Sugar deficiency causes changes in cuticle permeability and cell wall composition that influence fruit postharvest shelf-life

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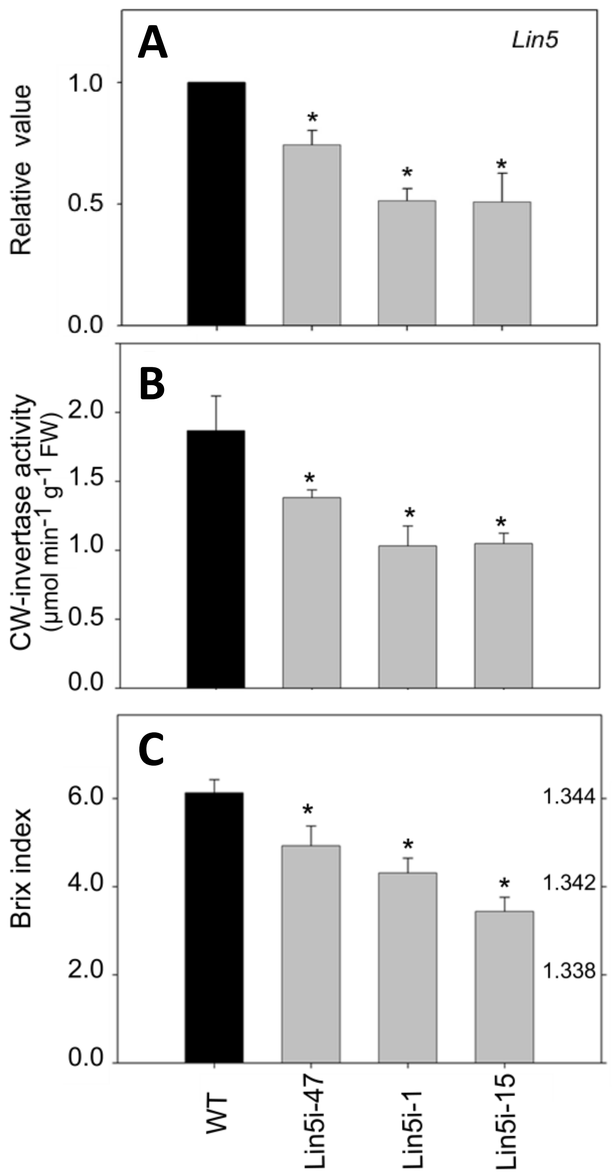
The cuticle is a protective layer synthesized by epidermal cells of the plants and consisting of cutin covered and filled by waxes. In tomato (*Solanum lycopersicum*) fruit, the thick cuticle embedding epidermal cells has crucial roles in the control of pathogens, water loss, cracking, and postharvest shelf-life. Tomato fruits with reduced expression of the tomato gene LIN5 encoding cell wall invertase exhibits decreases transpirational water loss. Transcriptomic, biochemical, histological, and biomechanical analysis identified several unsual features of RNAi-LIN5 cuticles and the data indicate that, perturbation of endogenous fruit sugar levels affects the composition of the tomato cuticle and cell wall architecture which are an integral and regulated part of the ripening program affecting the postharvest shelf-life. A model is proposed in which sugar levels affects the cuticle formation which has a direct effect in softening of intact tomato fruit both directly, by providing a physical support, and indirectly, by regulating water status.

ANALYSIS OF TOMATO RNAi *LIN5* (cell wall invertase)



