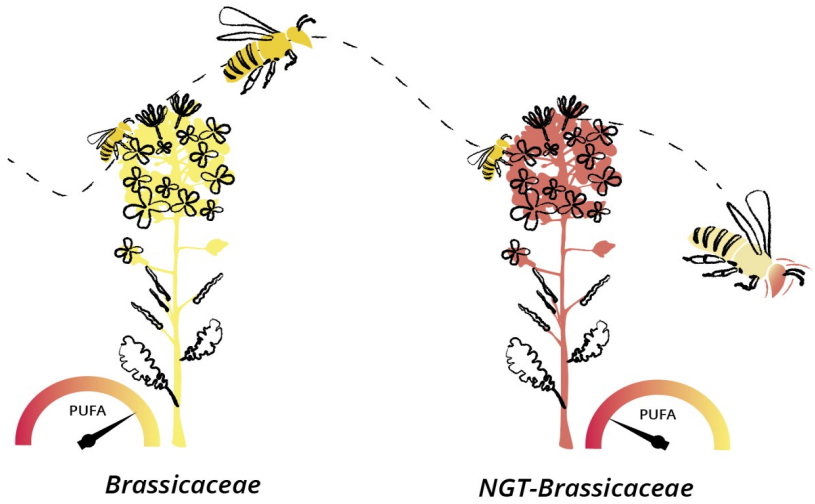

Figure 2: Decreasing amount of certain fatty acids in NGT plants can negatively affect the health of pollinators.[6]

[5] https://fachstelle-gentechnik-umwelt.de/en/publications/
[6] https://fachstelle-gentechnik-umwelt.de/wp-content/uploads/NGT-brassicaceae_FGU.pdf

Against this backdrop, when using NGT plants, systemic effects also need to be considered. Similarly to environmental pollution with plastics and chemicals, it may not be an individual NGT organism which creates the real problems, but rather the sum of diverse effects on the environment. As we can already see from climate change, it is the speed of these developments that can disrupt the ecosystem functions.

9. What are the risks for consumers?

The proposals of the Commission and the Parliament foresee that food and feed derived from NGT plants may be subjected to risk assessment under Novel Food regulation[7], even if categorized as Category 1. This may be required if the plants exhibit characteristics that previously were not present in the diet. A possible candidate to be subjected to Novel Food Regulation could be a tomato with high level in gamma aminobutyric acid (GABA) that is supposed to have blood pressure lowering properties.[8]

It has to be noted that if an NGT plant of Category 1 is exhibiting a trait that goes beyond the known characteristics of food plants, still no environmental risk assessment would be required.

And: Even if some food products obtained from NGT plants may undergo safety checks under the Novel Food Regulation, this does not mean safety for consumers. Many of the NGT plants are changed in their agronomic characteristics, such as aiming for improving resistance to pathogens, changing plant architecture or increasing yield. Such traits are not considered to be relevant for consumers and therefore can escape Novel Food Regulation. But these plants nevertheless may also show unintended effects that impact food safety or nutritional quality.

Figure 3: According to the proposal of the Commission, plants of NGT 1 category exhibiting new characteristics previously no present in the diet may be subjected to safety checks under Novel Food regulation. However this would mean less safety for consumers if compared with GMO regulation.

In addition, there are several NGT plants that aim to imitate characteristics that are known from existing food plants. One example is the so-called ‘de-novo’ domestication of tomatoes.[9] In this case, NGTs are used to transform wild tomatoes so they exhibit the characteristics of currently traded varieties. Such NGT ‘domesticated’ tomatoes may deviate in many genes and unintended

[7] Regulation (EU) 2015/2283
[8] https://www.testbiotech.org/en/limits-to-biotech/organisms/crispr-tomatoes/
[9] https://www.testbiotech.org/en/limits-to-biotech/organisms/de-novo-domesticated-tomato/

effects due to the NGT processes, even if their main nutritional characteristics may seem to be similar and not novel if compared to existing tomato varieties.

Finally it should be noted if several plants obtained from NGT processes are combined in a diet, the assessment of cumulative effects would not be requested under the Novel Food Regulation.

10. Are there any better solutions?

It is essential that GMO regulation remains adaptable, thus allowing the risk manager to maintain oversight and control in an expanding field. The proposed concept of ‘threshold criteria’ is not in accordance with these requirements, as it would be inadequate and outdated even before being implemented.

Therefore, what will be needed is a regulatory concept without thresholds. Future regulation should be sustainable, and include case-by-case risk assessment, traceability and monitoring to secure the future of food production.

These goals can be achieved by using the inbuilt flexibility of current GMO regulation. It already allows step-by-step approval processes for NGT plants on a case-by-case basis. GMO regulation requires data in each case on the molecular characterisation of the plants, including plants in the so-called Category 1. The data should cover information on intended and unintended genetic changes as well as any associated effects. This mandatory first step in risk assessment should also take into account the specific techniques used to introduce the gene scissors, including the various types of gene scissors and their mode of action.

Based on these data (that every company should have anyway for their own internal quality standards), informed decisions can be made on a case-by-case basis whether additional data is needed. Thus, requests for field or feeding trials, or any other need for more detailed information, can be tailored to the specific case to avoid unduly burdening the applicants. At the same time, this could substantially reduce risks and uncertainties. The framework of current GMO regulation is also needed to monitor and keep control of hybrid offspring with unintended or unexpected characteristics. Finally, it also can provide information to food producers and consumers as desired.

In conclusion, in order to safeguard the well-being of future generations, the EU should not abandon or erode the current regulatory system, but make use of its already inbuilt flexibility to maintain oversight, request access to the data needed for risk assessment and to establish measures to retrieve and remove NGT plants if necessary.

Further reading including references:

Testbiotech (2025) ‘Technically-tuned’ NGT plants show: There is no magic threshold for the number of mutations to conclude on risks. https://www.testbiotech.org/publikation/technical-tuning-of-ngt-plants/