

**Title** 1-Methylcyclopropene (1-MCP) application to *Spadona* pears at different stages of ripening to maximize fruit quality after storage

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### Abstract

The 'Spadona' pear is a summer cultivar that ripens without chilling-induced ethylene production. To expand our understanding of ethylene involvement in the initiation and progress of 'Spadona' fruit ripening, and with the aim of improving fruit quality after storage, pears were treated with the ethylene action inhibitor 1-methylcyclopropene (1-MCP). Fruit were treated with  $0.2 \mu\text{L L}^{-1}$  1-MCP for 20 h at 20 °C, at four stages of ripeness as determined by ethylene production: pre-climacteric fruit at early and late harvests (H1 and H2, respectively), and early harvested fruit after 7 and 12 d conditioning at 20 °C (C1 and C2, respectively), reflecting early and mid-climacteric fruit. The treatment effect was evaluated after 6 months' storage in controlled atmosphere (-0.5 °C, 1.5% O<sub>2</sub>, 5% CO<sub>2</sub>) and subsequently during 2 weeks at 20 °C. 1-MCP treatment effectively inhibited pear ripening when applied immediately after both early (H1) and late (H2) harvests and improved the storage potential of the fruit. However, the effect of 1-MCP treatment on H2 pears was less pronounced, resulting in a more rapid recovery of sensory attributes after storage. 1-MCP application to C1 pears also effectively inhibited ethylene production after storage and delayed pear softening during the first week at 20 °C, but thereafter fruit quality deteriorated. Applying 1-MCP to C2 pears resulted in a transient inhibition of ethylene production, which was recovered at 20 °C, with little effect on the storage potential of the fruit. mRNA expression of ACC oxidase 1 (ACO1), ACC synthase 1b (ACS1b) and the ethylene response sensor 1 (ERS1) after storage was inhibited by 1-MCP treatment at all stages of ripening, but the extent of inhibition was affected by the stage of ripening at the time of application. ACO activity was inhibited in fruit of all stages of ripeness, apart from mid-climacteric fruit. Improved quality of 'Spadona' pears was achieved after 6 months controlled atmosphere (CA) storage and 2 weeks shelf-life by applying 1-MCP immediately after harvest and the later harvested fruit were larger and of superior sensory attributes. Thus, 1-MCP can serve as an important tool for the regulation of postharvest pear ripening with economic benefits.