

# Effects of preharvest regulation of ethylene on carbohydrate metabolism of apple (*Malus domestica* Borkh cv. Starkrimson) fruit at harvest and during storage

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## Abstract

The main purpose of this study was to investigate the effects of preharvest regulation of ethylene on apple fruit carbohydrate metabolism and quality at harvest and during storage. The positive regulation of ethylene was achieved by Ethephon, and the negative regulation was by Harvista, a kind of sprayable 1-methylcyclopropylene (1-MCP). 'Starkrimson' apple were treated with Harvista or Ethephon 7 d before harvest, respectively, and then stored at 0 °C for 180 d. The contents of starch, sucrose, glucose, fructose, and related enzymes activities and gene expression levels of sucrose phosphate synthase (SPS), sucrose synthase (SUSY), acid invertase (AINV), neutral invertase (NINV), cell wall invertase (CWINV) and amylase (AMY) were determined. The results showed that Harvista inhibited the starch degradation, retarded the increase of soluble sugar, reducing sugar, sucrose, glucose and fructose contents before 120 d of fruit storage, while no obvious difference was observed in these sugar content after 120 d of storage among three treatments. The enzyme activities of SPS, AINV, CWINV and AMY were also inhibited by Harvista at the early period of storage, and the expression levels of *MdSPS*, *MdAINV*, *MdCWINV* and *MdAMY* were positively correlated with their enzyme activities. In addition, Harvista reduced the fruit dropping rate at harvest and maintained the fruit firmness, while Ethephon showed the opposite effect. These results indicated that the preharvest regulation of ethylene effectively altered the carbohydrate metabolism and the quality of 'Starkrimson' apple fruit, and Harvista may be a useful tool applied at preharvest to maintain fruit quality at harvest and during storage.