

ENDOGENOUS HORMONE CONCENTRATIONS AND BUD BREAK RESPONSE TO EXOGENOUS BA IN SHOOTS OF APPLE TREES WITH TWO GROWTH HABITS GROWN ON THREE ROOTSTOCKS

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ABSTRACT

Apple tree form influences yield efficiency and management decisions in orchards. Tree size and shape are strongly affected by the development of branches and by the kind of rootstock to which the shoot is attached. Branching can be intentionally controlled with cultural practices such as rootstock choice but branch patterns and apple tree form may also be modified by genetic selection. We evaluated potential causal factors for branch development in two, genetically-distinct apple tree growth forms (upright, narrow and spreading, round) that were grown on three size-controlling rootstocks (dwarf, semi-dwarf, and invigorated).

Scion of two apple (*Malus xdomestica*) siblings were budded to three size-controlling rootstocks (M.9, M.7, and *Malus antanovka*) and planted in the field in 1997. The scion had two contrasting growth habits; one with narrow crotch angles, few branches, and an upright narrow canopy (UN) and the other with wide crotch angles, numerous branches, and a spreading round canopy (SR). Shoot tips were collected at time of bud break in April 2004 and analyzed for indole-3-acetic acid (IAA), cytokinins (CK), and abscisic acid (ABA).

The UN growth habit had higher IAA, lower ABA, and equivalent CK as the SR growth habit. The synthetic cytokinin, 6-benzyl adenine (BA), was applied to 30 cm shoot explants of both growth habits in a greenhouse in March 2006. An 8.7 mM concentration of BA stimulated bud break in both growth habits, compared with controls, and bud break was increased more in UN than SR growth habits. It is possible that the higher auxin-to-cytokinin ratio contributed to the upright, narrow growth form. Either growth form grown on invigorating rootstock had nearly twice the auxin-to-cytokinin ratio than on dwarf or semi-dwarf rootstocks.

Size-controlling rootstocks likely have a number of primary and secondary effects on chemical, hydraulic, and nutritional messages. Results from the current experiment indicate that rootstocks can influence hormone concentrations but results were not as simple as dwarfing rootstock induced high or low quantities of ABA, IAA, or CK. In the apple growth habits of this experiment, the auxin-to-cytokinin ratio appeared to be lower in the dwarfing than the invigorating rootstock. Improved knowledge of how such messages interact with each other and with exogenous regulators can benefit efforts to grow fruit trees to specifications needed for efficient orchard management.

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