

### Abstract

For the past two years we have been studying the effects of the combined application of 2 ppm MCP + 1% O<sub>2</sub> on apple fruit ripening at 1°C and 7 °C. Last year, in fruits stored at 7 °C the onset of the C<sub>2</sub>H<sub>4</sub> climacteric occurred 10, 55 and 95 d, for the controls, 1% O<sub>2</sub> and 2 ppm, respectively, whereas in fruits treated with MCP and kept under 1% O<sub>2</sub> the onset of the C<sub>2</sub>H<sub>4</sub> climacteric did not occur for 200 d, the duration of the experiment. Even now (March 2005), there is still no rise in C<sub>2</sub>H<sub>4</sub> evolution in fruits kept at 7 °C under the combined treatment of MCP and O<sub>2</sub>. The retardation of the climacteric rise was attended by a complete suppression of the ACS1 and ERS1 genes that are critically dependent on the rate of C<sub>2</sub>H<sub>4</sub> evolution, The promoters of both genes contain C<sub>2</sub>H<sub>4</sub>-responsive elements. Thus once ACS1 is induced, it can sustain the auto-catalytic increase in C<sub>2</sub>H<sub>4</sub> evolution. The dependence of mRNA accumulation in both genes on C<sub>2</sub>H<sub>4</sub> was also demonstrated by treating climacteric fruits with 1.5% O<sub>2</sub>, 2 ppm MCP, and 2 ppm MCP + low O<sub>2</sub>. The degree of decrease in C<sub>2</sub>H<sub>4</sub> evolution differed with the treatments, being stronger in the last treatment. This was reflected in the amounts of the accumulated transcripts. At present the developmental changes that precede the induction of ACS1 are unknown. A rise in C<sub>2</sub>H<sub>4</sub> may be involved since treatment of early maturity fruits with 25 ppm C<sub>2</sub>H<sub>4</sub> for 48 hours induces ACS1 within 18 d, whereas in controls it took about 30 d. At 1°C the climacteric rise in C<sub>2</sub>H<sub>4</sub> evolution was also retarded by the combined treatment for 250 d. However, when the fruits were transferred after 250 d, to 18°C, ripening occurred normally, as could be judged by the rise in C<sub>2</sub>H<sub>4</sub> evolution, softening and induction of the expression of C<sub>2</sub>H<sub>4</sub>-dependent genes, e.g., polygalacturonase. The data thus show that apples treated with MCP + 1% O<sub>2</sub> can be successfully stored at relatively high temperatures.