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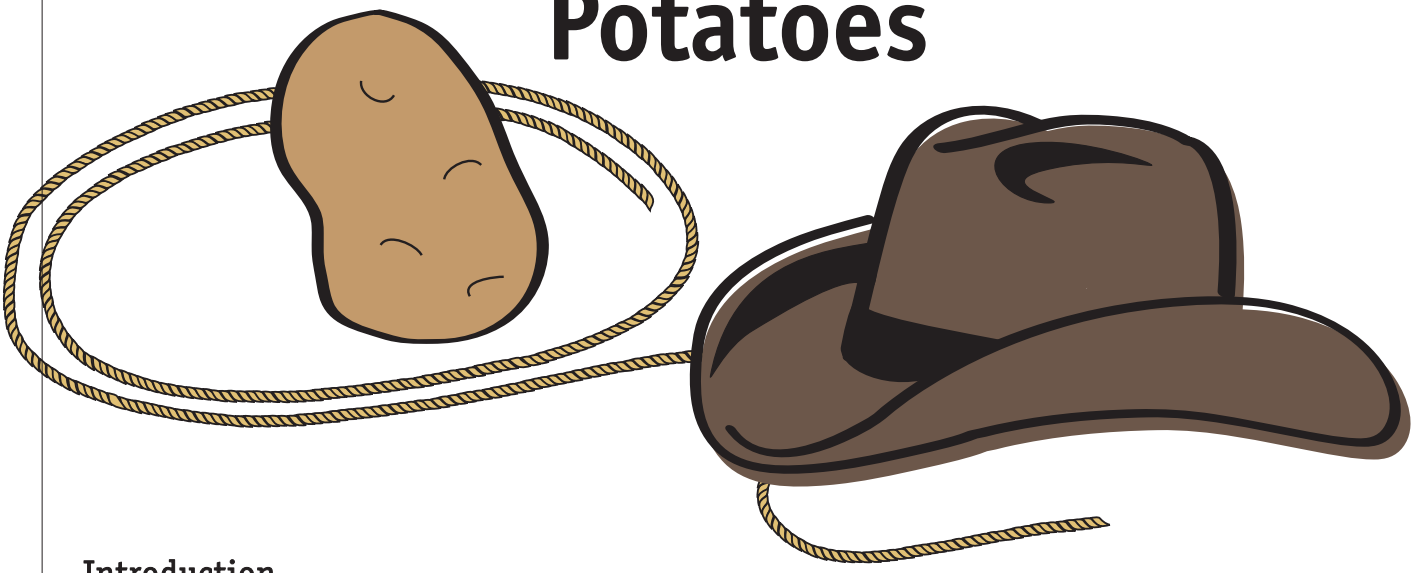
CIS 1151

Storage Management of Western Russet Potatoes



Introduction

Western Russet (A9761-1) is a multi-purpose potato variety released in 2004 by the USDA-ARS and the agricultural experiment stations of Idaho, Oregon and Washington. This variety is medium to late maturing, and produces medium to high yields of oblong tubers with medium russet skin and moderate specific gravity. It is resistant to sugar ends, tuber malformations and most external and internal defects. It is resistant to common scab and is moderately resistant to PVY^{O}, Verticillium wilt, foliar early blight, tuber late blight, and PLRV-caused tuber net necrosis. Western Russet is susceptible to soft rot, foliar infection by late blight and PLRV, and is significantly more susceptible to tuber early blight relative to Russet Burbank. Previous tests have shown Western Russet to possess 63% higher vitamin C content compared to Russet Burbank.

The storage characteristics of Western Russet potatoes were studied for two years (2004-05 and 2005-06) at the University of Idaho Kimberly Research and Extension Center Potato Storage Research Facility in a project funded by the Idaho Potato Commission. Results of those studies are detailed in this publication along with storage management recommendations.

Western Russet potatoes were produced at Kimberly, ID, from G2 seed in the years 2004 and 2005. After harvest, the potatoes were placed in storage and allowed to cure at 55°F and 95% relative humidity for 14 days. The temperature was then decreased at a rate of 0.5°F per day to holding temperatures of 42°, 45°, and 48°F. Potatoes used for data collection on dormancy length were not treated with a sprout inhibitor. Samples used for sugar, fry color, mottling, and disease analysis were treated with a thermal aerosol application of chlorpropham (CIPC) at 22 ppm at approximately 60 days after harvest. Percentage weight loss was determined on subsamples comprising three replications of approximately 10 pounds each contained in mesh bags, which were weighed monthly throughout the storage season.

