

## Apple rootstocks affect scion vigor through their effect on scion water relations

Abstract - Hort 510

Erica Casagrande Biasuz

Dwarfing rootstocks are used to reduce shoot vigor and improve fruit quality and productivity. Although growth habits of different rootstocks have been clearly described, the underlying mechanisms contributing to dwarfing are not well understood. Plant water status and stem water potential are strongly influenced by the water movement through the vascular system. Stomata regulate transpiration rates and are essential to protect the hydraulic system under water limitations. Carbon ( $\delta^{13}\text{C}$ ) and oxygen isotope composition ( $\delta^{18}\text{O}$ ) are established proxy measures of water-use efficiency in plants. Combined, the effects of limited stomatal control, and subsequently, limited gas exchange may affect tree growth and biomass and should be reflected in tissue isotope composition. In order to evaluate the hypothesis, 'Honeycrisp' apples were grafted on different rootstock and analyzed in the field and greenhouse. Vegetative growth, gas exchange, stem water potential, and leaf isotope composition were measured to understand how rootstocks affect scion water relations and whether these differences correspond to shoot vigor. These experiments showed a positive relationship between shoot growth and photosynthetic rate and stomatal conductance and a negative correlation with stem water potential. Moreover, previous research has suggested that rootstocks may affect anatomical traits in the vascular system. Thus, another study was conducted to associate vegetative growth and water relations and to changes in anatomical traits in the stem and leaves. Scanning Electron Microscopy images were obtained for woody trunk, vegetative stem growth, and leaves. Measured parameters included ray parenchyma cells and xylem vessel diameter, and leaf traits. Dwarfing rootstocks affected xylem vessel density and leaf anatomy of the scion and has implications in water movement in the scion. The effects of rootstock on water relations were also observed for non-grafted plants. Consistently through independent experiments, the effect of dwarfing rootstocks corresponded to water limitations induced by rootstock genotype in apple.