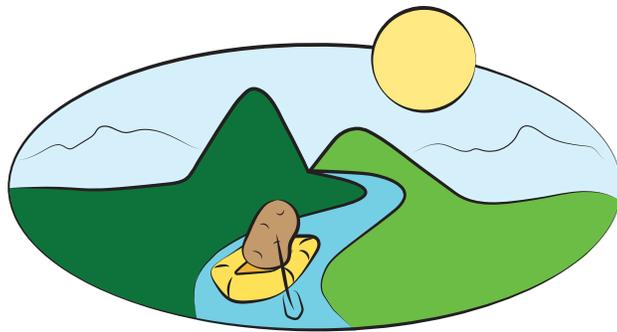


Storage Management of Payette Russet Potatoes



Introduction

Payette Russet is a full-season variety released in 2015 by the USDA Agricultural Research Service and the agricultural experiment stations of Idaho, Oregon, and Washington. It produces higher U.S. No. 1 yields of oblong, medium-russeted tubers than the standard russet potato varieties and has a higher protein content.

Payette Russet has excellent cold-sweetening resistance in storage, even when grown under high temperatures. It also has significantly lower levels of reducing sugars and produces consistently lighter fry color than the industry standard varieties, resulting in excellent processing characteristics.

Payette Russet has moderate to high levels of resistance to *Verticillium* wilt, foliar and tuber early blights, foliar and tuber late blights, common scab, and corky ring spot. However, it does have susceptibility to *Fusarium* dry rot.

Payette Russet grown under high, multi-strain PVY virus pressure over two field seasons showed no virus-infected plants or daughter tubers produced from those plants. Under the same conditions, Russet Burbank had an infection rate of 85%.

Payette Russet has demonstrated greater resistance to growth cracks and second growth than Russet Burbank and Ranger Russet but less resistance than Russet Norkotah. Payette Russet shows a susceptibility to shatter bruise similar to that of Russet Burbank and greater than those of Ranger Russet and Russet Norkotah. Payette Russet is more resistant to blackspot bruise than Ranger Russet and Russet Norkotah. It also has exhibited a lower incidence of hollow heart/brown center than Russet Burbank or Russet Norkotah.

About the study

Payette Russet and Russet Burbank potatoes were grown at the University of Idaho Kimberly Research and Extension Center in 2012, 2013, and 2014. After harvest, potatoes were placed in storage at the University of Idaho Kimberly Potato Storage Research Facility 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°F, 45°F, and 48°F. The potatoes were subsequently stored for 9 months at these temperatures.

Potatoes used in analyses of sugar content, fry color, mottling, disease susceptibility, and weight loss were treated with a thermal aerosol application of chlorpropham (CIPC) at 22 ppm approximately 60 days after harvest. Potatoes used in assessing dormancy length were not treated with a sprout inhibitor.

Dormancy was assessed by monthly evaluations of sprout development, with dormancy length being defined as the number of days from harvest until sprout elongation of at least 0.2 inch in 80% of 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.

Glucose, sucrose, and fry color data were collected each month of storage from three replications of 10 tubers per variety and storage temperature. Glucose and sucrose concentrations were determined using a YSI model 2700 Analyzer (Yellow Springs Instrument Co., Inc., Yellow Springs, OH) and expressed on a percentage fresh weight basis.

Fry color analysis was performed concurrently with sugar extraction

using the same tubers. Fry color was determined on 10 planks (1.2 inch x 0.3 inch) per sample after cooking the planks in canola oil at 375°F for 3.5 minutes. Percentage reflectance was read with a Photovolt Reflection Meter Model 577 (Photovolt Inc., Indianapolis, IN) on the stem ends of each plank. The planks were also scored subjectively for mottling (thin veins of dark coloration in the cortex of the fried potato tissue) on a scale of 1 to 4, where 1 = none, 2 = mild, 3 = moderate, and 4 = severe.

In studies to evaluate *Fusarium* dry rot infection, potatoes were first bruised and then inoculated with *Fusarium sambucinum*. Following inoculation, potatoes were cured at 55°F and 95% relative humidity for 2 weeks. The temperature was then decreased 0.5°F per day, and the potatoes were 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.

Percentage weight loss was tracked in three replications of 10-pound samples of Payette Russet and Russet Burbank potatoes monthly throughout the three storage seasons.

Dormancy

In the absence of sprout inhibitors, dormancy length of Payette Russet is about 20 to 25 days shorter than

that of Russet Burbank (table 1). At 42°F, Payette Russet remains dormant until approximately 170 days after harvest, compared to 190 days after harvest for Russet Burbank.

