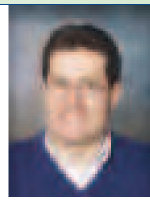
Research Spotlight



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Improving Sugarbeet Storability

Storing sugarbeets, in piles, under ambient conditions, in production areas with mild climates, allows for longer and more productive factory campaigns. In southern Idaho, approximately one-third of the roots are directly processed, one-third are held in short-term storage, and one-third are held in long-term storage (greater than 90 days). Some beets in long-term storage will be held up to 150 days, leaving roots susceptible to a number of negative influences. Extreme temperature fluctuations, excessive moisture, restricted air flow (snow, soil, weeds, and rotted roots), microbial development, respiration rate, and buildup of impurities can all negatively impact sucrose recovery. In addition to disease and water-related problems in the field, wounding during harvest and transport will also negatively influence beet storability; therefore, saving sucrose in storage begins with cultivar selection for disease resistance and storability along with good field and harvest management.

Controlling sucrose loss in storage has been an industry goal since the 1950s. Since that time, sugarbeet roots have been documented to lose between 0.2 and 0.5 lbs of sucrose per ton of sugarbeets per day. Based on historical data, sugar companies could expect to have 8 to 17 percent sucrose reduction in 100 days with healthy roots under good storage conditions; however, cultivar selection for storability, although tried by a number of groups over the decades, has proven to be a challenge. In order to establish a cultivar selection program for storability in Idaho, both outdoor and indoor approaches, were investigated.

Our first approach (details in Plant Disease 92:581-587) studied selection under ambient conditions in an outdoor sugarbeet pile. In mesh onion bags, eight beet samples were placed in a metal corrugated pipe (not part of ventilation system, but the pipe had holes) on top of plywood at least 20 feet from the edge of the pile (Figure 1). The pipe was sealed off using hay bales. This approach allowed for easy access to the bottom and middle of the pile, facilitated sampling over time, and samples were not subject to loss during reloading. By placing the bags near the bottom and center of the pile, conditions were assumed to be more stable. To improve our calculation for sucrose reduction, samples taken at harvest were only compared with storage samples originating from the same field plot. The percent sucrose was determined with a polarimeter at harvest, but sucrose in storage samples was determined via gas chromatography (GC) analysis. GC was utilized for stored samples, because polarimeter readings may be influenced by the buildup of impurities.

Our second approach (details in Plant Disease 93:632-638) involved placing beet samples on top of an indoor pile (Figure 2). Conditions on top of the indoor pile were more stable and fungal growth on roots could be observed without disturbing the bags. Based on observations, there was more fungal development and regrowth with roots on the surface of the indoor pile than in the pile, so storage on the surface was assumed to be more challenging and might provide for better cultivar separation.

Results from our outdoor studies indicated that differences in storability exist between healthy roots from different cultivars. Roots from six cultivars produced in a disease-free commercial field in 2005 and 2006 had sucrose losses ranging from 14 to 31 percent after storage for 144 and 142 days, respectively. This data was consistent with historical losses in storage research by others; however, statistically separating the best cultivars from the worst on a consistent basis was problematic. Roots from the same six cultivars produced in a Rhizomania, Beet necrotic yellow vein virus (BNYVV), infested field, in 2005, had sucrose reduction ranging from 41 to 94 percent and cultivar separation was significant ($P < 0.0001$). In 2006, with BNYVV infested roots under more favorable storage conditions, sucrose reduction only ranged from 13 to 32 percent, but cultivar separation was significant ($P = 0.0133$).

Roots in 2006, from the same infested plots, were also included as check cultivars in indoor storage tests, where sucrose reduction ranged from 24 to 60 percent and cultivar separation was significant ($P < 0.0001$). Roots from 26 additional commercial cultivars were also included with the 2006 check cultivars in the indoor tests. Sucrose reduction for these 26 cultivars ranged from 13 to 90 percent and significant ($P < 0.0001$) differences between cultivars were evident. In 2007, similar differences were observed, with significant differences

