

Storage Management of **A93157-6LS** Potatoes



Introduction

The storage characteristics of A93157-6LS (6LS) potatoes were studied for 3 years 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.

6LS is a multi-purpose potato variety released in 2006 by the USDA-ARS and the agricultural experiment stations of Idaho, Oregon, and Washington. This variety is mid- to late maturing, and produces high yields of oblong, medium-russeted tubers with high specific gravity. It is resistant to sugar ends, tuber malformations, and most external and internal defects. It possesses a high level of PVY⁰ and early die resistance and is resistant to both common and powdery scabs. It also is moderately resistant to tuber early blight and soft rot (*Erwinia*). It is susceptible to blackspot bruise and Fusarium dry rot and has moderate susceptibility to hollow heart. It also has been identified as having tolerance to water stress relative to Russet Burbank. It has very high resistance to cold sweetening in storage.

6LS potato crops were produced at Kimberly, ID, from G2 seed in the years 2003, 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 in mesh bags, which were weighed monthly throughout the storage season.

Dormancy

Dormancy length of 6LS 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 utilized because the length of time between initial sprout development (peeping) and sprout elongation varies greatly among potato varieties.

The trial results indicate that 6LS tubers break dormancy between 45 and 55 days earlier than tubers of Russet Burbank, depending on storage temperature. At 42°F, 6LS breaks dormancy at 120 days after harvest (DAH), whereas Russet Burbank potatoes break dormancy at 175 days after harvest. At 45° and 48°F, 6LS breaks dormancy at 100 and 85 DAH, respectively, while Russet Burbank breaks at 155 and 130 DAH, respectively. Due to the shorter tuber dormancy length of 6LS, CIPC residues should be monitored to ensure long-season sprout inhibition.

Glucose and Sucrose Development

Reducing sugar concentrations are critical to the eventual utilization of stored potatoes. Potatoes used for any frozen or dehydration processing must meet reducing sugar criteria specific to the end user. High concentrations of glucose (a reducing sugar) in tubers produce dark coloration in the end product when tuber tissue is exposed to high temperatures during frying. Glucose concentrations of less than 0.10% (fresh weight) are considered acceptable for the production of frozen potato products.

Glucose concentrations in tubers of 6LS at three temperatures over a 3-year period were compared with

those of Russet Burbank (figure 1). Glucose concentrations in 6LS were much lower than in Russet Burbank at all three storage temperatures. Glucose concentrations were minimized in 6LS at 48°F storage but were only slightly higher (and still acceptable for processing) at 45° and 42°F. Glucose concentration for 6LS in 2003-04 was initially high at 0.05%, possibly due to the immaturity of the potatoes at harvest, but it dropped off rapidly in storage. Ultra-low glucose concentrations are uncommon in russet type potatoes. The highest concentration observed for 6LS was 0.029% fresh weight (at 42°F and 105 DAH), far below the lowest observed glucose concentration of 0.04% for Russet Burbank stored at 48°F at 227 DAH. Glucose concentrations remain very low for 6LS at the three storage temperatures, and this positive processing quality attribute corresponds to lighter fry color.

Sucrose concentrations in 6LS at harvest ranged from 0.17 to 0.20%

of fresh weight compared with 0.12% in Russet Burbank (figure 2). In general, percentage sucrose in Russet Burbank decreases more over the storage season than in 6LS. A peak in sucrose concentrations was observed 70 to 80 days after harvest in both 6LS and Russet Burbank potatoes stored at 42°F. The higher sucrose concentration for 6LS does not appear to influence the production of glucose later in the storage season.

Fry Color

Glucose concentrations in potato tubers are a good indicator of fry color. However, in the processing industry, fry color determinations are made directly on samples of fried potato strips, discs, or planks. In this study, fry color determinations were made by performing reflectance measurements with a Photovolt Reflection Meter Model 577 (Photovolt Inc., Indianapolis, IN) on fried planks (1.2 inch x 0.3inch) from the same

Table 1. Mean dormancy length (days after harvest) of Russet Burbank and A93157-6LS potatoes at three storage temperatures. (Values are means of three storage years, 2003-04 through 2005-06.)

	42°F	45°F	48°F
Russet Burbank	175	155	130
A93157-6LS	120	100	85

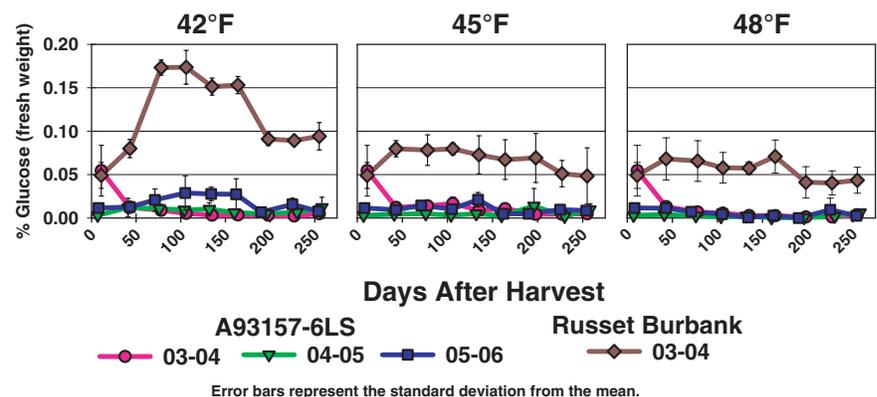


Figure 1. Percentage glucose in A93157-6LS potatoes in three storage seasons (2003-06) at three storage temperatures compared with Russet Burbank potatoes in an average year (2003-04).

tubers that were used for the sugar analyses.

