Apple trees possess a higher abscisic acid concentration in xylem exudates and leaves when grown on dwarfing than on invigorating rootstocks.

*Background*. Small, efficient trees are critical for early and high yielding apple trees in high density plantings. Apple tree size has been reduced by budding scion to dwarfing rootstocks but new rootstocks are needed for tree size management under a variety of environmental stresses. The mechanisms for dwarfing rootstocks are not known but may include hydraulic and hormone communication between root and shoot. Cytokinins (CK) are known to be produced in roots and research has shown that root-produced CK may play a role in bud-break and development effects of size-controlling rootstocks on scion. Other evidence suggests that elevated abscisic acid (ABA) may play a role in dwarfing apple rootstocks. ABA has been shown to be a root-produced message that regulates shoot growth and development in drying soils. In addition to direct inhibitory effects on growth, ABA can inhibit auxin translocation and subsequently reduce cambial activity and xylem development in dwarfing rootstocks. More work is needed to understand the nature of root/shoot signals (e.g. concentrations, fluxes, balances) of rootstock/scion combinations and of trees with different architectures to fully utilize the genetic capabilities to manage high density orchards and to develop rootstocks that are adapted to environmental stress.

*Approach*. Compact apple trees are critical for high-density plantings that are integral for efficient and mechanized orchard operations. The size-controlling mechanism of apple rootstocks is unknown but important for selection of new stress-resistant, dwarfing rootstocks. Abscisic acid (ABA) is a root-produced stress-response signal that suppresses growth and it may be a key regulator in size-controlling apple rootstocks. Trees grown on different size-controlling rootstocks (dwarfing to vigorous) will be obtained from the USDA rootstock breeding program at Geneva, NY or from commercial nurseries. Trees will be placed in cold storage and, with increased time after removal from storage, trees will be placed in root-pressure chambers to sample xylem exudates. Newly-devised chambers allow repeated sampling; thus allowing characterization of xylem-mobile metabolites over time within the same tree. Abscisic acid and other biologically-active compounds will be measured by GC-MS. The work is a biological link to obtaining trees of desired size and structure that is integral for success of orchard mechanization.

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