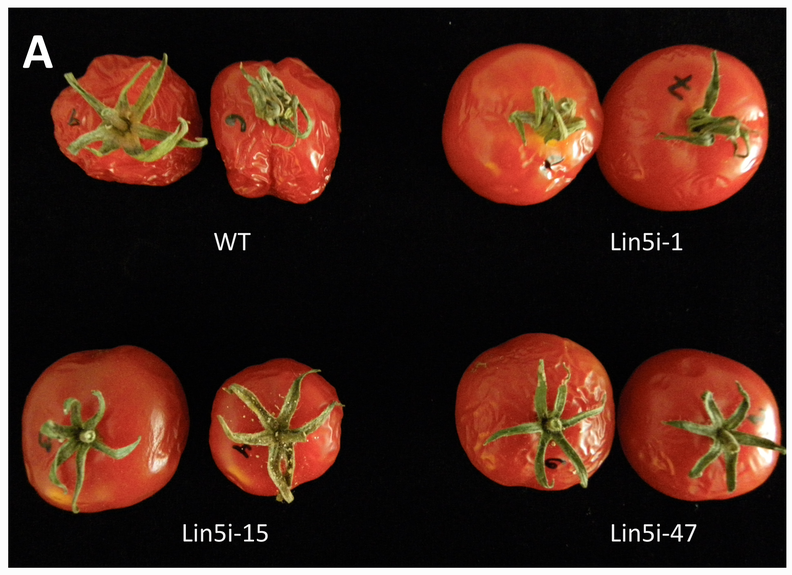
qRT of *Lin5*

CW invertase activity

Brix index

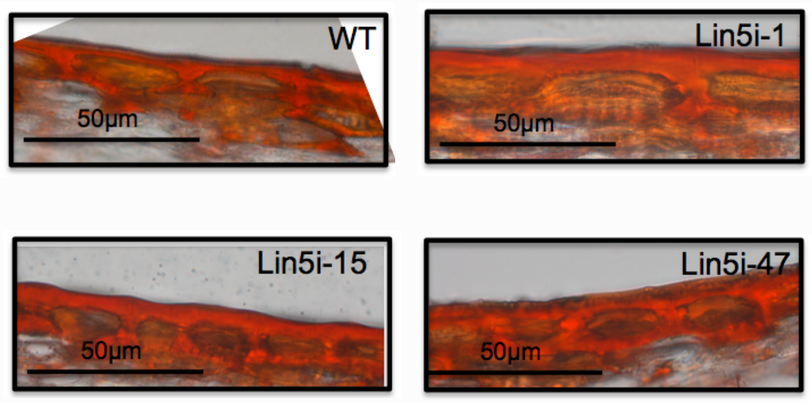
Figure 1. A, qRT-PCR of LIN5 in the three selected Lin5i transformants. B, Cell wall activity pf extracts from young fruits. C, Total soluble solids content (Brix index) in mature fruits (Zanor et al., 2009).

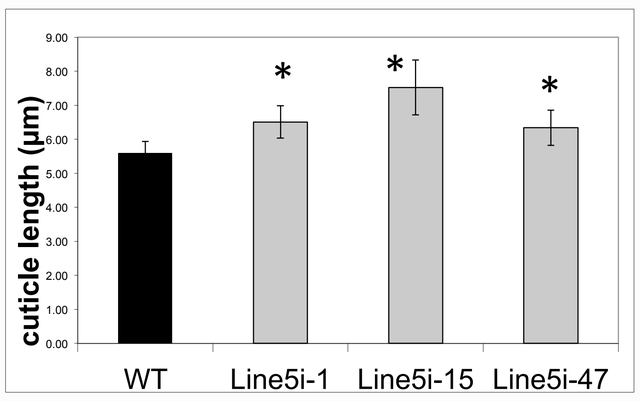
POSTHARVEST CHARACTERISTICS OF THE TRANSFORMANTS (Cuticle)



Water loss

Fruits from WT lose more water, which is reflected in clear signs of desiccation more rapidly that the three selected lines (Figure 2A).

