Title Can H_2O_2 application reduce chilling injury of horticultural crops?

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Abstract

Hydrogen peroxide (H_2O_2) at low endogenous concentration is a signaling compound leading to adaptation and stress tolerance during plant abiotic stress. At high concentrations, H_2O_2 can lead to cell death. Our study was to examine whether exogenous application of H_2O_2 could lead to stress tolerance and thereby improve the quality of horticultural crops. This study consisted of two types of experiments: chilling injury in sweet potato (growth chamber) and storage quality in sweet peppers (greenhouse). In sweet potato (growth chamber experiment), excised leaves had less chilling injury, when stored at 2.5°C for 2 to 3 days, if the petioles were immersed in 15 mM H_2O_2 as compared to de-ionized water (control). When cv. Purple (PUR) sweet potato shoots were subjected to 3-day chilling at 2.5°C, a 48h pre-treatment of 150 mM H_2O_2 under 16h photoperiod reduced chilling injury, but H_2O_2 showed no effect under 8h photoperiod. In sweet peppers (greenhouse experiment), decay index of sweet peppers after 4-week storage was lower when 500 ppm H_2O_2 was administered through the hydroponic system prior to fruit harvest. The beneficial effect gradually declined when H_2O_2 was continuously applied for a period of a few months. A similar decline in the beneficial effect on quality was observed through pulsed H_2O_2: postharvest decay was reduced if sweet peppers were harvested one or two weeks after H_2O_2 application, but no benefit was observed in those harvested after three weeks. Our data seem to support the hypothesis that endogenous H_2O_2 leads to stress tolerance. Our preliminary data also illustrated that the benefits of exogenous H_2O_2 application could not be observed under all experimental conditions. Rather, H_2O_2 effects were observed under specific conditions, such as photoperiod in sweet potato, or specific number of weeks between H_2O_2 application and harvest in pepper fruits. Therefore further studies are required to devise specific, practical H_2O_2 applications for assured benefits in crop production.