Title Endogenous and exogenous ethylene modulates the response of 'Bartlett' pears to 1-methylcyclopropene

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Citation ISHS ActaHorticulturae 945:309-316. 2012.

Keyword ethylene; 1-methylcyclopropene; pears; postharvest; *Pyrus communis*; ripening

Abstract

The capacity of the ethylene binding inhibitor, 1-methylcyclopropene (1-MCP; SmartFresh™ technology) to delay ripening of European pears reportedly decreases with advancing fruit maturity. In the present study, the influence of endogenous and exogenous ethylene on the efficacy of 1-MCP to delay 'Bartlett' pear fruit ripening was determined. Physiologically mature-green fruit were harvested at an early-, mid-, and late-season maturity. They were treated with 0 or 600 nl L^{-1} 1-MCP alone or in combination with 12, 30, 60 or 600 nl L^{-1} ethylene for 24 hours at 0°C. The fruit were then exposed to 100 µl L^{-1} ethylene for 24 hours at 20°C or stored at 1°C for 5 weeks. Treatment of early-season fruit with 600 nl L^{-1} 1-MCP for 24 hours at 0°C delayed ethylene-mediated ripening by 9 days at 20°C. Mid- and late-season fruit were less responsive to this treatment and shelf life was only extended by 3 days. The reduction in treatment efficacy was associated with increased ethylene production and accumulation in treatment chambers by mid- and late-season fruit. Similarly, including exogenous ethylene in the treatment atmosphere modulated 1-MCP efficacy. For early-season fruit, the benefits of 1-MCP were maintained even when 12 and 30 nl L^{-1} ethylene was initially added to chambers. Inclusion of 60 nl L^{-1} ethylene in chambers; however, reduced 1-MCP efficacy. For mid- and late-season fruit, the addition of 12, 30 and 60 nl L^{-1} ethylene did not reduce 1-MCP effects although the delay in ripening was modest even without added ethylene. 1-MCP benefits were completely negated when 600 nl L^{-1} ethylene was included in the treatment atmosphere for all fruit maturity stages. 1-MCP responses were also slightly diminished after storage at 1°C for 5 weeks following treatment compared to the response at harvest. These findings highlight the competitive nature of 1-MCP and ethylene for fruit binding sites, and underscore the importance of monitoring ethylene concentrations in treatment atmospheres.