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Influence of harvest time tuber pulp temperature and storage conditions on Leak in Russet-skinned Potato Cultivars

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Leak is a storage disease that can occur after tubers undergo mechanical damage at harvest, especially at warmer temperatures (Figure 1). *Pythium ultimum* is the most common species causing leak, however, other species of *Pythium* have been found to cause symptoms (Porter et al. 2009). Oospores are the main source of inoculum, infecting via openings or wounds of the periderm (Jones 1935; Taylor et al. 2004). The tuber periderm may appear dark, sunken and water soaked while the flesh is a dark brown to grey color in infected tubers (Figure 1). If squeezed, water will readily "leak" or drip out of the tuber (Salas and Secor 2001). These symptoms can develop within days of infection.

Figure 1: (a) Shatter bruise on a potato tuber which is a possible infection site for *P. ultimum*. (b) Color of flesh infected with *P. ultimum*.

Cultural practices, such as tuber pulp temperature and early storage management play a role in leak development, and specific relationships need to be studied further. In addition, potato cultivars developed or grown in the Pacific Northwest may differ in susceptibility and therefore management practices should be tailored to minimize risk. As a result of these on-going questions, research was designed to determine how harvest pulp temperatures and early storage temperature manipulation affect leak disease incidence among different Russet –skinned cultivars. The cultivars Bannock

Russet, Clearwater Russet, Russet Norkotah, Russet Burbank, Teton Russet, and Umatilla Russet were used in these trials.

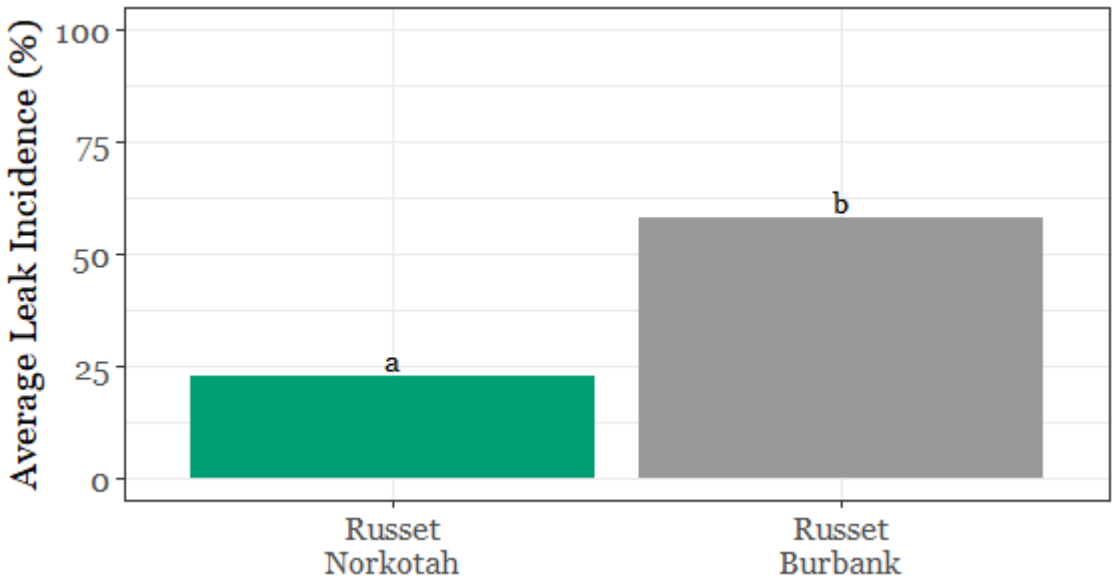

Figure 2: Leak incidence of Russet Norkotah and Russet Burbank averaged across 55, 60, 65, and 70°F tuber pulp temperatures. Different letters above bars represent significance ($\alpha = 0.05$).

In the first trial, tubers with pulp temperatures of 55, 60, 65, and 70°F were wounded, inoculated with *Pythium ultimum*, and then maintained at the same temperatures until evaluated 4 days later. Russet Norkotah tubers developed less leak than Russet Burbank across the four temperatures (Figure 2). When the study was expanded to other cultivars, results showed leak susceptibility varied among cultivars (Figure 3). The least susceptible cultivars were Ranger Russet and Russet Burbank compared to more susceptible cultivars Bannock Russet, Clearwater Russet, and Teton Russet. Having knowledge of relative susceptibility to leak development helps identify cultivars of greater risk and management can be intensified for these cultivars to lessen that risk.

Tuber pulp temperature at harvest is an important management consideration because the temperature can determine the initial risk of leak development and determine how quickly tubers can be cooled down in storage. For example, when all the cultivars were averaged together, tubers with harvest pulp temperatures of 70°F and stored at 70°F for four days had 86% leak incidence. Tubers with pulp temperatures of 65, 60, and 55°F and stored at those same temperatures, had 72, 61, and 39% leak incidence, respectively (Figure 4). The risk of leak decreases with each decrease in pulp temperature and associated early storage temperature. This demonstrates the importance of avoiding harvesting tubers at warmer temperatures, especially with cultivars more susceptible to leak.

