

Balance between oxidative stress and the antioxidant system is associated with the level of cold tolerance in sweet potato roots

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Abstract

The balance between oxidative stress and antioxidant defense system was investigated in roots of the cold-sensitive (cvs. BRS Rubissol and BRS Cuia) and cold-tolerant (cv. Beauregard) sweet potato stored at 6 or 13 °C for 60 d. We hypothesized that the absence of chilling injury symptoms on cv. Beauregard stored at 6 °C depends on the induction capacity of enzymatic and non-enzymatic antioxidant systems. The manifestation of chilling injury symptoms on cvs. BRS Rubissol and BRS Cuia were associated with the loss of membrane integrity, increased lipid peroxidation, accumulation of hydrogen peroxide (H₂O₂), and low catalase (CAT) and ascorbate peroxidase (APX) activities. In these cold-sensitive cultivars, proline and total phenolics increased with the progression of chilling injury, acting as markers for cold sensitivity, and parallel increased activity of phenylalanine ammonia-lyase. In contrast, constitutive levels of enzymatic and non-enzymatic antioxidants, as well as stress-induced increased CAT and APX activity played an important role in the detoxification of H₂O₂ in the tolerant cv. Beauregard. Our results suggest that the balance between oxidative stress and antioxidant system is involved in the tolerance of cv. Beauregard to chilling injury.