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Dormancy

Dormancy length of Western Russet tubers, with no application of sprout inhibitors, is shorter than in Russet Burbank (table 1). Dormancy break is defined as the point at which sprout elongation (at least 0.2 inches long) is beginning to occur in 80% of the tubers in the sample. This definition is used because the length of time between initial sprout development (peeping) and sprout elongation varies greatly among potato varieties.

At 42°F, Western Russet breaks dormancy at approximately 130 days after harvest (DAH), compared to 175 DAH in Russet Burbank. At 45°F, Western Russet has a dormancy length of 100 days compared to 155 days for Russet Burbank. At 48°F, Western Russet has a dormancy length of 80 days, while Russet Burbank has 130 days of dormancy. Since dormancy of Western Russet is relatively short, ensure that proper sprout inhibitors are applied as soon as possible after wound healing if the intended storage duration is longer than the indicated dormancy length.

Glucose and Sucrose Development

Potatoes can develop a higher glucose content during storage. High concentrations of glucose result in dark colored fried potatoes. This dark coloration is generally unacceptable. Glucose concentrations of less than 0.10% (fresh weight) are considered acceptable for frozen potato products. Although sucrose itself does not cause fry color problems, it is a potential precursor for the formation of glucose and is thus monitored in storage.

Glucose concentrations for Western Russet and Russet Burbank stored at three temperatures during two storage seasons are shown in figure 1.

Glucose concentrations in Western Russet were similar to Russet Burbank and followed a similar pattern over time for the three storage temperature regimes. Glucose concentrations were lowest in Western Russet at 48°F storage, ranging from a low of 0.01% fresh weight (fw) at harvest (2004) to a high of 0.06% fw at 106 DAH in 2005-06. Following nine months of storage at 45°F in both years, glucose concentrations in Western Russet stayed below 0.10% fw. At 42°F, glucose concentrations exceeded 0.10% fw by 70 DAH, reached a peak and then decreased over time in storage, and depending on the year, may fall below the 0.10% concentration by about 220 DAH.

Sucrose concentrations in Western Russet ranged from 0.15% to 0.19% fw compared to 0.11% fw in Russet Burbank at harvest (figure 2). In general, the change in percent sucrose concentrations over time in Western Russet is similar to that of Russet Burbank, decreasing steadily over the storage season. A peak in sucrose concentrations (about 0.22%) was observed in both Western Russet and Russet Burbank potatoes stored at 42°F at 76 days after harvest in the 2004-05 storage seasons.

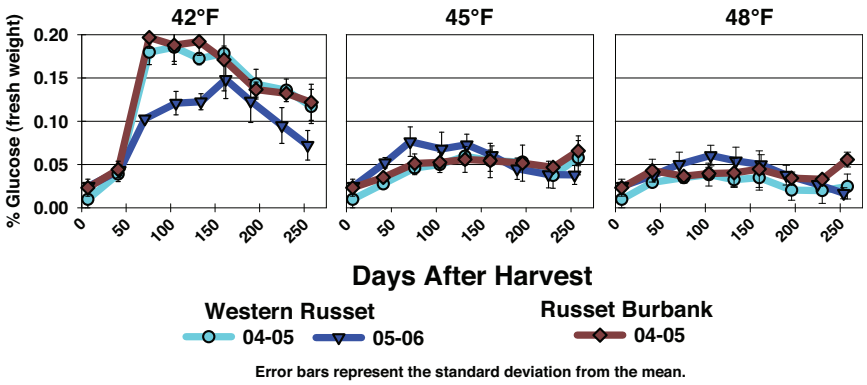
Fry Color

Glucose concentrations in potato tubers are a good indicator of fry color. However, in the processing industry, fry color is determined by testing samples of fried potato strips, disks, or planks. In this study, we performed reflectance measurements with a Photovolt Reflection Meter Model 577 (Photovolt Inc., Indianapolis, IN) on fried planks (1.2 inch x 0.3 inch) collected from the same tubers that were used for the glucose analyses. A higher reflectance value means a lighter fry color.

Table 1. Mean dormancy length (days after harvest) of Russet Burbank and Western Russet potatoes at three storage temperatures.

Variety	42ºF	45ºF	48ºF
Russet Burbank	175	155	130
Western Russet	130	100	80

Figure 1. Percent glucose in Western Russet potatoes in two storage seasons (2004-06) at three storage temperatures compared with Russet Burbank potatoes (2004-05).



