The UEAA Recommendations for an EU regulation frame concerning Genome Editing Research and Development for Crop Plants and Farm Animals

The Union of European Academies for Sciences applied to Agriculture, Food and Nature (UEAA, Union Européenne des Académies d'Agriculture) :

Taking into consideration

- the potential of New Breeding Techniques (NBT) such as Genome Editing (GE) to contribute to sustainable agri-food systems, and the UEAA conviction that European agriculture must rely on new technologies and innovation to produce more and better in order to provide citizens with sufficient food at affordable prices while preserving our environment,
- the UEAA position Paper (5 Nov 2020, www.ueaa.info) claiming that current EU regulation (Directive 2001/18 / EC) has become unsuitable due to advances in scientific knowledge and recent technical advances such as Gene Editing and its Press release (4 May 2021) following the EC study report on 29 April 2021,
- the European Commission study regarding the status of New Gene Techniques under Union law published on 29 April 2021,
- that as stated in the same EC study, the Commission intends to continue to build up the required scientific knowledge on animals for the use of NBT such as Gene Editing in animals.

recommends a novel approach regarding the governance of Gene Edited plants and animals and a new regulation frame adapted to most recent scientific advances and more specifically:

1 For Crop Plants

Stating that the objective to reach a more sustainable agriculture in Europe requires breeding new plant varieties for cultivation that are more resistant to stress, be it abiotic (e.g. adaptation to climate change) or biotic (e.g. tolerance to pathogens). This goal relies on relevant genetic variability, which, however, is not always available for the trait in the target plant. Therefore, it has to be induced.

The new approaches towards creating new genetic variability derive from two major scientific advances. One is the availability of massive DNA sequencing techniques that allow an analysis of genomes of any species and the comparison of varieties or races and even of individuals. The second major scientific advance is the development of methodologies that allow modifying genomes of any biological species in a precise way. The most useful of these methods is the

one based in the bacterial CRISPR-Cas9 system that was published in 2012 and was awarded the Nobel Prize in Chemistry in 2020.

It can be concluded that the GMO Directive which was approved in 2001 was drafted when the major discoveries that are fundamental to the New Breeding Methods had not yet been even anticipated. Therefore, the definition of mutagenesis at the time of approving the Directive could not take into account the methods that are now most relevant for plant breeding. It thus seems convenient to propose changes in the present legislation to put it in accordance with the situation of present technologies.

Therefore, the UEAA recommends:

- An amendment of the GMO definition as stated in article 2 of the Directive 2001/18 / EC (Article 2) to bring it in line with the Living Modified Organisms (LMO) as defined by the Cartagena Protocol on Biosafety in its article: any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology.

- The inclusion of the New Genomic Techniques (NGTs) which produce simple changes, to the list of techniques under the Annex I A of the Directive 2001/18 / EC that do not result in genetic modification.

- The introduction of a definition of mutagenesis into Article 2 of the Directive 2001/18 / EC that also encompasses modern, targeted forms of mutagenesis.

- The expansion of the list of techniques under Annex I B of the Directive 2001/18 / EC that leads to exemption from the Directive (modern targeted forms of mutagenesis).

2. For Farm Animals

Stating that in the context of the current pandemics of SARS CoV2, it is widely recognized that the health of humans and animals are closely linked and interdependent ("the One Health Concept"). Hence, it is of primary importance that the great potential of the NBT's, including Genome Editing, to generate disease-resistant or insensitive farm animals to some bacterial or viral pathogens, be a priority, actively investigated in Europe and pro-actively supported by the European Union.

The objective of contributing to improving both public health and animal health is a major point for possible public acceptance. It is in line with the objectives of the European Green Deal and Farm to Fork Strategy. The need for proactive support to research and development on GE in animals is further reinforced by the fact that competitors to Europe in other parts of the world are already producing pathogen-insensitive animals to the extent that it could rapidly lead to a drastic decline in our global competitiveness. Such decline could lead to EU losing independence in some agri-food industries, for example in swine.

Genome Editing can also enhance animal welfare, e.g. dehorning or culling of farm animals unnecessary. It can also minimize the environmental impacts of animal farming reducing nitrate and phosphate levels in chicken and pig manure.

Hence, it is of high necessity that this very much needed European R & D on animals by genome editing be subject to appropriate European regulations.

Therefore, the UEAA recommends:

- that Genome Edited Animals should be regulated on a sound scientific basis and a case-by-case approach. The regulation should be based on features of the final product and applications and not on the technology.

- For Genome Edited Farm Animals using a Site Directed Nuclease (SDN), which leads to the targeted insertion or deletion of nucleotides creating an allele already existing in the given species, should not be regulated as GMOs:
    - If the technique includes no risk of integrating exogenous material into the genome, it may only require a simple **declaration** including scientific evaluation showing there is no off-target (whole genome sequencing (WGS) of the modified animal).
    - If the technique includes a risk of integrating foreign exogenous material (such as with the use of plasmids): it may require both **declaration and validation** by a European authority that there is no insert of this material into the genome.

- For Genome Edited Animals using a Site-Directed Nuclease which leads to the targeted insertion or deletion of nucleotides creating an allele that does not exist in the given species: it may require an **application** for authorization with benefit/risk assessment (for the animal, its health, its welfare, for the farmer, for the consumer, etc.) and then a scientific evaluation showing that there is no off-target (whole genome sequencing (WGS) of the modified animal) or integration of exogenous material if relevant.

- For Genome Edited Animals using a Site-Directed Nuclease for a targeted modification with exogenous material insertion (knock-in), it could be regulated as GMO.

- For Offspring of validated founder animals, they should not have to be tested again as having inherited the status of the founders (non-GMO's or GMO's).

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