REDUCING SUCROSE LOSS IN SUGAR BEET STORAGE WITH FUNGICIDES

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Sugar beet roots are typically stored for long periods of time in outdoor piles or storage buildings, since factories do not have the capacity to direct process the whole crop at harvest time. In Idaho, typically about two thirds of the crop has to be stored for an average of 60-70 days, but some roots are in storage for up to 160 days. Storing sugar beet roots for lengthy periods of time under ambient conditions can be a challenge because of adverse weather conditions and microbial growth. In Idaho, the average annual cost of beet storage losses over the past several years (2010 to 2012) is $6.40 per ton of roots harvested. Thus, tens of millions of dollars can be lost to storage problems annually.

To alleviate losses to rot in storage, host resistance and selection of cultivars with resistance to storage rots can be identified. However, given the large losses currently suffered in storage, host resistance and cultivar selection alone are not enough to deal with storage problems at this time. Currently, physical methods such as tarping, ventilation, and pile stripping (removes the outer three feet of the pile surface) are utilized to reduce storage losses. Although these physical methods reduce sucrose losses, additional control measures for storage such as chemical treatments have also been investigated. In an effort to reduce fungal growth in piles, the fungicide thiabenzadole (marketed as Mertect or TBZ) has been labeled for use on sugar beet roots. However, the use of this fungicide to control fungal rots in sugar beet storage piles was not adopted in Idaho since it led to problems in factory processing. Therefore the efficacy of alternative fungicides should be investigated for use in sugar beet storage. Thus, the efficacy of two recently developed fungicides, Propulse (1.5 fl oz product/ton roots) and Stadium (4 fl oz/ton), with the potential for broad spectrum fungal control were evaluated versus Mertect (2 fl oz/ton) and a non-treated water check. The treatments were applied as direct sprays to the roots just prior to storage in a final volume of 2 gal/ton. The roots were harvested five times at weekly intervals from late September to mid-October from fields with trace and high levels of Beet necrotic yellow vein virus (BNYVV), the causal agent of rhizomania, to establish if the treatments can still control rot root and sucrose loss in roots compromised by this virus. The storage experiment was conducted in the commercial indoor storage building in Paul, ID through mid-February with 2012 roots and repeated again in 2013 using a randomized complete block design with six replications.

Differences and trends were evident when sugar beet roots held in storage up to 148 days were harvested over a 5-week period from BNYVV infested fields and treated with 1 of 3 fungicides. Roots for the non-treated checks harvested for week 1 when compared with week 5 ranked worse for fungal growth on the root surface (11-51% for week 1 versus 1-5% for week 5), root surface discolored (10-12% versus 4%), and sucrose loss (25-35% versus 18-19%). Similar trends were evident with BNYVV, since roots harvested week 1 ranked higher for fungal growth on the root surface (4-40% week 1 versus 1-2% week 5), root surface discolored (4-13% versus 1-2%), and sucrose loss (20-39% versus 15-19%). Thus, placing roots in storage as late as possible in October should help with reducing storage issues. When comparing fields, the high BNYVV roots ranked worse for fungal growth on the root surface in 14 of 20 comparisons and for sucrose loss in 8 of 10 comparisons. In fungicide comparisons, both Propulse and Stadium reduced fungal growth versus the check by an average of 84-100% with roots collected during the first 3 weeks both years. Both Propulse and Stadium reduced root surface discoloration versus the check by an average of 75-100% with roots collected across 5 weeks both years, except for Stadium in week 1 with 2012 roots. When compared to Mertect, both Propulse and Stadium reduced surface discoloration by 50-100% and fungal growth 46-67% when differences were observed. When compared to the check and Mertect, both Propulse and Stadium reduced sucrose loss by 14-46% when differences were observed (Fig. 1 and 2). Propulse was not different from Stadium in all but one week based on sucrose loss, but there was a trend for Propulse to rank better than Stadium in 8 out of 10 comparisons. At times, the performance of Mertect was not different from the check when controlling Athelia-like sp., Botritis cinerea, and Penicillium spp. Since both Propulse and Stadium provided excellent control in the present study, these fungicides should be given further consideration for controlling sugar beet storage rots. In addition to storing roots for sucrose production, sugar beet roots are routinely stored by seed companies and breeders in cold storage so they can be used for seed production the next year. The same storage fungi evaluated in the commercial storages also negatively impact roots held in storage for seed production. A preliminary evaluation of Propulse on roots stored for seed production at the USDA-ARS NWISRL research facility in Kimberly, ID suggests the product should work well for this purpose as well. Thus, these fungicides should be labelled for controlling fungal rot in sugar beet storage and used in commercial storage and on roots held for seed production.

