# Food derived using new breeding techniques

Dr David Chagné

17 Shere lane RD2

Palmerston North, New Zealand

## My expertise

I obtained a PhD in molecular genetics in 2004 (University of Nancy, France) and since then I have been employed by a New Zealand Crown Research Institute. My area of expertise in plant genetics and genomics and development of molecular tools for more efficient breeding in crops. Since 2000 I have published over 79 peer-reviewed papers in the topic of genomics applied to plant breeding, some of them highly cited and lead a group of ~30 researchers focusing on plant genomics. The views I express in this submission are based on my expertise in the relevant field of molecular breeding and do not represent those of The New Zealand Institute for Plant and Food Research Limited.

## Summary

NBTs such as gene editing and null segregants have similar end products as classical breeding techniques such as selective breeding and mutagenesis.

The genome composition of organisms used for food products using NBTs cannot be distinguished from organisms obtained using classical methods, even using modern high throughput genome sequencing methods.

Gene editing is more precise than non-targeted mutagenesis such as chemical and radiation mutagenesis.

## My recommendations are:

- Foods obtained from NBTs (gene editing with no foreign DNA transferred and null segregants) should not be treated differentially from foods derived from classical breeding methods.
- Food regulations should be based on the product, not the process how the organisms were developed.
- Foods derived from organisms modified using gene editing where foreign or native DNA is inserted should be regulated on a case by case basis.

**3.1.1 Questions**

Do you agree, as a general principle, that food derived from organisms containing new pieces of DNA should be captured for pre-market safety assessment and approval?

Should there be any exceptions to this general principle?

Food derived from organisms containing new pieces of DNA should be approved if the DNA composition of the new organisms could have been obtained using classical breeding or chemical and radiation mutagenesis. NBTs allow to breed these new organisms more efficiently and they would not be different from organisms obtained using pre-1998 breeding technologies.

**3.1.2 Questions**

Should food from null segregant organisms be excluded from pre-assessment and approval?

If yes, should that exclusion be conditional on specific criteria and what should those criteria be?

If no, what are your specific safety concerns for food derived from null segregants?

Food obtained from null segregant should be excluded from pre-assessment and approval as null segregants are no different from organisms obtained using classical breeding and they do not contain any foreign DNA. Nevertheless, if pre-assessment was required it is nowadays technically feasible to test for the presence / absence of foreign DNA from null segregants using whole genome sequencing. High throughput DNA sequencing technology is now cheap and many bioinformatics methods are available to analyse DNA sequencing.

**3.1.3 Questions**

Are foods from genome edited organisms likely to be the same in terms of risk to foods derived using chemical or radiation mutagenesis? If no, how are they different?

If yes, would this apply to all derived food products or are there likely to be some foods that carry a greater risk and therefore warrant pre-market safety assessment and approval?

Foods from genome edited organisms are likely to *at least* be the same in terms of risk compared to foods derived from chemical or radiation mutagenesis. Chemical and radiation mutagenesis both generate several orders of magnitude more changes in the genome of mutagenized organisms than genome editing. Genome editing is more precise where genomic changes are made and therefore are likely to be safer than older methods of mutagenesis. Off target mutations can be easily tested for genome edited organisms using modern DNA sequencing and bioinformatics technologies. This applies to all food products derived from genome editing.

**3.2 Questions**

Are you aware of other techniques not currently addressed by this paper which have the potential to be used in the future for the development of food products?

Should food derived from other techniques, such as DNA methylation, be subject to pre-market safety assessment and approval?

Transposon activation may be a method that could be sued to generate new type of organisms for food production. However, transposon activation is now different to processes that happen naturally.

Synthetic biology could potentially enable researchers to generate entirely new organisms with DNA and genes taken from a palette of organisms to obtain a new organism with specific characteristics. While this is technically challenging, such organisms may appear in the future and their regulation should be based on the end product of synthetizing them.

DNA methylation does not change the sequence of DNA and no foreign DNA would be inserted, so this method if technically feasible would be safe.

**3.3 Questions**

Do you think a process-based definition is appropriate as a trigger for pre-market approval in the case of NBTs? If no, what other approaches could be used?

If yes, how could a process-based approach be applied to NBTs?

Are there any aspects of the current definitions that should be retained or remain applicable?

A process-based definition is inappropriate in the case of NBTs such as genome editing and null segregants. Food safety should be based on the characteristics of the product. A product-based definition should be used.

**3.3 Questions**

Do you think a process-based definition is appropriate as a trigger for pre-market approval in the case of NBTs? If no, what other approaches could be used?

If yes, how could a process-based approach be applied to NBTs?

Are there any aspects of the current definitions that should be retained or remain applicable?

No