

**Title** Comparing the function of perforated and non-perforated film in modified-atmosphere packaging: impact on the quality of broccoli

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### **Abstract**

A wide range of steady-state O<sub>2</sub> partial pressures (0.1 to 18 kPa) was obtained in perforated and non-perforated packages composed of low density polyethylene (LDPE) film at 0 and 10°C for the storage of broccoli (*Brassica oleracea* L. var. *italica*). Half of the broccoli was treated for 24 h at 10°C with 1 ppm 1-MCP prior to storage. The combinations of steady-state O<sub>2</sub> and CO<sub>2</sub> partial pressures achievable depended on whether the film was perforated or not. The regression fitting the O<sub>2</sub> versus CO<sub>2</sub> headspace data for non-perforated packages was linear with a negative slope such that for every 4 kPa decrease in O<sub>2</sub>, there was a 1 kPa increase in CO<sub>2</sub>. The curve fitting the data for perforated packages was also linear and negative, but steeper, such that for every 4 kPa decrease in O<sub>2</sub>, there was a 4 kPa increase in CO<sub>2</sub>. The result was that for a given steady-state O<sub>2</sub> concentration, the CO<sub>2</sub> concentration was higher in the perforated package compared to the non-perforated packages. For florets stored at 10°C, the higher CO<sub>2</sub> in the perforated packages resulted in higher visual quality and better color retention was significantly better than in the non-perforated packages for packages with O<sub>2</sub> levels greater than approximately 2 kPa. There was no effect of the elevated CO<sub>2</sub> for the florets stored at 0°C. 1-MCP application only had a small positive impact on floret quality at 10°C and no effect at 0°C. The data suggest that combination of both perforated packages and 1-MCP application on broccoli florets may have the potential to provide some protection against rapid quality loss when the storage temperature exceeds the recommended 0°C.