

Physiological disorder development of ‘Honeycrisp’ apples after pre- and post-harvest 1-methylcyclopropene (1-MCP) treatments

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Postharvest Biology and Technology, Volume 182, December 2021, 111703

Abstract

Susceptibility of apple fruit to physiological storage disorders is affected by both pre- and postharvest factors that influence their ethylene production. In this study, the inhibitor of ethylene perception, 1-methylcyclopropene (1-MCP), applied before and after harvest, has been used to investigate the interactions between ethylene and development of physiological disorders in ‘Honeycrisp’ apples during storage. Preharvest 1-MCP (Harvista™) was applied to trees, either 2 weeks (early), 1 week (late), at 1 and 2 weeks (repeated), or at double rate 1 week, before first commercial harvest. Fruit were then untreated or treated with postharvest 1-MCP (SmartFresh®) and stored at 0.5 °C, or conditioned at 10 °C for 7 d and then stored at 3 °C (C + 3 °C), for 20 weeks. Fruit quality and physiological disorders were assessed after 4 d at 20 °C. Fruit from all preharvest 1-MCP treatments had lower internal ethylene concentrations (IECs) and were greener as indicated by higher I_{AD} values compared with untreated controls, while effects on starch pattern indices (SPI) were inconsistent. After storage, preharvest 1-MCP -treated fruit were firmer than untreated fruit, but effects of the different application timings were inconsistent. Effects of postharvest 1-MCP on IEC and I_{AD} values were greater at 0.5 °C than at C + 3 °C. High incidences of core browning and vascular browning developed during storage, especially in the preharvest 1-MCP-treated fruit. Soft scald was reduced by preharvest 1-MCP treatments compared with control. In the C + 3 °C storage treatment, preharvest 1-MCP-treated fruit had a higher bitter pit incidence than in control fruit, but less skin wrinkling and senescent breakdown. Postharvest 1-MCP treatment of preharvest 1-MCP fruit slightly decreased bitter pit incidence while greatly increasing that of core browning and leather blotch, and sometimes flesh browning and carbon dioxide injury. This study shows that pre- and postharvest inhibition of ethylene perception by 1-MCP can have marked effects on storage disorders that are affected by fruit maturity and storage temperatures.