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 and darkest color. To represent the most stringent test of fry color, stem end fry color data are presented in figure 3. Reflectance readings are presented together with the corresponding USDA fry color. USDA fry colors correspond to reflectance ranges: USDA 1 >44% reflectance, USDA 2 = 35-44%, USDA 3 = 26-34.9% and USDA 4 <25.9% reflectance. (The higher the reflectance and the lower the USDA fry color, the lighter the color.)

Stem end fry color in 6LS is remarkably light for potatoes stored at 42°, 45° and 48°F in all years tested (figure 3). The mean fry color was equivalent to a USDA 1 or below at all sampling dates and storage temperatures. By comparison, fry color in Russet Burbank stored at both 45° and 48°F ranged from USDA 2 to 3. When Russet Burbank was stored at 42°F, fry color ranged from USDA 3 to 4. The fact that 6LS consistently shows low glucose concentrations and light fry color at 42°F makes this cultivar a truly unique russet potato ideal for the frozen process industry.

Mottling, which is defined as thin, threadlike areas of dark coloration found in the cortex of the fried potato tissue, can occur in some varieties. Each fry was evaluated subjectively on a scale of 1 to 4, where 1=none, 2=mild, 3=moderate, and 4=severe mottling (figure 4). 6LS showed very limited mottling in 3 years of testing at all three storage temperatures. The highest level of mottling observed was less than a 2, or mild, and that occurred only on a few sampling dates in the 3-year study.

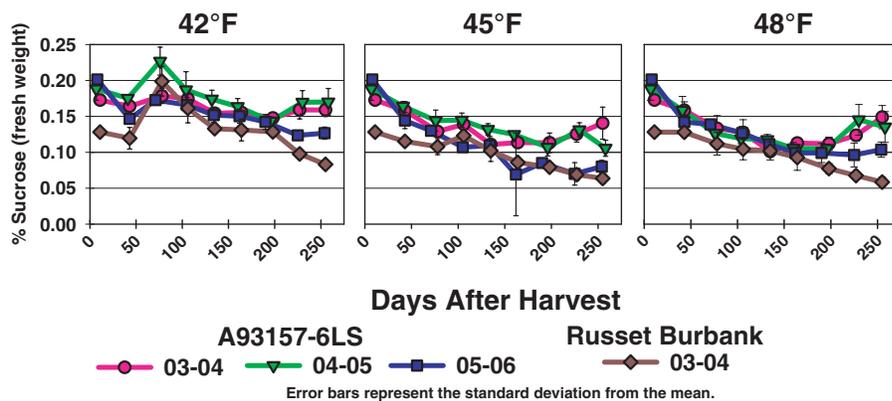


Figure 2. Percentage sucrose in A93157-6LS potatoes in three storage seasons (2003-06) at three storage temperatures compared with Russet Burbank potatoes in an average year (2003-04).

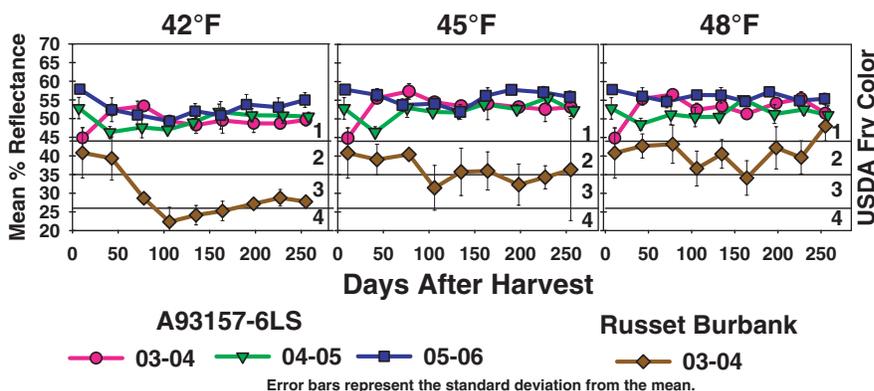


Figure 3. Stem end fry color in A93157-6LS potatoes in three storage seasons (2003-06) at three storage temperatures compared with Russet Burbank potatoes in an average year (2003-04).

