THE PILTON PROJECT

Establishing multiple and durable fungal disease tolerance in wheat through the latest breeding methods

New breeding methods have come to supplement the plant breeder's toolbox. They hold great potential for reducing the response time of plant breeding to new challenges, enabling timely solutions for agriculture. The precision of these techniques allows to develop plants that could also have been bred using conventional crossing and selection – even though it takes much longer. The PILTON research project, initiated in 2020, uses the latest breeding methods to create wheat plants enhanced with multiple and durable tolerances against fungi. The project is managed by the German Federation of Plant Innovation e. V. (GFPi) and involves approximately 60 mostly medium-sized plant breeding companies.

Climate change, dwindling resources and new societal expectations combine to create major challenges for agriculture. Farmers are expected to produce even more sustainably and environmentally friendly, without allowing yield or quality losses. The expiration and non-renewal of many plant protection products, changes in legislation for the use of fertilizers and the effects of climate change mean that future solutions to these complex problems will rely even more on the availability of high-yielding, adaptable plant varieties.

The **PILTON** project (acronym for German "**Pil**z**to**leranz von Weizen mittels **n**euer Züchtungsmethoden") aims to provide real world examples of how new breeding methods create plants that benefit both agriculture and wider society. The envisioned plants and their properties should exemplify and intend to demonstrate the considerable shortening of development cycles these methods enable.

The PILTON project is primarily designed to:

- demonstrate and quantify the potential to significantly reduce the use of plant protection products;
- demonstrate how available genome editing methods can be used by plant breeding companies, also in light of intellectual property implications.

Characteristic to be modified

Wheat is the crop plant with the largest cultivation area in Germany and Europe, and it is one of the essential staple crops in our society. The aim of the project is to create a durable and simultaneous tolerance in wheat against a variety of fungal diseases, in order to show how the use of new breeding methods can directly benefit society, the economy and the environment.

- Ecological benefit: significant reduction in the use of plant protection products in agriculture
- Economic advantage for the farmer: reduction in operating expenses
- Benefit to society: safeguarding wheat cultivation and wheat yield levels despite increasing restrictions on the use of fungicides

The necessary breeding steps will include targeted mutagenesis with Cas endonucleases while the genetic modifications will be limited exclusively to individual wheat genes already present in the wheat genome.

Molecular Basis: Deactivate negative regulators in pathogen defence

The molecular basis of the project will rely on natural pathogen-induced defence reactions of wheat. Such a pathogen defence, once activated, will normally be switched off after some time by negative regulators (repressors); thus the defence will be activated in case of a pathogen infestation only for a limited period of time, and therefore not prevent disease symptoms in the plant. The intention is to inactivate such a repressor gene in wheat in a very targeted approach with the help of Cas endonucleases. Without the negative regulator, the natural induced pathogen defence is expected to have a stronger and longer effect. The effectiveness of the pathogen defence of the plant, when enhanced in this way, will likely be less dependent on the type of pathogen; it is expected that as a result, a broad tolerance will be achieved against multiple diseases, e. g. against wheat leaf rust, stripe rust, septoria leaf blotch and fusarium head blight (scab).

Access to the CRISPR/Cas technology

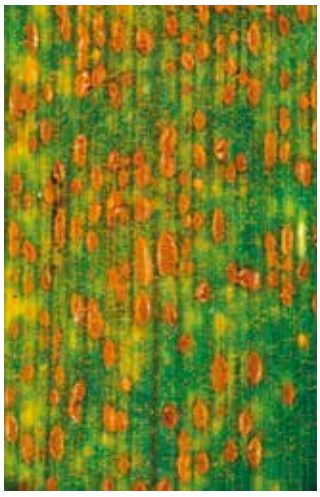
Another aspect of the PILTON project focusses on the accessibility of the CRISPR/Cas technology for plant breeding companies in light of intellectual property rights. Licence structures of providers, and the requirements to be fulfilled by potential licensees need to be analysed regarding their alignment with the abilities of German plant breeding companies.

In 2018, the European Court of Justice classified plants developed with the help of new breeding methods as genetically modified organisms (GMO). In view of the disproportionately high regulatory burden that comes with this classification, it is unlikely that these methods are going to be used in plant breeding, which is clearly a detriment to both agriculture and society at large. From a technical-scientific standpoint, the undifferentiated classification of plants derived from new breeding methods as GMOs is wrong. Plants that cannot be distinguished from conventionally bred varieties should not be regulated as GMOs.

Comparison of fungal diseases of wheat

Healthy ear

fusarium head blight



Wheat leaf rust

Septoria leaf blotch

German Plant Breeders' Association (BDP) – Bundesverband Deutscher Pflanzenzüchter e. V.

The German Plant Breeders' Association (BDP) represents the professional interests of its members – plant breeding companies for agricultural plants, vegetables, ornamental plants or grape vine, or seed traders. Approximately 130 member companies are breeding or trading seeds of agricultural or horticultural plants, 58 of which are operating own breeding programmes. Most companies are working with various crops. BDP works on national and European level for a legal framework that is best suited to promote plant breeding and the seed industry as well as for the organisation of plant research, the promotion of new technologies and the further enhancement of plant variety protection and seed marketing schemes.

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Plants – The Basis of Life