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ORALS

The interference of the ethylene perception system leads to a transcriptional re-programming involved in hormonal cross-talk and protection to superficial scald in apple

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Ethylene is a gaseous plant hormone playing master regulatory roles in triggering and coordinating the ripening syndrome in climacteric fruits. The control of this hormone represents a key point in the modern horticulture and postharvest management, since the reduction of ethylene can extend the postharvest life of fruits limiting quality decay and general fruit loss. One of the most efficient strategies to limit the effect of ethylene during the postharvest ripening of apple is the exogenous application of 1-methylcyclopropene (1-MCP), a molecule competing with ethylene at the receptor-binding site. The transcriptional signature coded by the application of 1-MCP was further investigated with microarray platforms. Together with an expected gene transcriptional repression, an equal dose of genes was also de-repressed or de-novo activated, underlying elements especially involved in regulatory processes and hormonal cross-talk, in particular with auxin. The re-programming of the auxin perception pathway, correlated with the amount of ethylene produced during normal ripening, was validated by the specific expression pattern of genes involved in conjugation/de-conjugation processes. In this physiological scenario the activation of auxin following the interference with ethylene is thought as an alternative mechanism induced by the fruit in the attempt to re-establish a normal physiological progression towards the completion of ripening. Although 1-MCP is usually applied to delay fruit ripening, it turns out to be also an effective strategy to prevent, in specific apple cultivars, the development of superficial scald, one of the most severe postharvest disorders for this fruit species. To elucidate the role of 1-MCP, a comprehensive investigation coupling large scale RNA-seq based transcriptomic and metabolite profiling was carried out. The exogenous application of 1-MCP in fruit of ‘Granny

Smith' apple cultivar induced an important series of re-programming events towards the triggering of a cold acclimation process. The transcriptome-metabolite correlation network reveals an induced accumulation of very long chain fatty acid and unsaturated type of fatty acids for protecting the stability of internal membrane against chilling injuries. This protecting mechanism enhances the compartimentation of chlorogenic acid and polyphenol oxidase enzyme, preventing, in the end, the browning phenomenon. Within the cluster of genes stimulated by 1-MCP, the most expressed resulted a sorbitol-6-phosphate-dehydrogenase (S6PDH), known as a limiting step in the biosynthesis of sorbitol, a polyalcohol with cryoprotectant role controlling the osmolarity of the cell. The over-expression of this gene in Arabidopsis transgenic lines validated the role of this gene in the protection from freezing temperatures and chilling injuries phenomenon such as superficial scald.

Deciphering the role of CO_2 treatment on chilling injury in tomato: Effect on transcriptome profiling

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A pre-treatment with high CO_2 proved effective in maintaining the fruit quality and alleviating chilling injury in tomatoes during storage. CO_2 treatments at 30% concentration successfully reduced chilling injury as fruits stored at 4°C displayed less pits even after transferring to 20°C for 8 days. The CO_2 treated tomato showed the lower lycopene contents, and higher lutein and ß-carotene contents than those of non-treated control. Co-ordinately, the skin color development in tomato was blocked by high CO_2 treatments and at low temperature. An antioxidant activity in tomato stored at 20℃ showed non-significant effect between CO_2 treated and non-treated control, in contrast, CO_2 treated tomato stored under chilling temperature (4℃) showed significantly high DPPH scavenge activity compared to non-treated control. Interestingly, ethylene production of CO_2 treated fruits stored at 20°C for 0-3 days both at 30 and 60% concentrations was higher than that of the control, whereas those of 60% CO_2 treated fruits showed a significant decline at 11 days storage. Transcription analysis showed the expression of ethylene signaling genes, LeERF3, LeETR1immediately increased after CO_2 treatment. However, CO_2 treatment