Annex 2A

English translation of the information material shared in the focus group discussions with citizen-consumers during the first discussion round.

Article title: Is gene editing natural and does it matter? A qualitative analysis of citizen-consumers' and farmers' views on the use of new genomic techniques in plants

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Corresponding author: Katriina Huttunen, University of Helsinki, katriina.huttunen@helsinki.fi

Plant breeding across times

- Plant's genome affects its traits. Plant breeding means developing plants' genome towards a favorable direction from the human perspective. Humans have modified plant traits for thousands of years, and all agri- and horticultural food is the end result of breeding. Plant breeding improves the traits of cultivated plants. Breding can be used to affect yields, nutritional values, pest resistance, taste, preservability and farming's environmental effects.

- Variation in plant's genome, i.e. their genes, enables *selective breeding*, where humans choose specific plant individuals to produce offspring. Modification, or mutation is a change in the genome, in the DNA, and it can be naturally occurring or human-induced. Offspring combines both parents' traits. When selections are repeated over generations, the breeder reaches incrementally the combination of aspired traits.

- Human has tamed and bred plants by selection for thousands of years. Our knowledge of heredity and genes has improved in the past two hundred years very rapidly. This, in part, has enabled developing methods that allow breeders to create new traits with planned deliberation and can create precise selection choices. Currently breeding a plant variety with new traits using selective breeding takes 5 to 15 years.

New practices in breeding: gene technologies

- Breeding uses mainly existing variations in the genome. By cross-breeding different plants that can reproduce, new trait combinations can be created for selection. Genomic modification can be added to target plant also using gene technology, when it would not be possible with cross-breeding, or when there is a need to accelerate breeding.

- Gene technology comprises of a large number of technologies that have in common the ability to create changes, i.e. mutations, to the genome, i.e. DNA. New modifications can be created with different technologies by mutagenesis or gene transfers. In mutagenesis the genome is mutated, or modified, while in transgenesis genes are transferred to the genome. Some of the plants created by gene technologies are called genetically modified organisms (GMO). In EU legislation, the categorisation of a plant as a GMO depends on the method used to create the mutation.

- Older, so called random mutagenesis technologies have been in use for 80 years, and they produce random mutations to DNA using chemicals or radiation. A large number of mutation lineages have been created this way for breeders' use. These plants created by random mutagenesis are not categorised as GMOs by the EU legislation. Breeders are still able to use the method freely within EU.

- The earliest gene transfer technologies are from 30 years ago, and they are based on gene transfers to random locations in the genome. Genes can be transferred either within species (cis-genesis) or across species (trans-genesis). With these older techniques the aspired changes cannot be determined entirely precisely. For example, many contemporary soy and maize varieties are GMO. In Europe, the breeding and cultivation of GMO-plants is very limited due to regulation.

New genomic techniques

- New genomic techniques comprise of a diverse group of techniques that can be used in various ways to change the genome of an organism and achieve different results and products. These are universally called gene editing. New techniques are based on using enzymes. These enzymes can be directed precisely to correct locations in the genome, where they cut the DNA. New genomic technologies can be used for both mutagenesis and gene transfer. They differ from the earlier gene tehchniques by precision and targeting capabilities. They accelerate breeding considerably.

Regulations are in change

- A proposal to amend gene technique legislation is under reading in the EU. The amendment proposal suggests that new targeted mutagenesis technologies, like within species gene transfer (cis-genesis) would be categorised to their own group with reduced regulation.