

Storage Requirements for Rainier Russet Potatoes

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Introduction:

Rainier Russet is a multi-purpose, medium- to late maturity potato variety released in 2020 from the Northwest Potato Variety Development Program. It produces attractive and blocky tubers with a heavy russeted skin and creamy white flesh. Total yields are slightly less than Russet Burbank and Ranger Russet, however marketable yields are greater with a higher percentage of tubers >284 g. Rainier Russet tubers have high specific gravities, similar to Ranger Russet. Rainier Russet has shown less susceptibility to sugar ends, environmental stresses, and several problematic potato diseases including common scab, foliar early blight, and dry rot.

Methods:

Rainier Russet and Russet Burbank potatoes were field grown at the University of Idaho Kimberly Research and Extension Center in 2020, 2021, and 2022. Following harvest, potatoes cured at 55°F and 95% relative humidity for approximately two weeks. The temperature was then decreased at a rate of 0.5°F per day to holding temperatures of 42°F, 45°F, and 48°F. The potatoes were subsequently stored for 9 months at these temperatures.

Sugar & Reflectance

Glucose, sucrose, and fry color data were collected monthly in from three replications of 10 tubers per variety and storage temperature. Fry color was determined using 10 fry planks (1.2-inch x 0.3 inch) after cooking in canola oil at 375°F for 3.5 minutes. Percent reflectance was collected using a Photovolt Reflection meter on the stem and bud ends of each plank. The planks were also scored subjectively for mottling and sugar ends. Mottling was subjectively scored on a scale of 1 to 4 where 1 = no mottling, 2 = mild, 3 = moderate, and 4 = severe mottling.

Reflectance readings are presented together with corresponding USDA fry color data. The USDA colors correspond to the reflectance ranges:

- USDA 1 >44% reflectance
- USDA 2 = 35 to 44% reflectance
- USDA 3 = 26 to 34.9% reflectance
- USDA 4 <25.9% reflectance

Higher reflectance readings indicate a lighter fry color. Fry colors below a USDA 2 are typically unacceptable by the frozen processing industry.

Fusarium dry rot

Potatoes were bruised and then inoculated with *Fusarium sambucinum* (50/50 mixture of thiabendazole sensitive to resistant). Following inoculation, potatoes were cured at 55°F and 95% relative humidity for 2 weeks and then stored at 45°F. After approximately 3 months in storage, tubers were evaluated for the percentage of dry rot decay and the incidence of the disease, expressed as the percentage of tubers evaluated having more than 5% decay.

Weight Loss

Samples, averaging 10 pounds per sample were weighed monthly and the results averaged over three storage seasons (2020, 2021, 2022).

Bruise

Tubers were impacted soon after harvest by dropping a 100 g steel weight from 7 inch (2020, 2021 and 2022), or 12-inch height (2021 and 2022) to deliver a uniform impact on both the bud and stem ends of a stationary tuber. Pulp temperatures of tubers were 55°F at the time of impact and held for 24 hours at 70°F until impacted areas were peeled and evaluated for blackspot bruise severity, bruise depth, incidence of blackspot bruise, and incidence of shatter bruise. Blackspot bruise severity was rated on the darkest color observed on a scale from 1 to 4: 1=no color, 2=light gray color, not severe but discoloration occurred, 3=dark gray color, severity is moderate, dark but not extreme, 4=dark gray/black color, severity is extreme. Blackspot bruise depth was evaluated by recording the number of slices (1.27 mm per slice) removed by the peeler until no bruise was present.

Dormancy

Dormancy length was defined as the number of days after harvest (DAH) until sprout elongation (at least 0.2 inches) occurred in 80% of tubers in the sample. Ten non-treated potatoes (replicated three times) were assessed each month at two storage temperatures (45°F and 48°F) for sprout growth

Results:

Glucose & Sucrose

Sucrose concentrations for Rainier Russet followed a similar pattern to Russet Burbank throughout the storage season with Rainier having higher concentrations of sucrose at each sampling (Fig. 1a).

