HAAGENSON, DARRIN M., AND KAREN L. KLOTZ, USDA-ARS, Northern Crop Science Laboratory, Fargo, ND 58105-5677. **Raffinose synthase is influenced by postharvest storage temperature and duration.**

ABSTRACT

Raffinose is a carbohydrate impurity that decreases the yield of extractable sucrose and alters sucrose crystal morphology, reducing filtration rates and slowing processing. Raffinose is a trisaccharide composed of a galactosyl residue attached to the glucose moiety of sucrose via an α-(1-6) glycosidic linkage. Raffinose formation is catalyzed by raffinose synthase, an enzyme that transfers a galactosyl unit from galactinol to sucrose. Raffinose is typically present at 0.3 to 0.5% of the total sucrose content, but concentrations may increase with prolonged periods of cold (<4°C) during sugar beet growth and storage. The physiological basis for raffinose accumulation is not understood. Therefore, research was conducted to gain a physiological understanding of the environmental and biochemical factors that control sugarbeet raffinose accumulation.

Field-grown beets from a Fargo, ND, location were sampled at three harvest dates (September 8th, September 23rd, and October 29th, 2003), and beets were stored for 2, 10, and 18 wk at 2 or 6°C. Root tissues were analyzed for raffinose content, raffinose synthase and galactinol synthase gene expression, and raffinose synthase enzyme activity. Raffinose concentrations and raffinose synthase enyzme activities increased during storage and were three-fold higher in beets stored at 2°C when compared to beets stored at 6°C. Harvest date did not influence raffinose concentrations or raffinose synthase enzyme activity in storage. Galactinol synthase gene expression was highest from beets harvested October 29th, but harvest date did not influence raffinose biosynthetic gene expression during storage. The increased galactinol synthase expression in late October may be associated with decreased temperature in October when compared with beets sampled in early and mid-September. Raffinose synthase and galactinol synthase gene expression were highest in roots stored for 2 wk at 2°C and gene expression decreased markedly at 10 and 18 wk of storage. Raffinose synthase enzyme activity increased after 2 wk of storage, but unlike mRNA levels, enzyme activity remained elevated at 10 and 18 wk of storage. Differences between transcript abundance and enzyme activity in storage suggest that protein stability or posttranscriptional regulation may have an important role in regulating raffinose accumulation.