# Fruit ripening behaviour:  Ethylene and the Regulation of Sugar Metabolism

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Japanese plums represent the most variable group among tree species and include most of the fresh-market plums commercialized worldwide. We characterized and compared two Japanese plum cultivars, "Santa Rosa" (SR) and its bud-sport mutant "Sweet Miriam" (SM). These cultivars share the same genetic background but display contrasting ripening behaviors (SR, climacteric and SM, non-climacteric). Both cultivars differ in their sugar metabolism conferring the SM fruits with unusual quality properties (lower glucose and fructose, higher sorbitol). The main objective of this research is to characterize the differences in the complex sugar metabolic pathways between the cultivars and their possible crosstalk with ethylene biosynthesis-related enzymes, underlying their climacteric and non-climacteric fruit ripening behaviors. Fruits from each each cultivar were harvested at an early (S2: pit hardening) and late (S4: fully-ripe) stages of fruit development and assessed using Systems Biology. Transcriptomics, proteomics and metabolomics, together with targeted gene expression and enzymatic activity assays were analyzed to reveal complex sugar metabolic interrelations and identify differences between the cultivars that could be associated to the observed changes in sugar homeostasis as well as ethylene biosynthesis and signaling. This experimental system provides a unique tool to study metabolic pathways underlying climacteric and non-climacteric fruit ripening behaviors and offers several practical applications. Understanding mechanisms that allow fruits to 'switch' to a sorbitol-based metabolism would have a great industry impact, since sorbitol is an alternative and healthier natural sweetener to sucrose. It could also allow the identification of candidate genes for breeding programs focused on fruit quality improvement.