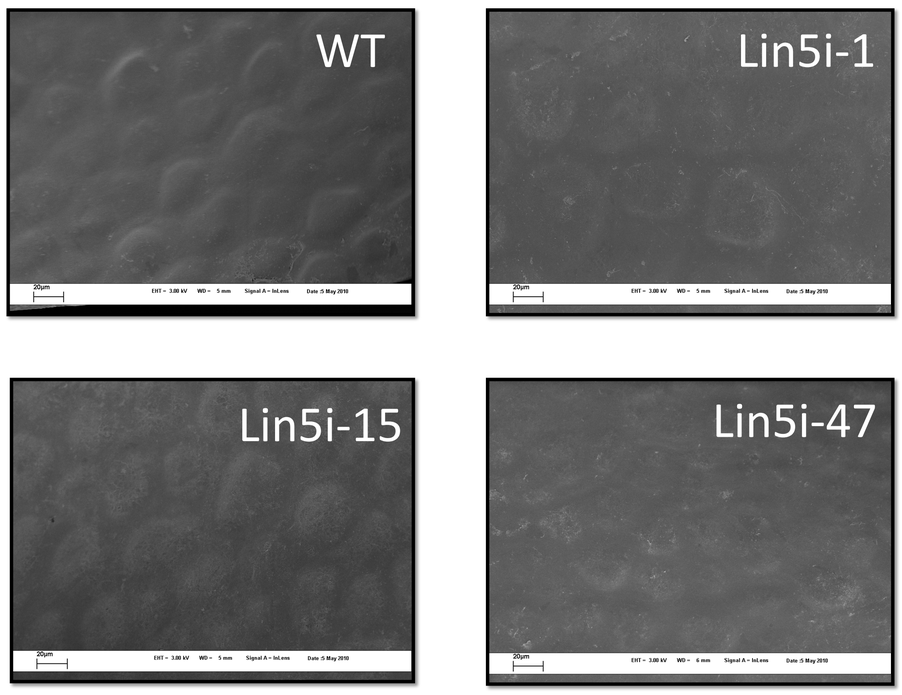




Cuticular layer

Sudan IV stainning demostrating the difference in cuticular lipid deposition in red fruit epidermis between WT and the three Lines Lin5i

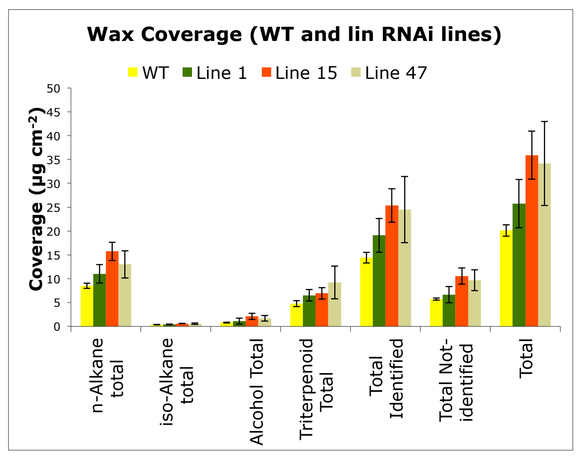
POSTHARVEST CHARACTERISTICS OF THE TRANSFORMANTS (Epicuticular Waxes)

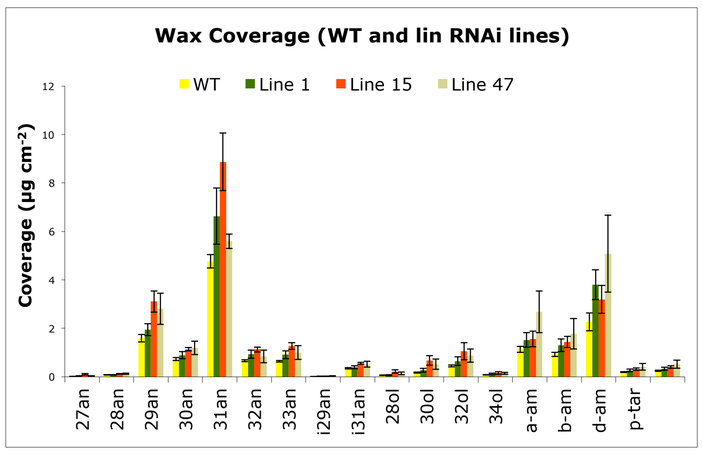


Cuticular Waxes

Altered cuticle waxes in red fruit of the Wt and the RNAi Lin5i lines.

Scanning electron microscopy images of epicuticular wax crystals on red fruit. Bars = 20 µm





Cuticular Waxes

Cuticular wax amounts and composition on red fruit of WT and the RNAi LIN5i lines revealed higher amounts of alkanes in the RNAi5 red fruits. Cuticular waxes were extracted with chloroform and analyzed by GC-FID and GC-MS.

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