Techniques to study graft union formation in grapevine

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Abstract:

Context and purpose of the study – Grapevines are grown grafting in most viticultural regions. Grapevine rootstocks are either hybrids or pure species of different American *Vitis spp.* (particularly *V. berlandieri*, *V. rupestris* and *V. riparia*), which are primarily used to provide root resistance to the insect pest Phylloxera. In addition to Phylloxera resistance, ideally grapevine rootstocks should be resistant to other soil borne pathogens and adapted to abiotic stress conditions. New rootstocks have the potential to adapt agriculture to climate change without changing the characteristics of the harvested product. However, high grafting success rates are an essential prerequisite. The objective of this work is to develop quantitative techniques to characterize graft union formation in grapevine.

Material and methods – The development of grafts of different scion/rootstocks of grapevine was studied during the first few months after grafting. The quantity of callus produced (fresh and dry mass) and the mechanical strength of the graft union were quantified. We also used x-ray tomography to study functional xylem vessels by labelling functional vessels with the contrast agent Iohexol.

Results - Equipment to quantify the mechanical strength of the graft union was assembled and tested on different scion/rootstock combinations to determine the suitability of this technique to quantify graft union development. The quantity of callus produced at the graft interface different between different genotypes and was not necessarily related to the mechanical strength of the graft union. Three dimensional reconstruction of x-ray tomography images allowed us to visualize the connections between the scion and rootstock, and this knowledge will be used to develop protocols to quantify xylem vessel connections using simpler methods.

Significance of the study – Difficulties in quantatively phenotyping the different steps of graft union formation have considerably retarded the identification of the genetic determinants of grafting success in all plant species. We are developing different quantative techniques to overcome this bottleneck with the view to charactering the genetic architecture of graft union formation in grapevine.

Keywords: Grapevine, xylem vessels, grafting, callus, mechanical strength.