MODELING HEAT EXCHANGE IN SUGARBEET PILES IN MICHIGAN

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Harvested sugarbeet (Beta Vulgaris L.) roots are stored out-of-doors in Michigan in large piles and exposed to weather during the winter storage period, which generally lasts three to four months. During this time, the air temperature may range from as low as -10 °F to as high as 60 °F. The temperature of the pile will affect the storability of the roots. Given the variability in air temperature and the long-term trends of increasing global temperatures, it is important to gain a good understanding of the factors that affect pile temperatures. We wanted to be able to predict pile temperatures based on the history of air temperature, pile age, and pile architecture. We therefore embedded thermocouple sensors in transects across the beet pile through winter storage of 2011-2012 and monitored air, beet and soil temperatures. From these data, we developed a contour map of the cross-section of the beet pile and used these profiles to depict changes in the specific heat of the pile and thereby heat transmission. We found that the temperature of the pile generates a temperature gradient that commonly reaches 20 °F throughout the holding period, with the warmest point in the center of the pile near the earth. We found the pile temperature to vary rapidly on a daily basis with changing air temperature. These data, in conjunction with data previously collected describing respiratory heat production, will be used to develop a model for predicting pile temperature and root storability.