Title Regulation and genetic manipulation of ripening in climacteric fruit

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Abstract

Purpose of the review: Ripening in climacteric fruit is controlled at many levels and by branches of several complex, interacting pathways. Regulatory genes and their protein products involved in ethylene, developmental and light signal transduction pathways are reviewed, and the potential for plant improvement by their genetic manipulation is assessed.

Main findings: Some genetic controls of ripening have been shown to succeed, for example suppression of ethylene biosynthesis by post-transcriptional gene silencing of *ACS* or *ACO*, and the generation of hybrid tomato lines heterozygous for the *rin* mutation, a defective version of a developmental regulatory gene. The fruit-specific silencing of protein factors in the light signal transduction pathway has also been used to increase the pigment content of some fruit, resulting in improved nutritional content. However, genetic manipulation of ethylene perception and response appears insufficiently understood at present for commercial exploitation.

Directions for future research: Control of fruit ripening by suppression of ethylene biosynthesis is a successful technology that is currently being explored for a commercially useful application. Tropical fruit species with a very short shelf-life are a potential target. In tomato, shelf-life has been increased by introgression of the *rin* gene, but future research should attempt to reduce deleterious effects on flavour and colour components of ripening. The use of *rin* homologues to control shelf-life has promise in other species, including non-climacteric varieties, but flavour, colour and nutritional content should not be compromised.