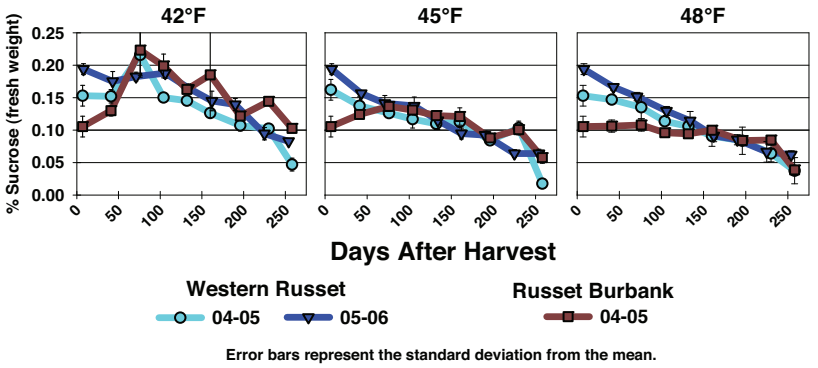
Error bars represent the standard deviation from the mean.

When variation in fry color occurs within a potato, it is generally the stem end of the potato that has the highest levels of sugar as well as the darkest color. Therefore, we performed our tests on the stem end. The fry color data are presented in figure 3. Reflectance readings are presented together with the corresponding USDA fry color data. The USDA colors correspond to reflectance ranges as follows: USDA 1 = >44, USDA 2 = 35-44, USDA 3 = 26-34.9 and USDA 4 = <25.9 percent reflectance.

Stem end fry color in Western Russet was similar to Russet Burbank in storage (figure 3). Fry color was lightest at 48°F in both Western Russet and Russet Burbank. In Western Russet, fry color at 48°F was less than or equal to USDA 1, while in Russet Burbank fry color was USDA 2 or below. At 45°F, fry color stayed below or equal to USDA 2 for both Russet Burbank and Western Russet. At 42°F, fry color became unacceptably dark (greater than or equal to USDA 3) in both cultivars by approximately 70 DAH, and remained unacceptable throughout the storage period.

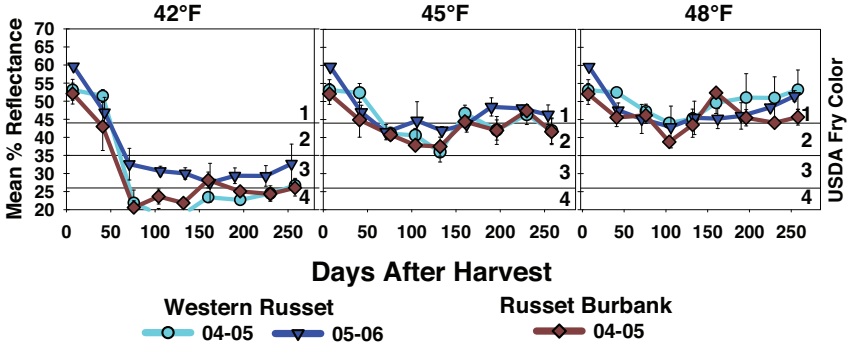
Mottling, which is defined as thin, thread-like areas of dark coloration found in the cortex of the fried potato tissue, can occur in some varieties. Each fry sample was subjectively evaluated on a scale of 1-4; where 1=none, 2=mild, 3=moderate, and 4=severe mottling (figure 4). Mottling was highest in both Western Russet and Russet Burbank at 42°F, with lower but similar levels of mottling observed in both varieties at 45° and 48°F. At 45°F, mottling ranged from mild to moderate for both varieties. Mottling was minimized at 48°F, and ranged from none to mild. Therefore, 48°F is the recommended storage temperature for minimizing tuber mottling of Western Russet.

Figure 2. Percent sucrose in Western Russet potatoes in two storage seasons (2004-06) at three storage temperatures compared with Russet Burbank potatoes (2004-05).



