

Title Impact of storage temperature, ethylene exposure, and 1-MCP on respiration rates, shelf-life, and composition of spinach

Author M.I. Cantwell, P. Freitas, X. Nie and G. Hong

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### **Abstract**

Ethylene can have negative effects on postharvest quality of leafy vegetables such as spinach, depending on temperature, ethylene concentration and length of exposure. 1-MCP (1-methylcyclopropene, commercially formulated as SmarFresh<sup>®</sup>) blocks the ethylene-binding site in plant membranes and prevents ethylene responses. This chemical tool offers the opportunity to reevaluate the effects of ethylene and storage temperature on shelf-life and quality of spinach cultivars currently grown for the fresh market. The main objective was to determine the postharvest quality of spinach under good and poor temperature management in relation to ethylene exposure and inhibition. Five experiments were conducted using young spinach leaves obtained from processors on the day of harvest. Ethylene concentration of 0, 0.1, 1 and 10 ppm were provided in humidified flows through the storage containers. Leaves were pretreated with 1000 ppb 1-MCP for 12 h. Spinach was evaluated after 0, 3, 6, and 9 d at 10 °C and after 0, 6, 12 and 18 d at 5 °C for visual appearance and defects, L\*a\*b\* color values, and concentrations of chlorophyll, carotenoids, ascorbic acid, and ammonia. Respiration rates (CO<sub>2</sub> production) were measured in 3 experiments. Ethylene induced significant increases in respiration rates at 5 and 10 °C and this resulted in increased yellowing (lower hue values), most notable at 10 °C after 9 days, but also evident at 5 °C after 20 d. 1-MCP treatment prevented the increases in respiration rates caused by ethylene and prevented loss of chlorophyll and carotenoids. Ammonia concentrations remained low in all 1-MCP treated spinach, whereas untreated spinach exposed to ethylene had 2-fold and 3-8-fold increases at 5 and 10 °C, respectively. 1-MCP treatment also resulted in higher ascorbic acid concentrations at 10 °C, but not 5 °C, in ethylene-exposed spinach. 1-MCP is clearly effective in reducing detrimental ethylene-induced deterioration in spinach, especially under temperature abuse conditions.