Breeding mildew-resistant wheat using NGTs

The EU Green Deal aims to increase the sustainability of EU agri-food systems. However, impact assessments have warned that these measures risk reducing EU agricultural production[1,2,3].
Plant breeding is at the basis of our agri-food systems and is solely responsible for **~66%** of production gains over the past two decades[1].

Scientific and technological advances enabling faster, more precise, and more efficient plant breeding must be leveraged to maintain food and nutritional security in the EU and globally, while ensuring the socio-economic, as well as environmental, sustainability of our agri-food systems.

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

Plants for the Future
European Technology Platform

Wheat (Triticum spp.)

Wheat is the 2nd most **important staple food crop** after rice, providing ~20% of all calories consumed by humans and grown worldwide on 220 million ha.

Leading producers are the **EU, China,** and **India**. Demand for wheat is **expected to increase 60-70%** by 2050[4,5].

Currently 13% of wheat grain is lost to disease, despite the use of fungicides[4].

Fungi are responsible for major wheat losses, with **powdery mildew** one of the top three wheat diseases[4].

Mildew-resistant wheat variety

Wheat infected with powdery mildew[7]

The inactivation of genes called MLO leads to mildew-resistance in a wide range of plant species, including barley, grapevine, pea, tomato and apple[6].

Inactivation of MLO is often accompanied with growth defects and yield losses, limiting its use in conventional plant breeding programmes[8].

Mildew-susceptible (left) and mildew-resistant wheat (right)[8]

Targeted mutagenesis (i.e., genome editing) was used to inactivate 3 MLO genes in wheat while activating a 4th gene, which resulted in a **mildew-resistant wheat with no growth defects[8].**

Breeding for mildew-resistant wheat

New genomic techniques

Targeted mutagenesis using genome editing can be performed directly in commercial varieties, reducing the breeding time to 3-4 years.

Conventional breeding

Obtaining the donor wheat plant using classical mutagenesis would take between 8-10 years and be extremely resource intensive

The donor plant would be used to introduce the mutations to commercial varieties adding an additional 2-5 years.

The random nature of classical mutagenesis and the requirement for a specific combination of genetic changes providing these characteristics, make unlikely the development of similar wheat varieties using conventional breeding.
NGTs offer more precision and control in a **shorter amount of time**, while avoiding trade-offs.

Mildew-resistant wheat variety

NGT-derived mildew resistant wheat varieties:

Require **fewer fungicide applications**[1]

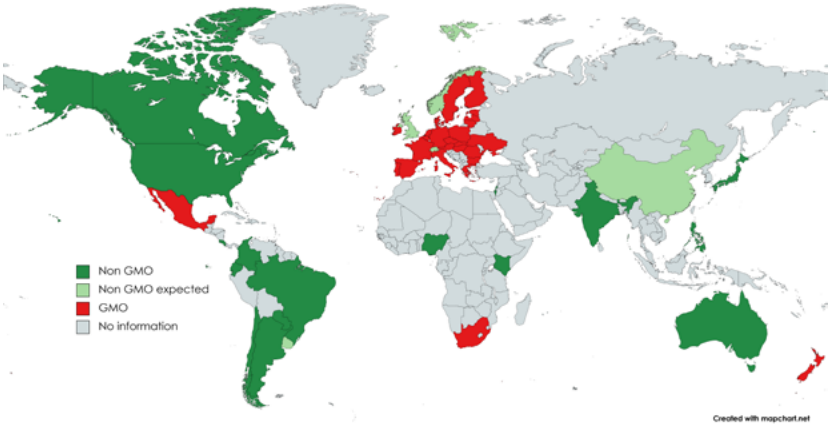
- Farmers currently applying fungicides would be able to reduce costs, while maintaining productivity and promoting ONE HEALTH;
- Farmers making little or no use of fungicides, would be able to maintain high grain quality and reduce production losses, thereby contributing to food and nutritional security;

Would directly contribute to the EU **Green Deal** goals of **reducing pesticide use** and **protecting biodiversity**, while increasing the s**ocio-economic and environmental sustainability** of primary production.

Would also contribute to several **UN SDGs**:

How are NGTs being regulated worldwide?

By regulating NGTs as GMO, the EU is hindering their contribution to the EU Green Deal and UN SDGs. As non-EU countries are embracing these technologies, the EU is getting left behind, at the expense of the agri-food stakeholders, particularly farmers, SMEs and consumers.



Plants for the Future calls on EU policymakers to exclude plants developed using NGTs (targeted mutagenesis or cisgenesis) from the scope of the GMO directive, so that they may contribute to the transition towards more sustainable food systems.

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

Plants for the Future
European Technology Platform

References

1.Noleppa and Cartsburg (2021)
2.Bremmer et la., (2021)
3.Barreiro-Hurle et la., (2021)
4.Singh et al., (2016)
5.FAO (March 2022)
6. Kusch and Panstruga (2017)
7. AHDB website
8.Li et al., (2022)

Check out our other factsheets here!