Title Physiological disorders of apples during controlled atmosphere storage and the role for glutamate decarboxylase derived gamma-aminobutyrate

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Abstract

This thesis focuses on the relationship between physiological injury and γ-aminobutyrate (GABA) in apples ('Honeycrisp', 'Empire', 'McIntosh') stored under controlled atmosphere (CA) conditions, and the biochemical mechanisms that are likely responsible for GABA accumulation. Chilling enhanced the development of internal disorders in 'Honeycrisp', whereas CO_2 had a rapid effect on external disorders for 'Empire'. The relative GABA concentration was generally increased in all cultivars following CA storage. A two-fold increase in relative GABA concentration in 'Empire' and 'McIntosh' fruit was apparent after two weeks of CA storage. GABA levels were maintained in high CO_2 -stored 'Empire' during prolonged storage, whereas it declined in low CO_2 -stored 'Empire and then returned to the level of high CO_2 -stored fruit after 16 weeks of storage. Glutamate decarboxylase (GAD) activity in cell-free extracts from 'Empire' fruits was regulated by pH and stimulated by Ca^{2+} /CaM. An 'Empire' fruit GAD gene was cloned, and the recombinant *Md* GAD1 displayed maximal activity at pH 5.5, but no stimulation by Ca^{2+} /CaM. These data are interpreted as support for a correlation between the onset of physiological injury and GAGA levels in CA-stored fruit, and for the presence of a Ca^{2+} /CaM-regulated GAD in apple fruit. However, it appears that an additional GAD(s) may be involved in GABA accumulation in CA- stored apple fruit.