Title Postharvest ascorbate metabolism in two cultivars of spinach differing in their senescence rates.

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Abstract

Rapidly declining levels of ascorbate (vitamin C [ascorbic acid]) have been associated with advancing senescence and postharvest quality loss in spinach (*Spinacia oleracea*). To further explore the association between ascorbate metabolism and senescence, two cultivars of spinach previously shown to differ in their postharvest senescence rates were grown under controlled conditions (18 deg C, 14 light:10 dark photocycle) and harvested 6 weeks after planting. Detached leaves of 'Spokane F1' (with relatively fast senescence rate) and 'BJ412 Sponsor' (with relatively slow senescence rate) were bagged and placed in the dark at 10 deg C. Samples were removed on days 0, 7, 14, 21 and 28, and analysed for activities of L-galactono- gamma -lactone dehydrogenase [galactonolactone dehydrogenase] (GLDH), ascorbate peroxidase [L-ascorbate peroxidase] (ASPX), ascorbate oxidase [L-ascorbate oxidase] (AAO), dehydroascorbate reductase (DHAR), and monodehydroascorbate reductase (MDHAR), and levels of ascorbate [reduced (AsA) and oxidized (DHA)] and malondialdehyde (MDA) (estimator of lipid peroxidation). Oxidative stress, as estimated by MDA levels, steadily increased in both spinach cultivars during storage, but increased more in 'Spokane' than in 'Sponsor'. GLDH activities peaked on day 14 for both cultivars and levelled off thereafter, while activities of ASPX, DHAR, and MDHAR declined during storage. ASPX activities were lower in 'Spokane' than in 'Sponsor' after day 21. No difference in AAO activities was noted between 'Sponsor' and 'Spokane' during storage. Total ascorbate concentrations declined in both cultivars on day 14 after which no further decreases were noted, while DHA/AsA ratios increased during storage. Early in the storage regime (days 0 and 7), ascorbate levels were lower in 'Spokane' than in 'Sponsor'. GLDH activities may have increased as part of a strategy to maintain the ascorbate pool during escalating oxidative stress. However, decreased levels of ascorbate suggests that, even though ascorbate biosynthesis was increased, ascorbate was being degraded, possibly through hydrolysis of DHA to 2,3-diketogulonate. Initially, lower levels of ascorbate (days 0 and 7) and lower activities of ASPX (day 28) in 'Spokane' may have resulted in comparatively greater susceptibility of this cultivar to oxidative stress than 'Sponsor'.