- At 48°F storage temperature, glucose concentrations for Rainier Russet remained below 0.050% FW over the course of 270 days in storage and across three years of trials. Russet Burbank had an average glucose concentration of 0.06% FW across three years of trials (Figure 1b).
- During the nine-month storage season across three years of testing, glucose concentrations for Rainier Russet tubers stored at 45°F, averaged 0.1% FW with a peak of 0.16% FW after 210 days in storage. This concentration was similar to Russet Burbank, which had an average of 0.07% FW and a peak of 0.1% FW after approximately 119 days in storage.
- At 42°F, glucose concentrations for Rainier Russet and Russet Burbank averaged 0.12% and 0.13% FW, respectively.

Potato varieties that maintain glucose concentrations below 0.1% FW at colder storage temperatures are considered cold-sweetening resistant and can be stored at cooler temperatures without increased risk of darkening of the finished product that can occur with varieties non- cold sweetening resistant. Based on the data, Rainier Russet would not be considered cold-sweetening resistant.

Fry color

- Storage at 48°F – Rainier Russet maintained light color throughout the storage season at this temperature. The mean fry color was above the USDA 1 cutoff and lighter than the 3-year mean of Russet Burbank, which maintained a USDA 2 except for the second sampling date (Figure 1d).
- Storage at 45°F – Rainier Russet maintained USDA 1 fries during the storage season except at 152 DAH. Russet Burbank fry colors were consistently USDA 2 and USDA 3 for the entire storage season.
- Storage at 42°F – Rainier Russet began the season with light colored fries but fell to a USDA 2 by 84 DAH and USDA 3 by 152 DAH. Russet Burbank followed a similar trend, although fry color dropped to USDA 3 by 27 DAH.

