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Influence of harvest timing, fungicides, and BNYVV on sugar beet storage.

ABSTRACT

Root rots in sugar beet storage can lead to multi-million dollar losses because of reduced sucrose recovery. Thus, studies were conducted to establish better chemical control options and a better understanding of the fungi involved in storage rot. The commercial sugar beet cultivar B-5 which is partially resistant to BNYVV and intermediate for storability was planted and managed using standard cultural practices for Idaho. B-5 was planted in fields with a high and low incidence of rhizomania to provide a source of roots for this study. On 19 September 2012, root samples (n = 8 roots/sample) were randomly hand dug and topped from each field, and placed in polyethylene mesh onion bags. The experiment was arranged in an indoor commercial storage building in Paul, ID (temperature set point of 1.1°C) as a randomized complete block with six replications. The two field treatments (high vs. low incidences of rhizomania) and four spray treatments (water vs. one of three fungicides) formed a 2-by-4 factorial treatment design for a total of 48 eight-beet samples collected each week of harvest. An additional two eight-root samples from each field were analyzed at the Amalgamated Sugar Company tare laboratory (Paul, ID) to establish baseline harvest yield data for percent sucrose, conductivity, and nitrates. Prior to placing the roots in storage, the fungicides applied included Mertect 340F (42.3% thiabendazole [v/v]; Syngenta Crop Protection, LLC) at 0.065 ml product/kg roots, Propulse (17.4% fluopyram and 17.4% prothioconazole [v/v]; Bayer CropScience) at 0.049 ml product/kg roots, and Stadium (12.51% azoxystrobin, 12.51% fludioxonil, and 9.76% difenoconozole [v/v]; Syngenta Crop Protection, LLC) at 0.13 ml product/kg roots. The fungicides were diluted in well water and applied in a volume of 8.34 ml/kg roots using a CO_2-pressurized backpack sprayer equipped with a wand and a band nozzle (Model 8004EVS; TeeJet Technologies, Wheaton, IL) at a pressure of 2.8 kg/cm^2. Additional roots were harvested and treated at weekly intervals, with the second, third, fourth, and fifth harvest times initiated on 26 September, and 3, 10, and 17 October, respectively. Fungal growth on the surface of each root was evaluated visually on 15 January 2013 and again on 7 February 2013 to establish the percentage of root area covered by fungal growth. On 8 February, five samples from each aerial mycelium type were collected from roots across all treatment combinations to identify the fungi growing on the surface of the roots. The samples remained in storage until 13 February (148 days for Week 1 samples). Just prior to processing the roots on 13 February for brei samples, the roots were weighed, a surface root rot evaluation was conducted, and five root samples with rot for each of the four spray treatments were collected (20 root samples regardless of the field) for fungal isolation from internal root tissue under each lesion. The storage temperature was recorded at 1-h intervals using Hobo sensors located in the root storage pile. The study with a series of five sample timings after harvest conducted in 2012 was repeated in 2013.

Differences in root surface area with fungal growth, root weight, and sucrose loss were evident when sugar beet roots were held in storage up to 148 days after the roots had been harvested over a five-week period from BNYVV infested fields in Idaho at low or high incidences of rhizomania and treated with one of three fungicides (Mertect, Propulse, or

Stadium). Non-treated roots harvested the first week had more fungal growth on the root surface compared with roots harvested in Week 5 (11 to 51% surface area with fungal growth for Week 1 vs. 1 to 5% for Week 5), more root surface discoloration (10 to 12% for Week 1 vs. 4% for Week 5), and greater sucrose loss (25 to 35% for Week 1 vs. 18 to 19% for Week 5). Similar differences were evident regardless of the incidence of rhizomania in the fields from which the roots were harvested, since roots harvested at Week 1 had more fungal growth on the root surface than roots harvested at Week 5 (4 to 40% for Week 1 vs. 1 to 2% for Week 5), more root surface discoloration (4 to 13% for Week 1 vs. 1 to 2% for Week 5), and greater sucrose loss (20 to 39% for Week 1 vs. 15 to 19% for Week 5). Thus, placing roots in storage later in October in Idaho should reduce storage problems (rot, sucrose reduction, and weight loss) compared with roots harvested in late September or early October.

The application of either Propulse or Stadium reduced fungal growth on the root surface compared to the control roots by an average of 84 to 100% for roots collected from the field during the first three weeks (late September to early October) both years. Both Propulse and Stadium treatments also reduced root surface discoloration compared to the control roots by an average of 75 to 100% for roots collected across the five weeks in both years, except for 2012 roots treated with Stadium in Week 1. Compared to the Mertect treatment, both Propulse and Stadium treatments reduced root surface discoloration by 50 to 100% and fungal growth 46 to 67% when significant differences (6 of 10 and 8 of 20 evaluations, respectively) were observed. Compared to Mertect-treated roots, both Propulse and Stadium treatments reduced sucrose loss by 16 to 39% the six times out of ten when differences in sucrose loss were observed. Propulse did not differ from Stadium in terms of reducing sucrose loss except for 2013 roots in Week 3. However, Propulse did rank better than Stadium for reducing sucrose loss in 8 out of 10 evalutions. The roots treated with Mertect typically did not differ from the control roots in terms of fungal growth on the root surface (10 of 20 evaluations) and sucrose loss (6 of 10 evaluations). The predominant fungi isolated from symptomatic roots were an *Athelia*-like sp., *Botrytis cinerea*, *Penicillium* spp., and *Phoma betae*. If Propulse and Stadium are labelled for use on sugar beet in storage, these fungicides should be considered for root rot control in commercial sugar beet storage and on roots held for vernalization for seed production.