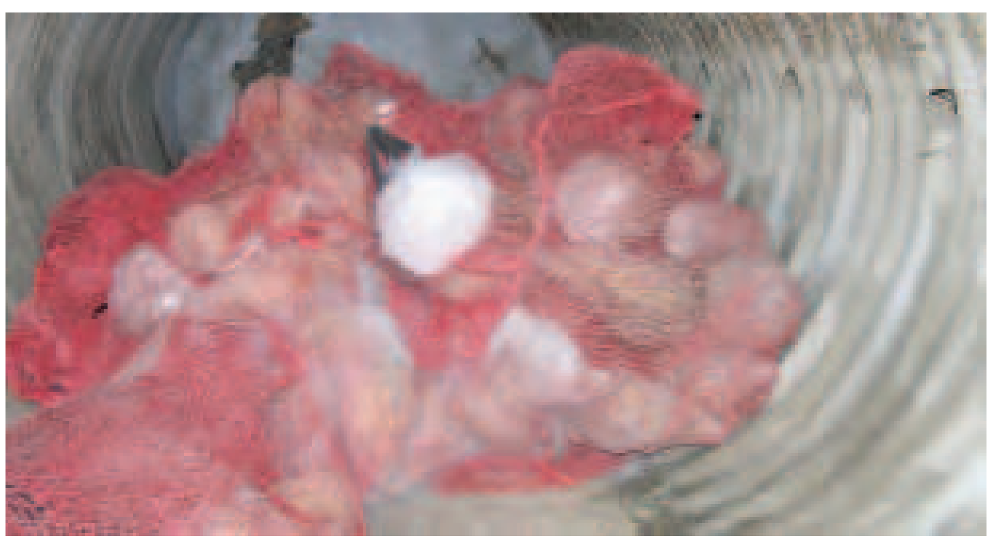

Figure 1. *Sugarbeet cultivars being compared for storability inside pipe placed in an outdoor commercial sugarbeet pile.*

(P = 0.0004) evident within both the check and commercial cultivars when BNYVV-infested roots were utilized. When comparing the same 20 commercial cultivars assayed in 2006 and 2007, the rank correlation was similar (r = 0.55, P = 0.01) indicating cultivar performance did not vary between years. In addition to sucrose loss, BNYVV also had a significant negative impact on storage root surface rot, weight loss, and susceptibility to freeze damage. The increased susceptibility to freeze damage could potentially make pile management more challenging, because roots must be processed in seven to ten days if they thaw. To help alleviate sucrose losses in storage, roots originating from highly diseased fields might be considered for early processing and not storage.

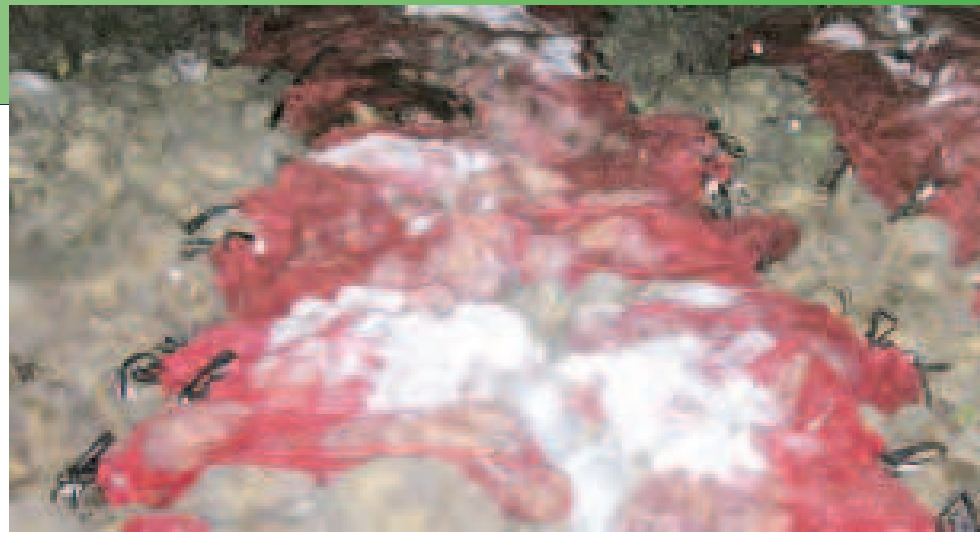

Figure 2. *Sugarbeet cultivars being compared on top of an indoor commercial sugarbeet pile.*

Work outdoors under ambient conditions was necessary to establish real-world losses; however, cultivar selection was better with the indoor assay using roots produced in BNYVV infested commercial fields. Since most fields in Idaho have some level of BNYVV infestation, all Idaho commercial cultivars are required to have some BNYVV resistance; all possess at least the Rz1 gene for resistance. With the indoor storage approach and BNYVV infested roots, cultivars that retained the most sucrose also had resistance to BYNVV and the least fungal growth and weight loss. By combining cultivar selection for storage and disease resistance with good field and harvest management, grower-owned cooperatives should be able to increase profitability.