Glucose and sucrose concentrations

Potatoes used for frozen or dehydration processing must meet reducing sugar criteria specific to the end use. High concentrations of glucose (a reducing sugar) in potato tubers produce a dark coloration in potatoes exposed to high processing temperatures. Glucose concentrations above 0.10% fresh weight (FW) are often considered too high for frozen processing. Concentrations of glucose in excess of 0.20% FW exceed the upper limit of acceptability for use in premium dehydrated potato products. Sucrose can serve as a potential pool for glucose formation in stored tubers and therefore is monitored at harvest and throughout storage.

Glucose concentrations at harvest.

Glucose concentrations at harvest in Payette Russet were substantially lower than in Russet Burbank across the study years, ranging from 0.006% FW in 2014 to 0.015% FW in 2012 (figure 1). By comparison, the 3-year mean glucose concentration in Russet Burbank was 0.052% FW.

Glucose concentrations during storage.

Glucose concentrations in Payette Russet tubers were exceptionally low in storage

Table 1. Mean dormancy length (days after harvest) of Payette Russet potatoes and Russet Burbank potatoes at three storage temperatures. Values are means of three storage seasons (2012–15).

Variety	42 °F	45 °F	48 °F
Russet Burbank	190	165	145
Payette Russet	170	140	120

(figure 1), remaining acceptable throughout the 9-month storage season at every sampling date and at all storage temperatures over the 3 storage seasons. Maintenance of acceptable glucose concentrations is indicative of Payette Russet having a high level of resistance to cold-induced sweetening of tubers.

- At 48°F, glucose concentrations in Payette Russet remained below 0.03% FW throughout the 9-month storage season during 3 years of testing and were far below the mean glucose concentrations for Russet Burbank, which reached a maximum of 0.09%.

- At 45°F, glucose concentrations of Payette Russet remained at or below 0.05% FW throughout the 9-month storage season during 3 years of testing. The 3-year mean glucose concentrations of Russet Burbank exceeded the 0.10% FW threshold on five sampling dates at 45°F.
- At 42°F, glucose concentrations in Payette Russet peaked at 0.065% FW at about 135 days after harvest in the 2014–15 storage year. Glucose concentrations in Payette Russet tended to be higher in mid-storage in 2014–15 than in the other two years. Nevertheless, it remained well below the 0.10% FW threshold throughout

the storage season in all 3 years tested and well below the peak mean glucose concentration of 0.23% of Russet Burbank.

Sucrose concentrations. Sucrose concentrations in Payette Russet at harvest varied across the 3 years, ranging from 0.23% FW in 2012 to 0.11% FW in 2014. The 3-year average for Russet Burbank was within this range and was 0.12% FW at harvest (figure 2). Sucrose concentrations were lowest throughout storage at all three temperatures during the 2014–15 storage season. The greatest differences in sucrose concentrations among years occurred at 42°F, whereas the smallest differences occurred at 48°F.

Fry color

Glucose concentrations in potato tubers are a good indicator of fry color. The higher the glucose concentration, the darker the fry color. However, the processing industry generally makes fry color determinations using samples of fried potato strips, discs, or planks to assess product quality.

When variation in fry color occurs within a potato, it is generally the stem end of the potato (tuber end closest to the plant and where the stolon attaches) that has the highest levels of sugar and darkest color. Data for stem-end fry color—the most stringent test of fry color—are presented in figure 3. Reflectance readings are presented together with the corresponding USDA fry color data. The USDA colors correspond to the following reflectance ranges:

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

Figure 1. Mean percentage glucose (fresh weight) in Payette Russet potatoes at harvest and in storage at three temperatures in three storage seasons compared with Russet Burbank potatoes (3-year mean).

