

Title Sweetening responses of potato tubers of different maturity to conventional and non-conventional storage temperature regimes

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Abstract

Low storage temperatures stimulate the accumulation of glucose and fructose (sweetening) in potato (*Solanum tuberosum* L.) tubers, resulting in unacceptably dark processed products during frying. Information on how tubers respond to unorthodox storage temperature regimes is lacking, especially for the relatively new frozen-processing cultivars, 'Umatilla Russet' and 'Ranger Russet'. Such knowledge could greatly facilitate the ability to manage immature, over-mature, or otherwise stressed potatoes. This study characterizes the sweetening responses of 'Russet Burbank', 'Ranger Russet' and 'Umatilla Russet' tubers of different maturity, over a range of conditioning and holding storage temperatures. Tubers from early- and late-planted crops were wound-healed (12 °C) for 17 d after harvest (DAH), conditioned for a month (17–48 DAH) at 4.5, 6.7, or 9 °C, and subsequently stored (48–230 DAH) at 4.5, 6.7 or 9 °C (nine temperature regimes) for an additional 182 d before reconditioning at 16 °C for 21 d. Reconditioning hastens catabolism of reducing sugars and restoration of processing quality. On average, tubers from the early planting had lower rates of respiration during wound-healing and emerged from dormancy sooner than those planted later, indicating relative immaturity of the latter. The early-planted crop of 'Ranger Russet' was more sensitive to low temperature sweetening than the late-planted crop, reflecting a tendency of tubers to become over-mature and reinforcing the benefit of a 'green' harvest for this cultivar. All cultivars sweetened rapidly when conditioned at 4.5 °C. Conditioning at 6.7 and 9 °C, however, decreased the extent of low temperature sweetening during subsequent storage at 4.5 °C through most of the storage season, expanding the options for managing potatoes with lower than normal temperature later in storage. The processing quality of 'Ranger Russet' was maintained for 230 d with higher conditioning/holding temperature regimes. Reducing sugar concentrations in cold-sweetened 'Ranger Russet' and 'Russet Burbank' tubers decreased more than in 'Umatilla Russet' tubers in response to reconditioning at 16 °C. Following an interval of wound-healing, the use of combinations of non-conventional conditioning and holding temperatures that do not stimulate excessive sweetening broadens the management options for storing potatoes for the frozen-processing industry.