Title Ethylene production and ethylene effects on respiration rate of postharvest sugarbeet roots

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Abstract

Ethylene elevates respiration, is induced by wounding, and contributes to wound-induced respiration in most postharvest plant products. Ethylene production and its effects on respiration rate, however, have not been determined during storage of sugarbeet (*Beta vulgaris* L.) root, even though any elevation in respiration due to ethylene would increase storage losses and reduce postharvest quality. To determine the effect of ethylene on sugarbeet root storage respiration rate, sugarbeet root ethylene production was quantified, and the effects of exogenous ethylene, an ethylene biosynthesis inhibitor, and ethylene response inhibitors on root respiration rate were determined using uninjured, severely injured, and conventionally harvested roots. Ethylene production was low (0.045–0.047 pmol kg^{-1} s^{-1}) in uninjured and conventionally harvested and piled roots. Consequently, ethylene concentrations in commercial piles 0–67 d after piling were low, ranging from <0.001 to 0.054 μL L^{-1}. Exogenous ethylene at concentrations of 0.020–14 μL L^{-1} increased root respiration. The increase in respiration rate, however, was transient at ethylene concentrations $\leq$0.11 μL L^{-1} suggesting that any ethylene effects on respiration rate in commercial piles would be short term. Severe injury induced ethylene production an average of 3.7-fold and increased respiration rate 3–4 d after injury. Wound-induced ethylene production, however, was not directly responsible for wound-induced respiration since elimination of wound-induced ethylene production by the ethylene synthesis inhibitor aminoethoxyvinylglycine had no effect on wound-induced respiration. The ethylene response inhibitors 1-methylcyclopropene (1-MCP) and silver thiosulfate reduced wound-induced respiration 3–4 d after injury when applied after wounding. A portion of the increase in respiration due to wounding, therefore, required ethylene perception. However, when applied prior to wounding, 1-MCP elevated wound-induced respiration 3–4 d after injury, suggesting that blockage of ethylene receptors prior to injury was ineffective at eliminating ethylene perception after wounding, possibly due to the synthesis of new receptors after the injury. Moreover, 1-MCP effects on root respiration rate occurred only when roots were severely injured; 1-MCP had no effect on respiration rate of uninjured or conventionally harvested roots. Postharvest sugarbeet roots, therefore, produce ethylene, increase ethylene production in response to wounding, and respond to exogenous ethylene with an increase in respiration rate, but ethylene production and ethylene effects on root respiration rate are likely to be small under commercial storage conditions and of limited economic significance.