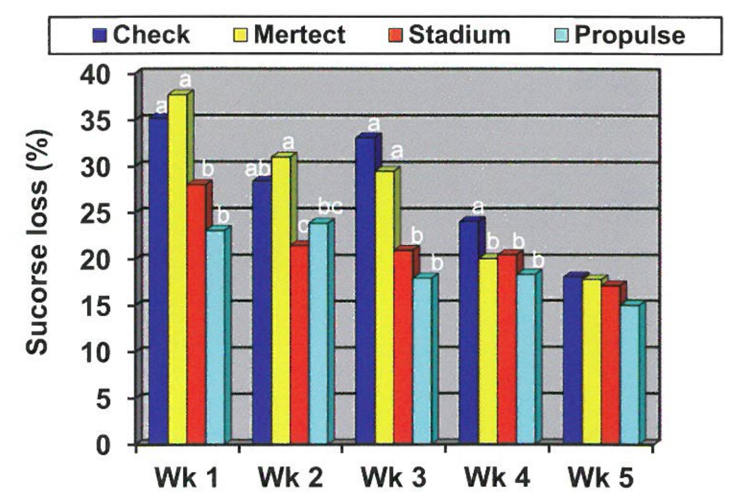

Figure 1. Percent sucrose loss in sugar beet roots of the commercial cultivar B-5 harvested on weekly intervals over a five week period (late Sept. to mid-Oct.) and subjected to one of four treatments (untreated check and three fungicides) in 2012. Treatments in weeks 1 thru 4 were significantly different (P <0.0001 to 0.0128), while those in week 5 were not different (P = 0.4519). Treatment means within a week with different letters are significantly different (P = 0.05).

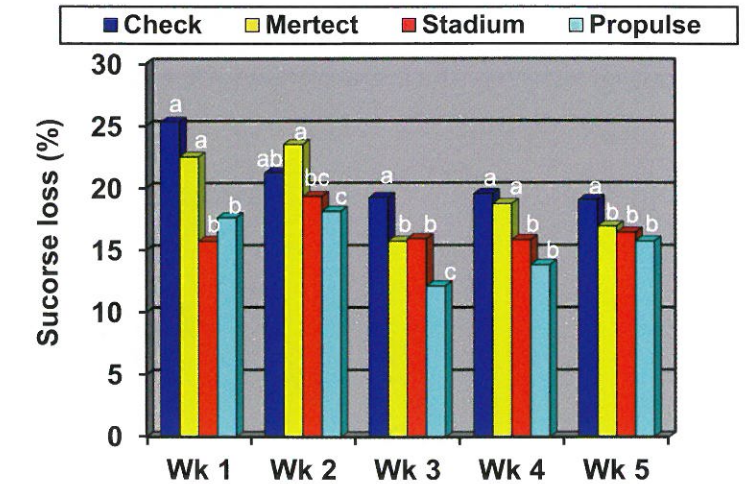

Figure 2. Percent sucrose loss in sugar beet roots of the commercial cultivar B-5 harvested on weekly intervals over a five week period (late Sept. to mid-Oct.) and subjected to one of four treatments (untreated check and three fungicides) in 2013. Treatments were significantly different (P <0.0001 to 0.0146) for all weeks. Treatment means within a week with different letters are significantly different (P = 0.05).