Plant breeding is the heart of our food systems

Plant breeding is the pillar holding up our food systems.
As planetary boundaries are being stretched to the brink and climate change is threatening global food and nutritional security, the need for new and better adapted plant varieties has never been so urgent.
For plant breeding to respond to this urgency, access to faster and more efficient breeding technologies, like new genomic techniques (NGTs), is essential.

NGTs can complement existing breeding methods in the development of plant varieties that can better support the transition to more sustainable food systems. Unfortunately, NGTs varieties are currently regulated as GMOs in the EU, despite EFSA concluding that they are safe[1].

For more information on plant breeding, see our factsheet "Plant Breeding is the Basis of our Food Systems".

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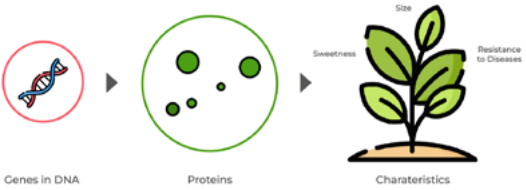
Plant breeding

Plants are at the basis of our food systems. Throughout millennia, humans have guided plant evolution by crossing and selecting plants with more desirable characteristics, such as bigger fruit size or sweeter flavour, representing the first acts of plant breeding.



Did you know?

~57,500 plant varieties are currently registered in Europe. Every year ~3,500 additional new varieties are added!

It is the changes in plant genes that provide genetic diversity and allows breeders to develop plants that are better suited to meet consumer and societal needs for affordability, nutrition, resilience to climate change, and resistance to diseases.

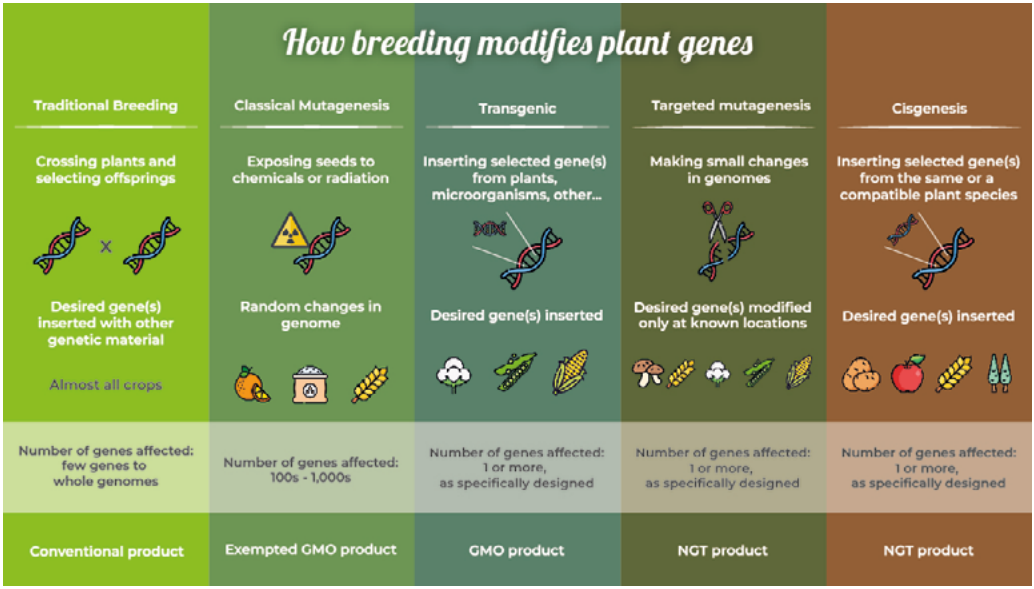
The limitations of plant breeding

Plant breeding takes a long time and is resource intensive, resulting in more breeding efforts being focused on plants species that are more widely cultivated (wheat, maize).

Innovative tools, like NGTs, that **speed up breeding and increase efficiency**, can **reduce the cost of breeding** and promote the **breeding of more diverse plant** species.

Duration of breeding from an initial cross to a new variety.
Courtesy of: Rod Snowdon.

How breeding changes plant genes



Adapted from the Gene Literacy Project

Plant breeding's contribution to sustainability

In the past two decades, plant breeding alone has contributed to **~67% increase of agricultural production**[4], ensuring food and nutritional security, as well as **supporting all three pillars of sustainability**.

In this way, plant breeding has contributed, and will continue to contribute, to protecting biodiversity and reducing GHG emissions, thereby supporting the EU Green Deal goals and several UN SDGs[4,5].
NGTs can complement existing plant breeding methods to speed up the development of plant varieties that are better adapted to the effects of climate change, while ensuring food and nutritional security, and increasing sustainability.

Each breeding method has advantages and limitations

No single breeding technique can act as a silver bullet. Plant breeders make use of the **most adapted techniques for their purpose**, often in combination with each other, to reach their breeding goals in the **most efficient manner possible**.

		Pros	Cons
Conventional Breeding	**Traditional Breeding:** Introduces a desirable trait (e.g. drought tolerance) from one variety to another through crossing.	· Conventional breeding; · Used to create hybrids.	· Slow process, resource intensive; · Cannot separate desirable from undesirable characteristics if genes too close together.
	Classical Mutagenesis: Uses chemicals, radiation, or UV light to cause random gene mutations.	· Regulated as conventional breeding; · Large source of diversity.	· Outcome unprecise / random; · Can introduce unwanted mutations; · Slow process, resource intensive.
NTGs	**Targeted mutagenesis:** Uses genetic scissors (e.g. CRISPR-Cas) to introduce small changes in a precise way directly into a commercial variety.	· Outcome predictable; · Fast and efficient process; · Low cost and ease of use; · Can be used to introduce same characteristic to several varieties; · As safe as conventional breeding[1].	· Currently regulated as GMO in EU*; · Mostly limited to inactivation of genes.
	Cisgenesis: Introduces a complete gene from a sexually compatible variety/species into a commercial variety.	· Outcome predictable · Fast and efficient process · Low cost and ease of use · Can be used to introduce same characteristic to several varieties · As safe as conventional breeding[1] · Both activation and inactivation of genes possible.	· Currently regulated as GMO* in EU;

*Plants regulated as GMO undergo a long and uncertain pre-market evaluation process, followed by a vote of member state representatives. Regardless of the outcome, many member states have chosen to ban the cultivation of GMO plants (17 member states)[2,3]. Currently, only one GMO variety is cultivated in the EU (MON810 maize), despite the EU importing a range of GMO plants and products from third countries.

About us
Plants for the Future (Plant ETP) is a multistakeholder platform representing the plant sector, with members for academia, industry and the farming community. Plant ETP considers the challenges and opportunities of agricultural value chains and develops a vision for future food systems.
For more information see our website: www.plantetp.eu.
Contact secretariat@plantetp.eu

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References
1. EFSA scientific opinion (2020)
2. Restrictions of geographical scope of GMO
3. Directive (EU) 2015/412
4. Noleppa and Cartsburg (2021)
5. OECD (2021) Making Better Policies for Food Systems

Check out our other factsheets here!