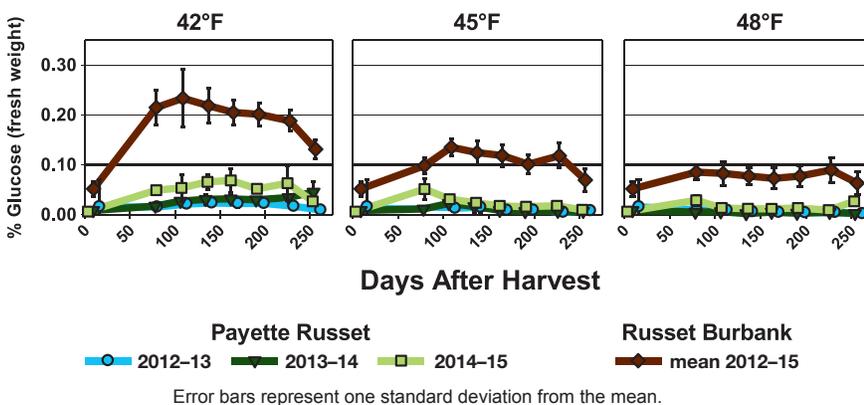
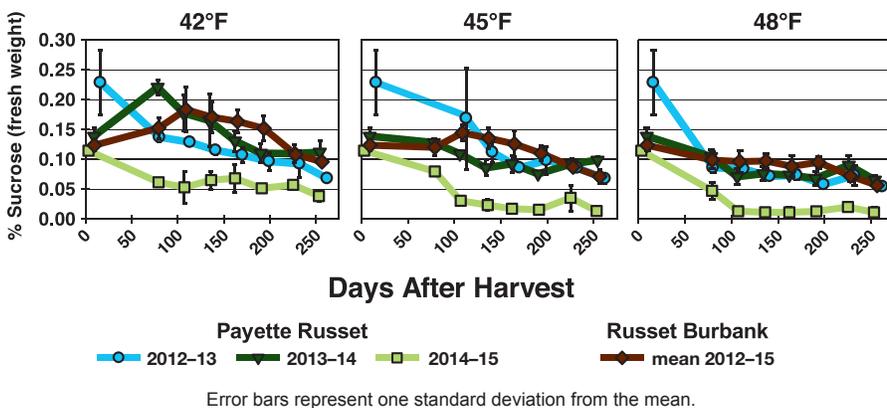


Figure 2. Mean percentage sucrose (fresh weight) in Payette Russet potatoes at harvest and in storage at three temperatures in three storage seasons compared with Russet Burbank potatoes (3-year mean).



The higher the reflectance reading, the lighter the fry color. Fry color of USDA 2 or lower ($\geq 35\%$ reflectance) is generally considered acceptable by the frozen potato industry.

Stem-end fry color of Payette Russet was much lighter than that of Russet Burbank in these evaluations, indicative of Payette Russet having a higher level of resistance to sugar end disorder than Russet Burbank. Fry color was lightest at the highest storage temperature and slightly darker at the lowest storage temperature, but still within acceptable limits (figure 3).

- Storage at 48°F—Fry color in Payette Russet was lightest when stored at this temperature. The average fry color was less than a USDA 1 and far lighter than the 3-year mean fry color of Russet Burbank.
- Storage at 45°F—USDA fry color of Payette Russet was less than or equal to a USDA 1 in all years, while the mean fry color of Russet Burbank (except at harvest) was a USDA 3 to USDA 4.
- Storage at 42°F—Fry color of Payette Russet was a USDA 1 or better in the 2012–13 storage season. In 2013–14 and 2014–15, stem end fry color in Payette Russet was USDA 1 to USDA 2 and thus acceptable. The 3-year mean stem end fry color in Russet Burbank was a USDA 4 (except at harvest).

Mottling

Thin, thread-like areas of dark coloration found in the cortex of the fried potato tissue, known as mottling, can occur in some varieties. Mottling in Payette Russet was generally rated at none to mild at 42°F and 45°F and none

at 48°F (figure 4). Russet Burbank exhibited mottling symptoms ranging from mild to moderate.

Fusarium dry rot

Because Fusarium dry rot is an important storage disease in potatoes, new varieties are bruised,

inoculated, and screened for susceptibility to this disease. The disease organism infects tubers through cuts or openings in the skin.

Results averaged over 3 years indicate that the percentage of decay in Payette Russet (54%) was

Figure 3. Mean percentage reflectance (stem end) and USDA fry color in Payette Russet potatoes in storage at three temperatures in three storage seasons compared with Russet Burbank potatoes (3-year mean).

