

**Title** Characterisation of cell death in bagged baby salad leaves

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### **Abstract**

Baby leaf salads are gaining in popularity over traditional whole head lettuce salads in response to consumer demand for greater variety and convenience in their diet. Baby lettuce leaves are mixed, washed and packaged as whole leaves, with a shelf-life of approximately 10 days post-processing. End of shelf-life, as determined by the consumer, is typified by bruising, water-logging and blackening of the leaves, but the biological events causing this phenotype have not been studied to date. We investigated the physiological and ultrastructural characteristics during postharvest shelf-life of two lettuce varieties with very different leaf morphologies. Membrane disruption was an important determinant of cell death in both varieties, although the timing and characteristics of breakdown was different in each with Lollo rossa showing signs of aging such as thylakoid disruption and plastoglobuli accumulation earlier than Cos. Membranes in Lollo rossa showed a later, but more distinct increase in permeability than in Cos, as indicated by electrolyte leakage and the presence of cytoplasmic fragments in the vacuole, but Cos membranes show distinct fractures towards the end of shelf-life. The tissue lost less than 25% fresh weight during shelf-life and there was little protein loss compared to developmentally aging leaves in an ambient environment. Biophysical measurements showed that breakstrength was significantly reduced in Lollo rossa, whereas irreversible leaf plasticity was significantly reduced in Cos leaves. The reversible elastic properties of both varieties changed throughout shelf-life. We compared the characteristics of shelf-life in both varieties of bagged lettuce leaves with other leafy salad crops and discuss the potential targets for future work to improve postharvest quality of baby leaf lettuce.