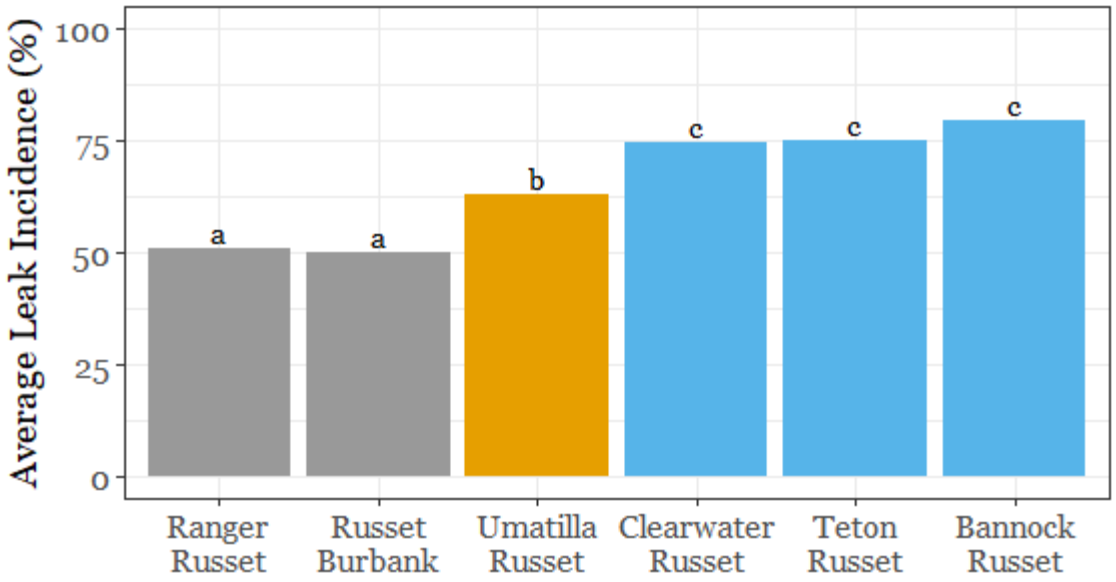

Figure 3: Leak incidence of Russet potato cultivars averaged across harvest pulp and early storage temperatures of 55, 60, 65, and 70°F. Different letters above bars represent significance (α = 0.05).

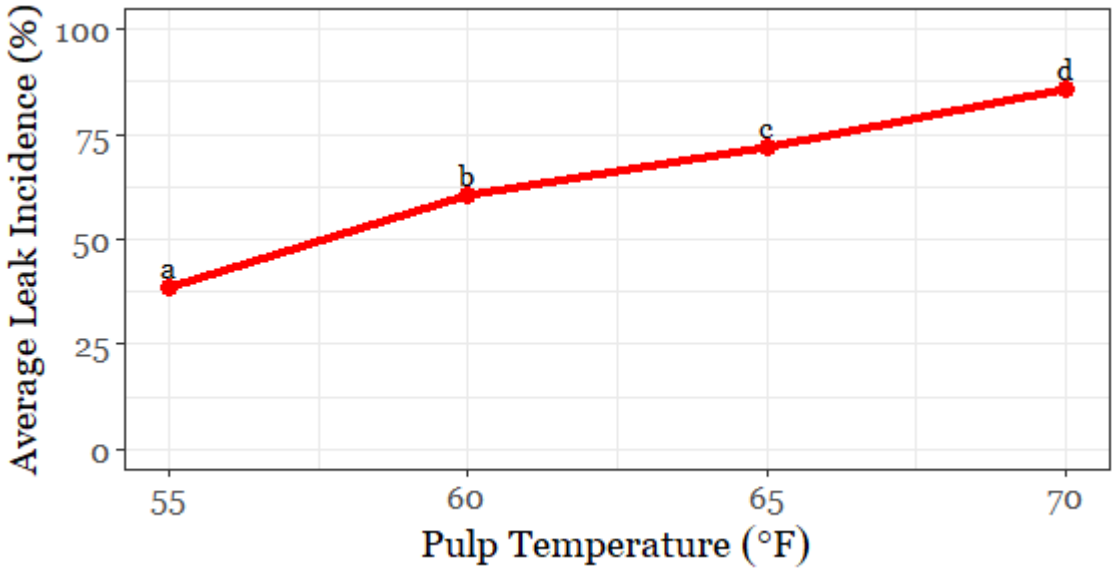

Figure 4: Leak incidence by pulp temperature averaged across six potato cultivars. Tubers were at the designated pulp temperatures and maintained at that temperature for 4 days. Different letters above points represent significance (α = 0.05).