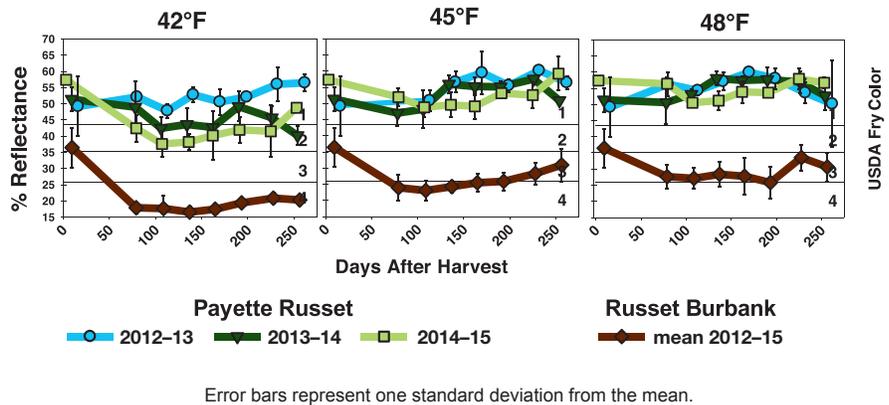


Figure 4. Mean mottling severity in Payette Russet potatoes stored at three temperatures in three storage seasons compared with Russet Burbank potatoes (3-year mean).

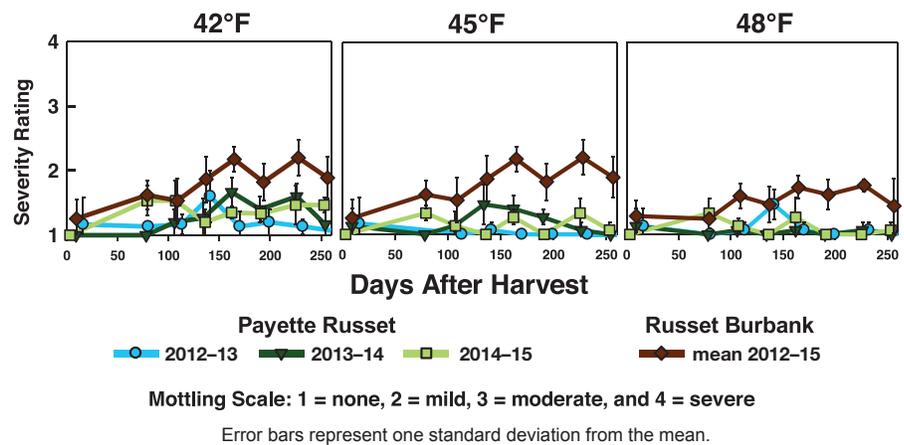


Table 2. Mean decay (%) and incidence of potatoes with greater than 5% Fusarium dry rot decay (%) in bruised and inoculated lots of Payette Russet and Russet Burbank potatoes. Values are means of three storage seasons (2012–15).

Variety	Decay (%)	Incidence (% of potatoes with > 5% decay)
Russet Burbank	31	78
Payette Russet	54	97
LSD (P < 0.05)	8	9

significantly higher than in Russet Burbank (31%) (table 2). The incidence of potatoes with at least 5% decay was also significantly higher in Payette Russet (97%) than in Russet Burbank (78%). Managing for good skin set and maturity and reducing bruising during harvest and handling will be important strategies to reduce the potential for Fusarium dry rot in Payette Russet tubers.

Weight loss

The 3-year mean weight loss was significantly higher in Payette Russet than in Russet Burbank at the three storage temperatures (table 3). Average weight loss in Payette Russet ranged from 12 to 16%, while the average weight loss in Russet Burbank was 7 to 9% across the 9 months of storage.

Table 3. Mean total weight loss (%) during 9 months in storage in Russet Burbank and Payette Russet potatoes at three storage temperatures. Values are means of three storage seasons (2012–15).

Variety	42°F	45°F	48°F
Russet Burbank	7.3	7.0	8.8
Payette Russet	14.1	12.4	15.7
LSD (P<0.05)	4.9	3.4	6.7

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Storage recommendations for Payette Russet

Harvest conditions. Pulp temperatures at harvest should be 45 to 65°F to minimize wounding and potential pathogen infection.

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

Storage. Maintain 95% relative humidity throughout storage.

- Frozen processing. Hold at 42–45°F for acceptable French fry processing quality.
- Fresh market. Hold at 42°F.
- Dehydration processing. Hold at 42°F to meet premium dehydration market standards.

Sprout inhibition. Apply sprout inhibitor before dormancy break but after curing.

Storage duration. Tubers lose 1.5 to 2 times more weight in storage than Russet Burbank so tuber turgidity may become lower the longer they are stored.

Fry color and mottling. Both fry mottling and fry color remain acceptable throughout 9 months of storage, even at 42°F.

Fusarium dry rot. Payette Russet has higher susceptibility to Fusarium dry rot than Russet Burbank.

Monitoring of tubers to determine optimal tuber skin set at harvest and minimizing bruising and wounding during harvest and handling are important to lessen this disease in storage. A post-harvest fungicide application may also be necessary.