Antioxidant enzyme activities and exogenous ascorbic acid treatment of 'Williams' banana during long-term cold storage stress

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Abstract

The effect of exogenous ascorbic acid (AA) application on chilling injury (CI) of banana fruit 'Williams' (Giant Cavendish AAA sub-group) harvested at the mature green stage. The investigation aimed to increase chilling tolerance of banana fruits under cold storage temperature. The experiment was carried throughout growth two seasons 2014 and 2015. Fruits were immersed in 0, 3, 6, and 9 mM ascorbic acid (AA) for 15 min at cold temperature. Thereafter, fruits were stored at cold temperature (6 \pm 1 °C with 90% RH) for 27days. The results pointed out that the immersing banana fruits at 9 mM of AA were most effective in reducing chilling injury incidences in fruit peel. Also, the treatment reduced increases in cell membrane dysfunction at to lipid peroxidation (MDA) and protein oxidation (PCG) accumulation consequently, decreases ion leakage. Moreover, immersing in AA at 9 mM minimized superoxide anion (O_2^{-}) and H_2O_2 production. Also, it increased significantly antioxidant enzyme activities during cold storage stress of ascorbate peroxidase (APX; CE: 1.11.1.11), peroxidase (POD; EC: 1.11.1.7), catalase (CAT; EC:1.11.1.6), and superoxide dismutase (SOD; EC: 1.15.1.1) so, less chilling injury symptoms on fruit peel which it reflects on fruit appearing compared to control fruit and other AA treatments. These results pointed out that the AA treatments at 9 mM might increase chilling tolerance of banana fruit by increasing antioxidant enzyme activities. Consequently, decrease/alleviate $O_2^{\bullet-}$ and H₂O₂ generation during cold storage stress. Thus, exogenous AA treatment at 9 mM could be a useful application to reduce/delay/alleviate CI in banana fruit during cold storage.