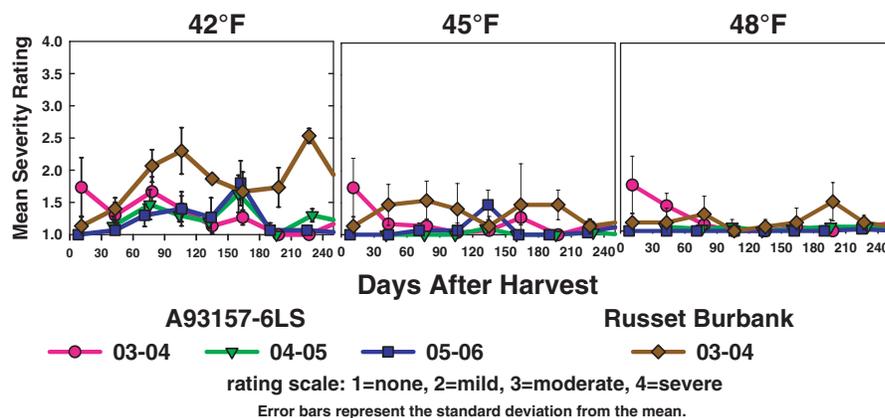


Figure 4. Severity of mottling in fried planks of A93157-6LS potatoes in three storage seasons (2003-06) at three storage temperatures compared to Russet Burbank in an average year (2003-04).

Table 2. Mean percentage decay and mean percentage incidence of potatoes with greater than 5% decay in lots of Russet Burbank and A93157-6LS potatoes bruised and inoculated with *Fusarium*. (Values are means of three storage years, 2003-04 through 2005-06.)

	Decay (%)	Incidence (% with >5% decay)
Russet Burbank	5.7	16.3
A93157-6LS	11.7	29.3
LSD ($P < 0.05$)	4.1	9.7

Fusarium Dry Rot

Because Fusarium dry rot is an important storage disease in potatoes, new varieties are screened for susceptibility to this disease. *Fusarium* (a fungus) infects tubers through cuts or openings in the skin. In these studies, therefore, potatoes 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 2 weeks then stored at 45°F. After approximately 3 months in storage, evaluations of dry rot decay and incidence were made (table 2).

Results averaged over 3 years indicate that percentage decay due to dry rot in 6LS was significantly higher than in Russet Burbank. The mean for Russet Burbank was 5.7%, while the mean for 6LS was 11.7%. The percentage incidence of potatoes with at least 5% decay also was significantly higher in 6LS. Thus, 6LS is classified as having high susceptibility to Fusarium dry rot. Take precautions at harvest to avoid bruising. Also implement proper wound healing (curing) conditions in storage to decrease dry rot potential.

Weight Loss

Percentage weight loss was tracked in subsamples of 6LS and Russet Burbank potatoes throughout the 2005-06 storage season (table 3). 6LS had significantly higher weight loss at the three storage temperatures than did Russet Burbank. Weight loss was minimized at 45°F for both cultivars; however, it was nearly double in 6LS at 8.0% versus Russet Burbank at 4.2%. General observations in the first 2 years of testing 6LS were consistent with this weight loss data.

Table 3. Mean total percentage weight loss in samples of Russet Burbank and A93157-6LS potatoes stored at three temperatures for nine months (Oct 2005 -Jun 2006).

	42°F	45°F	48°F
Russet Burbank	5.5	4.2	5.8
A93157-6LS	11.1	8.0	11.0
LSD ($P<0.05$)	0.8	3.1	1.1

Weight loss in storage was higher in 6LS than in other russet varieties despite maintaining relative humidity at 95% (data not shown). This is an important fact to consider when selecting a holding temperature for 6LS: although fry color was excellent at 42°F, weight loss was minimized at 45°F. Elevated weight loss in 6LS may necessitate shortening the storage season. Furthermore, it will be very important to minimize weight loss through proper skin set, tuber maturity, wound healing, and relative humidity in storage.

Storage Recommendations

Recommendations are based on data collected over 3 years at the UI Kimberly R&E Center on A93157-6LS potatoes grown in southern Idaho.

Harvest Conditions 6LS is susceptible to both black spot bruise and Fusarium dry rot. Take particular care to minimize bruising during harvest and handling.

Storage Conditions 95% relative humidity throughout storage. Weight loss is higher in 6LS than Russet Burbank. To minimize weight loss, store at 45°F.

- **Frozen Processing:** 42°F holding temperature
- **Fresh Market:** 45°F.
- **Dehydration Processing:** 42°F.

Sprout Inhibition Apply CIPC before dormancy break but after curing. Because this is a shorter dormancy potato, monitor CIPC residues to ensure long-season sprout inhibition.

- **42°F** Apply CIPC between 14 and 120 days after harvest
- **45°F** Apply CIPC between 14 and 100 days after harvest
- **48°F** Apply CIPC between 14 and 85 days after harvest

Duration of Storage High processing quality persists throughout 250 days after harvest at 42°, 45°, and 48°F, although higher tuber shrinkage than typically seen with Russet Burbank may occur in long-term storage.

Fry Mottling Virtually none throughout 250 days in storage.

Fusarium Dry Rot High susceptibility (more than Russet Burbank). Minimize bruising and manage with appropriate fungicides.

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