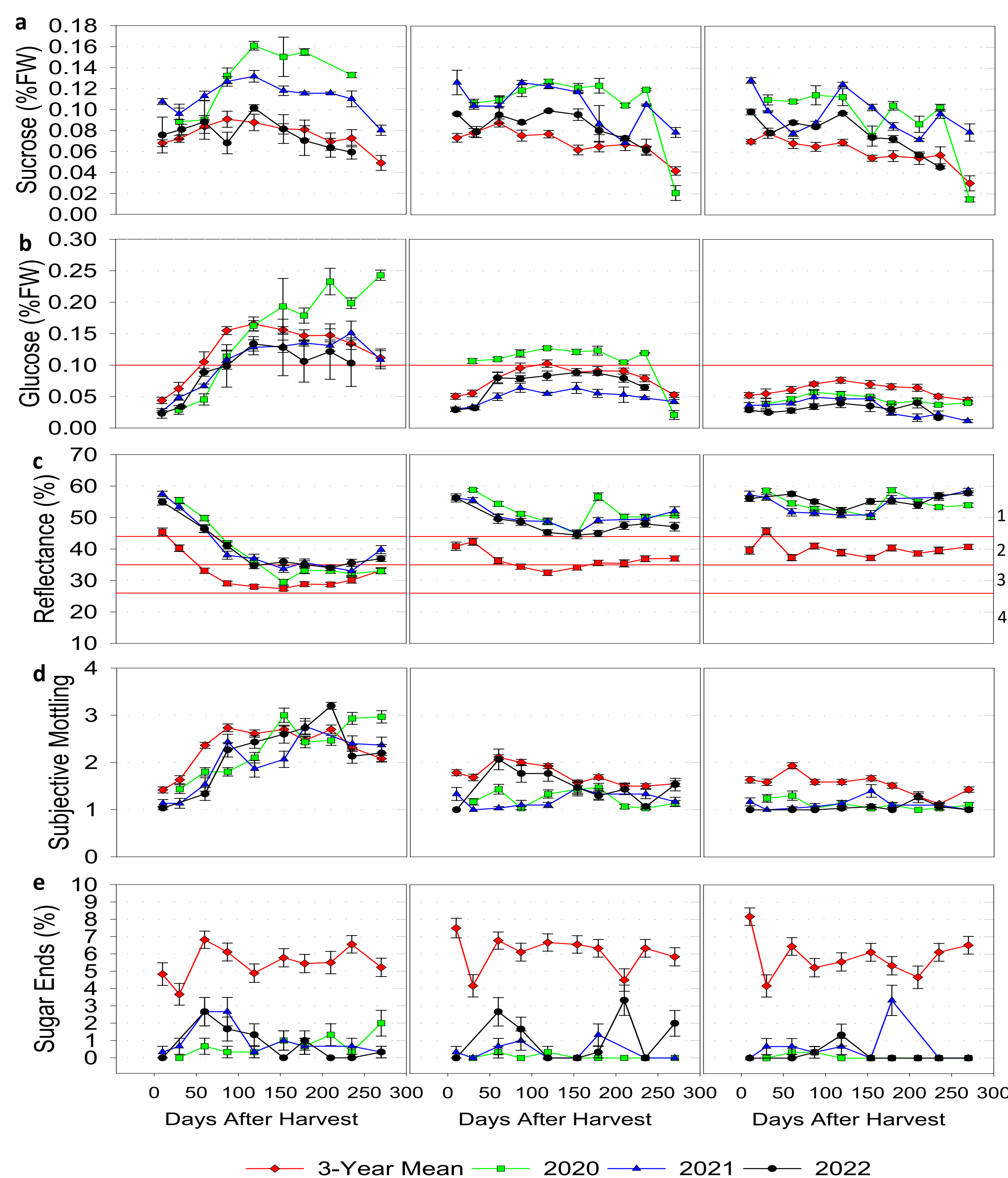
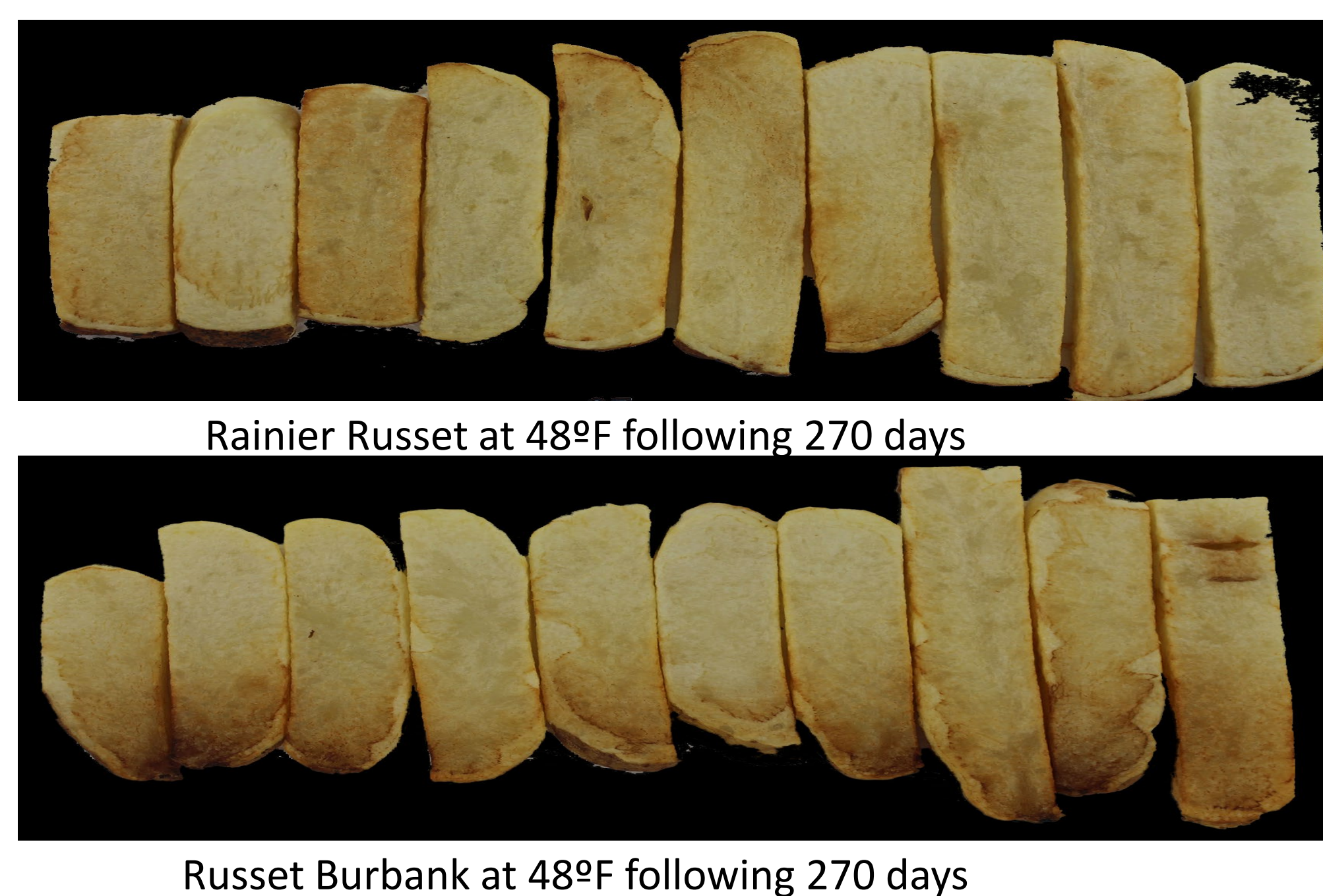


