

INFORMATIONS

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POSTER COMMUNICATION

New genomic techniques for sustainable management of water stress and pathogen control

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ABSTRACT

Context and purpose of the study. Climate changes pose the need to develop new grapevine varieties and rootstocks that are more tolerant to stress and diseases. Grapevine can tolerate moderate water deficits, however, extreme drought scenarios, such as those experienced in recent years in major wine-growing regions, represent a threat to viticulture. Furthermore, a more sustainable control of fungal pathogens, which is generally based on multiple chemical treatments during the growing season, is being advocated. While traditional breeding has always been fundamental to generate genetic variability, over the last ten years New Genomic Techniques (NGT), such as gene editing and cisgenesis, have emerged as powerful tools to obtain improved varieties in shorter times, while maintaining their genetic background.

Material and methods. In order to apply NGTs, it is essential to know the key genes that, when modified, can lead to a desired phenotypic effect. At the Edmund Mach Foundation, several projects are underway to study and functionally characterize genes involved in water stress dynamics as well as in the response to the main pathogenic fungi. The experimental workflow consists firstly in the production of transgenic lines through classical genetic transformation to investigate gene function under controlled conditions. Secondly, depending on whether the gene of interest is to be knocked out or expressed, NGT1 edited lines (regenerated from protoplasts previously transfected with the CRISPR/Cas9 ribonucleoprotein complex) or cisgenic lines are generated, respectively, to be tested in the field and observed over several years (in Italy, experimental field trials are allowed for gene edited and cisgenic organisms).

Results. The results of the physiological characterization of *epfl9-2* 'Sugraone' mutants with reduced stomatal density are presented here as a case study. The edited plants showed improved water use efficiency compared to WT. In addition, under high vapor pressure deficit (VPD) conditions, *epfl9-2* edited plants closed their stomata more slowly than WT plants, indicating that they may have an advantage in evaporative cooling dynamics. Our study suggests that knocking out the *VviEPFL9-2* gene may be beneficial for grapevine in mitigating the impact of water and heat stress.

The next step will be to confirm such improved traits under field conditions.