

Title Transcript levels of antioxidative genes and oxygen radical scavenging enzyme activities in chilled zucchini squash in response to superatmospheric oxygen

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Abstract

The transcript levels of antioxidative genes including Mn-superoxide dismutase (Mn-SOD), Cu/Zn SOD, ascorbate peroxidase (APX), and catalase (CAT) were relatively constant during storage at 5 °C with high oxygen treatment in freshly harvested zucchini squash (*Cucurbita pepo* L. cv. Elite). However, the expressions of alternative oxidase (AOX) were induced slightly in squash treated with 60% and 100% oxygen for 3 days when compared with control squash. These increases in AOX transcript levels were correlated with the increased chilling resistance in the treated squash. The corresponding oxygen radical scavenging enzyme activities including SOD, APX, CAT, and peroxidase (POD) in treated samples were also higher than those in the control for the first 3 days at 5 °C. Transcript levels of AOX increased substantially between 3 and 6 days in all treatments suggesting the involvement of alternative respiratory pathway during chilling stress. All of the enzyme activities in 100% oxygen treated squash started to decline after 6 or 9 days of cold storage to a level comparable or lower than those of the control. These declines were correlated to the loss of chilling resistance in the 100% oxygen treated tissue as indicated in the chilling injury index. However, squash treated with 60% oxygen maintained elevated levels of all enzyme activities except POD and sustained the least chilling injury throughout the 15 days of storage at 5 °C. The oxygen radical absorbance capacity (ORAC) values and total phenol content remained high in squash treated with 60% and 100% oxygen for the first 9 days, then their levels in the 100% oxygen treated samples declined sharply while those in the 60% oxygen treated samples maintained elevated, indicating that both ORAC activity and phenolic content may also contribute to the resistance of tissue against chilling injury. The 100% oxygen treated squash showed the lowest respiration rate and 60% oxygen treated samples had the lowest ethylene production. These data may also be an indication of the low chilling injury in the high oxygen treated squash.