

# Impacts of carbohydrate pulses and short-term sub-zero temperatures on vase life and quality of cut *Paeonia lactiflora* Pall. hybrids

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## Abstract

Flower quality of cut *Paeonia lactiflora* (peony) Pall. hybrids is best preserved between 0 and 1 °C. However, cut flower traits such as vase life and flower size often decline following 4 or more weeks of storage. While the use of sub-zero temperatures is avoided in the cut flower industry due to fears of freeze injury, sub-zero temperatures may allow extended storage of cut flowers. Peonies are a candidate for sub-zero storage due to their natural cold tolerance, exposure to spring freezes before harvest, and limited seasonal availability. Three cultivars: Karl Rosenfield, Monsieur Jules Elie, and Sarah Bernhardt were used to evaluate freeze tolerance of cut peonies by holding cut stems at three temperatures: 0, -2, -4 °C for 5 h. Pre-cold treatment pulses consisting of 24 h in either 100 g·L<sup>-1</sup> sucrose, 100 g·L<sup>-1</sup> fructose, or tap water did not improve total vase life, summation of the time spent as a bud and time open. Total vase life was 10.5, 7.1, and 9.3 d for 'Karl Rosenfield', 'Monsieur Jules Elie', and 'Sarah Bernhardt', respectively. Sucrose-pulsed stems of 'Karl Rosenfield' and 'Sarah Bernhardt' had the lowest total vase life. Pulses and cold-treatments decreased bud time for 'Karl Rosenfield' and 'Monsieur Jules Elie' by 2–3 d and 0.5–1 d, respectively. Petals were the only tissue to develop water-soaked spotting (freeze injury) following 5 h at -4 °C. Stems kept dry (not pulsed) prior to cold treatment were uninjured. Fructose-pulsed stems of 'Karl Rosenfield' and 'Monsieur Jules Elie' had the highest injury ratings when held at -4 °C. Carbohydrate-pulsing did not influence injury ratings on 'Sarah Bernhardt'. Supercooling and multiple freeze events were observed with infrared video in all tissues when held at -4 °C. Typically, ice nucleation started at the base of the cut stems and propagated throughout the stem, leaves, and bud within 3–5 min of initiation. Stems that were not pulsed remained in a supercooled state longer than those that were pulsed. These findings

indicate that storage temperatures between 0 and -2 °C may be a good option for longer periods of dry storage for peonies and other cold tolerant cut flower species.