Title Effect of 1-methylcyclopropene on flavonoid and antioxidant metabolism in pome fruits

Author Dan MacLean

Citation Thesis, Doctor of Philosophy (Horticulture), University of Guelph. 167 pages. 2007.

Keywords Flavonoid; Pome fruits; Antioxidants; Methylcyclopropene; *Pyrus communis*; *Malus x domestica*

Abstract

There has been a growing interest in understanding the role of antioxidants and phenolics in the human diet. Pome fruits are considered one of the greatest sources of dietary phenolics, thus it is important to understand how postharvest practices affect the phytochemical content of these fruits. Recently, the ethylene antagonist 1-methylcyclopropene (1-MCP) has been registered for use on apples (*Malus* x *domestica* Borkh.), with similar registration being sought for pears (*Pyrus communis* L.). Because the phenylpropanoid pathway is regulated by ethylene, there is concern that a postharvest 1-MCP treatment may adversely affect the phytochemical content of harvested pome fruit.

The total antioxidant capacity (TAC) of three apple cultivars under various 1-MCP, harvest maturity, storage, and ripening regimes, was determined using a modified total oxyradical scavenging capacity assay. In general, it was found that 1-MCP treatment resulted in significantly higher TAC in 'Delicious' (3%), and 'McIntosh' red (15%) and green (8%) tissues when compared with untreated fruit. Regardless of treatment, the TAC of 'Delicious' was 2-fold greater than 'Empire', while 'McIntosh' red and green tissues were intermediate. A subsequent study investigated the impact of 1-MCP on the postharvest synthesis or retention of phenolic compounds in 'Delicious' apple using HPLC-DAD analysis. 1-MCP treatment appears to have inhibited the catabolism of flavonoids, while concurrently inhibiting the biosynthesis of chlorogenic acid in early-harvested fruit. The effect of 1-MCP on the transcription of two key flavonoid biosynthetic (phenylalanine ammonia-lyase, PAL; and chalcone synthase, CHS), flavonoid transport (glutathione *S* -transferase, GST), and ethylene perception (ethylene response sensor 1, ERS1) genes was determined. 1-MCP treatment inhibited expression of PAL, CHS and ERS1 transcripts, and simultaneously inhibited ethylene production and chlorogenic acid biosynthesis. In non-treated fruit, an increase in PAL expression with the concomitant post-storage decrease of CHS expression and postharvest decrease of GST expression suggests a diversion of carbon from flavonoid compounds into chlorogenic acid, and perhaps an increased susceptibility of the fruit to the storage disorder superficial scald. These results suggest that 1-MCP treatment does not have a deleterious effect on the TAC or flavonoid concentration of pome fruit, but will result in lower chlorogenic acid concentration in early-harvested fruit.