

**Title** Influence of Md-ACS1 allelotype and harvest season within an apple germplasm collection on fruit softening during cold air storage

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### **Abstract**

Previous studies have demonstrated a relationship between *Md-ACS1* allelotype and apple fruit softening at ambient temperatures. The present study was undertaken to further examine the influence of this allelotype (-1/1, -1/2 or -2/2) and its interaction with harvest season (early or late) on changes in internal ethylene concentrations (IEC) and fruit softening during cold air storage. This was carried out by describing natural differences found among old apple cultivars/species and modern commercial cultivars. For late maturing cultivars, *Md-ACS1-1/1* was firmer at harvest than *Md-ACS1-2/2* with the heterozygote intermediate. However harvest firmness showed no differences among for the early season *Md-ACS1* allelotypes. The *Md-ACS1-2/2* allelotype had a slower rate of postharvest IEC increase and flesh softening compared with *Md-ACS1-1/1* and -1/2 allelotypes, and late maturing cultivars had a slower rate of fruit softening than early maturing cultivars, which was independent of postharvest IEC. All three late season allelotypes and early season *Md-ACS1-2/2* were firmer after storage than early season *Md-ACS1-1/1* and -1/2 allelotypes, reflecting differences in both harvest firmness and softening rates. While cultivar variation in final firmness could be explained partially through *Md-ACS1*-mediated postharvest ethylene increases and subsequent softening, much more variation was accounted for by their differences in harvest firmness. These results are discussed in relation to strategies for breeding cultivars with superior flesh textures that are maintained during storage.