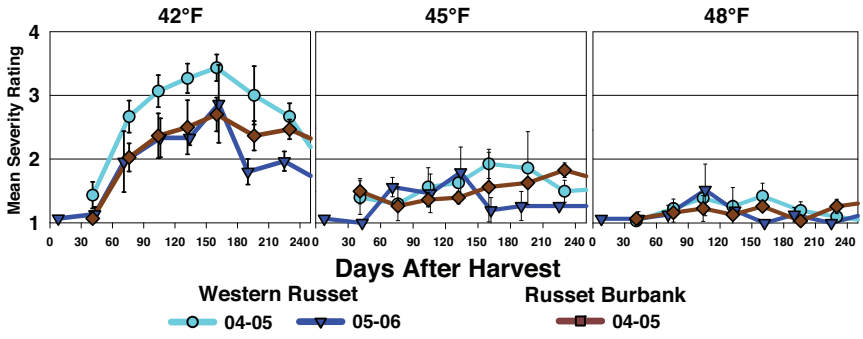
Error bars represent the standard deviation from the mean.

Figure 3. Stem end fry color in Western Russet potatoes in two storage seasons (2004-06) at three storage temperatures compared with Russet Burbank potatoes (2004-05).



Error bars represent the standard deviation from the mean.

Figure 4. Severity of mottling in fried planks of Western Russet potatoes in two storage seasons (2004-06) at three storage temperatures compared to Russet Burbank (2004-05).



rating scale: 1=none, 2=mild, 3=moderate, 4=severe
Error bars represent the standard deviation from the mean.

Table 2. Percent decay and percent incidence of potatoes with greater than 5% decay of Fusarium dry rot in bruised and inoculated lots of Russet Burbank and Western Russet potato samples. Values are means of two years (2004-05 through 2005-06).

Variety	Decay (%)	Incidence (%) (potatoes with >5% decay)
Russet Burbank	5.5	17
Western Russet	6.8	21
LSD (*P*<0.05)	ns	ns

Fusarium Dry Rot

Because Fusarium dry rot is an important storage disease in potatoes, new varieties are screened for susceptibility to this disease. *Fusarium* is a fungal pathogen that infects tubers through cuts or openings in the skin. Potatoes, therefore, were first bruised and then inoculated with *Fusarium* spp. to evaluate dry rot susceptibility. Potatoes were cured at 55°F and 95% relative humidity for two weeks, and then stored at 45°F. After approximately three months in storage, evaluations were made of the incidence and severity of dry rot decay (table 2).

Results averaged over two years indicate that percent decay due to dry rot in Western Russet was similar to that of Russet Burbank (table 2). There were no significant differences between the varieties for both percent decay and incidence. The mean decay for Russet Burbank was 5.5% while the mean for Western Russet was 6.8%. The percent incidence of tubers with at least 5% decay was 17% for Russet Burbank and 21% for Western Russet. Thus, Western Russet is classified as having moderate susceptibility to Fusarium dry rot.

Weight Loss

Percent weight loss was tracked in subsamples of Western Russet and Russet Burbank potatoes throughout one storage season (table 3). Western Russet had slightly but significantly higher weight loss in storage than Russet Burbank at 42° and 45°F.

Table 3. Mean total percent weight loss in samples of Russet Burbank and Western Russet potatoes in storage at three temperatures for nine months (Oct 2005 -Jun 2006).

Variety	42°F	45°F	48°F
Russet Burbank	5.5	4.2	5.8
Western Russet	6.5	4.6	6.5
LSD (*P*<0.05)	1.0	0.4	ns

Storage Recommendations

Recommendations are based on data collected over a two-year period at the University of Idaho Kimberly R&E Center on Western Russet potatoes grown in Southern Idaho.

Curing Conditions Cure at 55°F and 95% relative humidity for 14 days.

Storage Conditions Maintain 95% relative humidity throughout storage. Weight loss in Western Russet is slightly higher than Russet Burbank.

- **Frozen Processing** 48°F holding temperature
- **Fresh Market** 45°F holding temperature
- **Dehydration Processing** 42-45°F (depending on intended product)

Sprout Inhibition Apply before dormancy break but after curing.

- **42°F** Apply CIPC between 14 and 130 days after harvest
- **45°F** Apply CIPC between 14 and 100 days after harvest
- **48°F** Apply CIPC between 14 and 80 days after harvest

Due to the fact that this is a shorter dormancy potato, CIPC residues should be monitored to ensure long season sprout inhibition.

Duration of Storage High processing quality persists throughout 250 days after harvest at 48°F.

Fry Mottling Mottling occurs in Western Russet at lower storage temperatures. To minimize mottling, store at 48°F.

Fusarium Dry Rot Moderate susceptibility similar to Russet Burbank.

About the Authors

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