Abstract

The objectives of this study were: (1) to determine the effects and interactions of 1-methylcyclopropene (1-MCP) and diphenylamine (DPA) on the quality of 'Empire' apples during storage and (2) to investigate the effects of CO_2 in the CA regime for 'Empire' apples treated with 1-MCP. 'Empire' apples were harvested, treated with or without DPA (1 g L^{-1}) and 1-MCP (1 μL L^{-1}, 24 h at 0 °C), and subsequently stored in controlled atmosphere (CA) of 2.5 kPa O_2 with either 2 or 0 kPa CO_2 for 120 and 240 days at 2 °C. DPA treatment had no significant effect on CO_2 production, ethylene, and total volatiles, while apples not treated with 1-MCP were firmer with DPA than without DPA. 1-MCP-treated fruit were firmer than those not treated with 1-MCP, while untreated fruit held in CA with CO_2 were firmer than those held with no CO_2. 1-MCP-treated fruit held in CA with CO_2 were slightly firmer than those held in CA without CO_2 after 240 days of storage. 1-MCP effectively suppressed CO_2 production, ethylene and total volatiles in fruit in CA storage and after removal to air, but recovery of these metabolic processes occurred sooner with longer CA storage duration. CO_2 in the storage regime further suppressed CO_2 production, ethylene, and total volatiles in 1-MCP-treated apples. These results confirm the importance of DPA treatment and CO_2 in the CA regime for maintaining 'Empire' apple quality, especially after long-term storage. However, 1-MCP treatment mimics the beneficial effect of CO_2 on firmness. The data suggests that CO_2 could be eliminated or reduced in CA regimes for 'Empire' apples treated with 1-MCP, in order to reduce susceptibility to CO_2 injury and shorten recovery time of metabolic processes upon removal from CA.