Figure 1. Mean tuber sucrose (a) and glucose concentrations (% FW) (b). The red reference line indicates 0.1% glucose. Varieties that maintain glucose concentrations below this level at temperatures below 45°F are generally considered to be cold sweetening resistant. Photovolt reflectance values averaged across 2020, 2021, and 2022 for Russet Burbank, and each year for Rainier Russet (c). Visual mottling score (d). Percent incidence of sugar ends (e). Error bars represent mean standard error.



Russet Burbank at 48°F following 270 days

Fusarium Dry Rot

Results averaged over 3 years indicate that Rainier Russet was less susceptible than Russet Burbank to Fusarium dry rot (Table 1). The percentage of tuber decay due to dry rot in Rainier Russet was 13% with a 42% incidence (potatoes with > 5% decay), compared to 36% decay and 71% incidence for Russet Burbank.

Table 1. Percent decay (severity) and incidence of potatoes with greater than 5% decay of Fusarium dry rot in bruised and inoculated Rainier Russet and Russet Burbank potatoes. Values are means of three storage seasons (2020, 2021, 2022). Values followed by the same letter were not significantly different ($\alpha < 0.05$) within a column.

Cultivar	% Decay	% Incidence (potatoes with >5% decay)
Rainier Russet	13 a	42 a
Russet Burbank	36 b	71 b

Weight Loss

Rainier Russet had similar weight loss compared to Russet Burbank at 42 and 45°F, however Russet Burbank did lose significantly less weight at 48°F (Table 2).

Table 2. Percent weight loss of Rainier Russet and Russet Burbank tubers after 270 days in storage averaged across three years (2020, 2021, 2022).

Variety	42°F	45°F	48°F
Rainier Russet	8.7 a ¹	8.3 a	9.2 a
Russet Burbank	6.0 a	7.5 a	7.2 b

Bruise susceptibility

Rainier Russet showed a higher incidence of blackspot bruise than Russet Burbank. The severity and depth of the blackspot bruise was also higher in Rainier Russet than Russet Burbank. While not significant, the incidence of shatter bruise in Rainier Russet tended to be slightly less (Table 3).

Table 3. Effects of drop height on blackspot bruise incidence, severity, depth, and shatter bruise incidence for tubers impacted at 7-inch drop height (2020, 2021, and 2022) and 12-inch drop height (2021 and 2022) of Rainier Russet and Russet Burbank. Values followed by the same letter were not significantly different ($\alpha < 0.05$) for each drop height within a column.

Cultivar	Blackspot bruise incidence (%)	Blackspot bruise severity rating (1-4) ¹	Blackspot bruise depth (mm)	Shatter bruise incidence (%)
7-inch drop height				
Rainier Russet	73 b	2.3 b	3.8 b	4 a
Russet Burbank	46 a	1.7 a	2.2 a	5 a
12-inch drop height				
Rainier Russet	91 a	2.8 b	5.2 b	23 a
Russet Burbank	67 a	1.9 a	3.2 a	25 a

¹Blackspot bruise severity was rated on the darkest color observed on a scale from 1 to 4: 1=no color, 2=light gray color, not severe but discoloration occurred, 3=dark gray color, severity is moderate, dark but not extreme, 4=dark gray/black color, severity is extreme

Dormancy

Without sprout inhibitors, dormancy length for Rainier Russet is 30 to 40 days longer than Russet Burbank, depending on storage temperature (Table 4). The relatively longer dormancy length of Rainier Russet may require less sprout inhibitors be applied or a change in timing from normal.

Table 4. Mean dormancy length in days after harvest (DAH) across three years (2020, 2021, 2022) of Rainier Russet and Russet Burbank tubers at two storage temperatures.

Variety	45°F	48°F
Russet Burbank	197 DAH	186 DAH
Rainier Russet	230 DAH	210 DAH

