

recrop

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Book of Abstracts

Combining Traditional Breeding and New Genomic Techniques (NGTs) for Disease Resistance in Grapevine

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The sustainability of viticulture hinges on maintaining quality and yield while reducing pesticide use. Promising strides in this direction involve the development of grapevines with enhanced disease tolerance. In our laboratory, we combine traditional breeding programs with New Genomic Techniques (NGTs) to develop climate-resilient and low-input crops. Traditional breeding is actively used to cross wild resistant relatives with commercial varieties to create new disease-resistant grapevines, known as PIWIs.

To complement this approach and to improve existing elite cultivars without changing their unique genetic backgrounds, we also develop different NGT strategies. The first approach involves the knockout of plant susceptibility genes using a DNA-free CRISPR/Cas9 genome editing platform. By delivering pre-assembled ribonucleoproteins (RNPs) into grapevine protoplasts, we successfully knock out the Downy Mildew Resistant 6 (DMR6) gene family. This 'single-cell technology' allows us to regenerate non-transgenic grapevine mutants with enhanced tolerance to Downy Mildew.

In parallel, we develop a cisgenic strategy to introduce new resistance (R) genes from wild *Vitis* species into elite cultivars. This method uses a transgenesis step followed by the controlled removal of the selectable marker and the transgenic cassette.

Together, these combined strategies and advanced in vitro plant regeneration allow us to provide a complete set of practical tools to adapt agronomically relevant cultivars to sustainable viticulture. Ultimately, these NGT products are well-positioned to align with the evolving EU regulatory framework, offering viable solutions for the future of European agriculture.