Harnessing the Potential of Genome Editing in Wheat

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Wheat production is facing a challenge from climate change. Rising temperature is one of the effects of climate change that represents a significant threat leading to a 3-8% decrease in the global average production of major crops for every 1°C increase in temperature.

To overcome this challenge, a fundamental role is played by climate-resilient crops. An interesting mechanism employed by plants to improve stress tolerance is the production of cuticular wax, a protective layer covering the surface of most plant organs.

One focus of our research is to provide knowledge about the role played by cuticular waxes under drought and heat stresses in durum wheat.

To pursue our goal, we are studying three different regulatory mechanisms through CRISPR/Cas9 technology. The selected genes include a transcription factor belongingto the AP2 family, associated with the negative regulation of wax biosynthesis in Arabidopsis; an E3 ubiquitin ligase that interacts with a positive regulator of wax biosynthetic genes; and a Gγ protein involved in calcium signalling perception, associated with a QTL for wax content and thermotolerance in rice.

A second goal of our research concerns the establishment of wheat cell suspension cultures of three bread wheat starch mutants (and the wild type) previously generated through TILLING, mutated in key genes involved in starch biosynthesis. Thesecultures will constitute a valuable resource to study the relationship between starch composition and key cellular processes of the plant. Furthermore, it will be used as starting materials to test the efficiency of the CRISPR- based transformation vectors.