Harvest pulp temperatures can dictate early storage temperatures. Warm pulp temperatures are often a sign of warm outside air temperatures which results in less available cooling air. If cooling air or refrigeration is available, then you have the ability to manipulate or lower the temperature of the incoming crop. In the case that temperatures are manipulated to be cooler, then leak incidence will also decrease. However, the rate of cooling depends greatly on the pulp temperatures of incoming tubers, cooling capacity of the refrigeration system, and temperature of available outside air. In the second study of these experiments, tubers of Bannock Russet, Russet Norkotah, Russet Burbank, and Umatilla Russet were warmed to 60°F and 70°F to simulate harvest pulp temperatures, bruised and inoculated with *Pythium*, and then stored for 4 days at 55, 60, 65, and 70°F to simulate early storage conditions. Results are explained by the trial scenarios discussed below and Figure 5.

Scenario 1: Tubers harvested with pulp temperatures of 70°F:

- When cooled to 55°F only 12% disease observed.
- If tubers remained at 70°F for a few days, then 71% of the tubers were infected by leak.
- Cooled tubers will have less disease develop than tubers maintained at 70°F early in storage.

Scenario 2: Tubers harvested with pulp temperatures of 60°F:

- Tubers cooled to 55°F observed 14% incidence of leak
- Tubers warmed to 65 and 70°F increased to 72% and 60% leak, respectively. Warming may result in tubers respiring or lack of cooling air available.

This demonstrates disease incidence is affected by storage temperature more than harvest pulp temperatures (no significant differences between 60 and 70°F), however, pulp temperature is important for determining how quickly tubers can be cooled in storage.

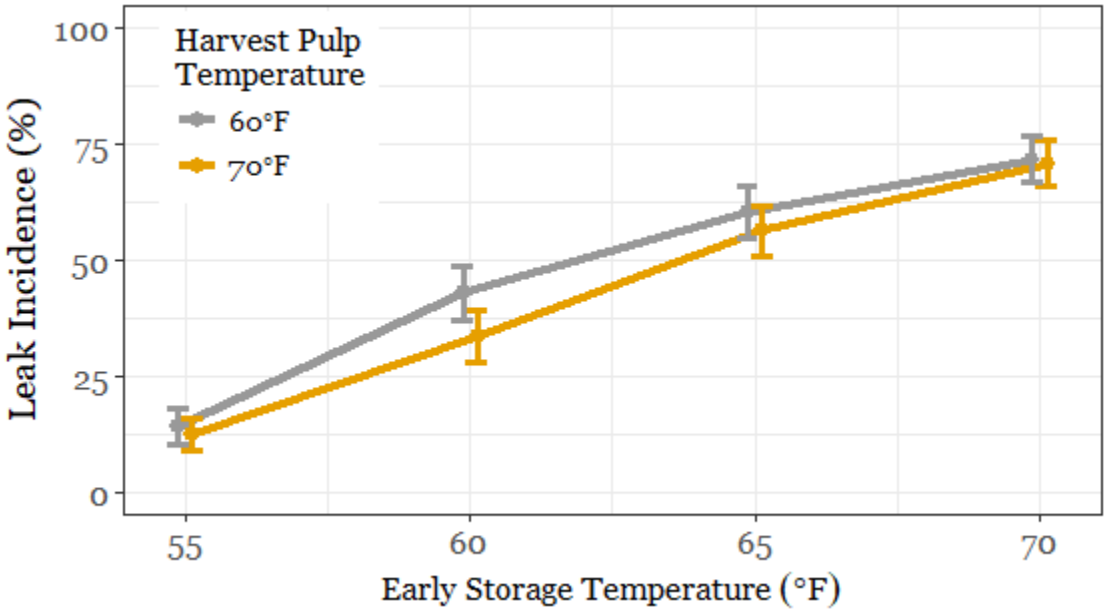

Figure 5: Leak incidence of 60°F and 70°F harvest pulp temperature tubers placed at different early storage temperatures (55, 60, 65, 70°F). Values are average of four potato cultivars. Error bars represent 95% confidence intervals.

Cultivars should be managed differently based on their susceptibility to leak. Bannock Russet is a very susceptible cultivar (Figures 3 and 6), and to manage leak for this cultivar harvest may need to be delayed until pulp temperatures are cooler making it easier to immediately cool tubers to 55°F. Umatilla Russet and Russet Burbank are less susceptible to leak and could be held at 60°F whereas Russet Norkotah is the least susceptible and could be held at 65°F. In all situations, the ability to cool tubers in the first few days of storage will decrease the likelihood of leak development.

Research is on-going to determine why cultivars differ in susceptibility to leak. One observation from our research is that shatter bruise susceptibility is positively correlated with leak susceptibility. Meaning, cultivars that tend to shatter bruise also are more susceptible to leak. Other current research has focused toward chemical control for better management of the disease, however, there is good evidence that either harvesting or immediately cooling tuber pulp temperatures to 55°F is

one of the most effective management procedures. If cooling is not available, then delay harvest of more susceptible tubers until pulp temperatures are lower.

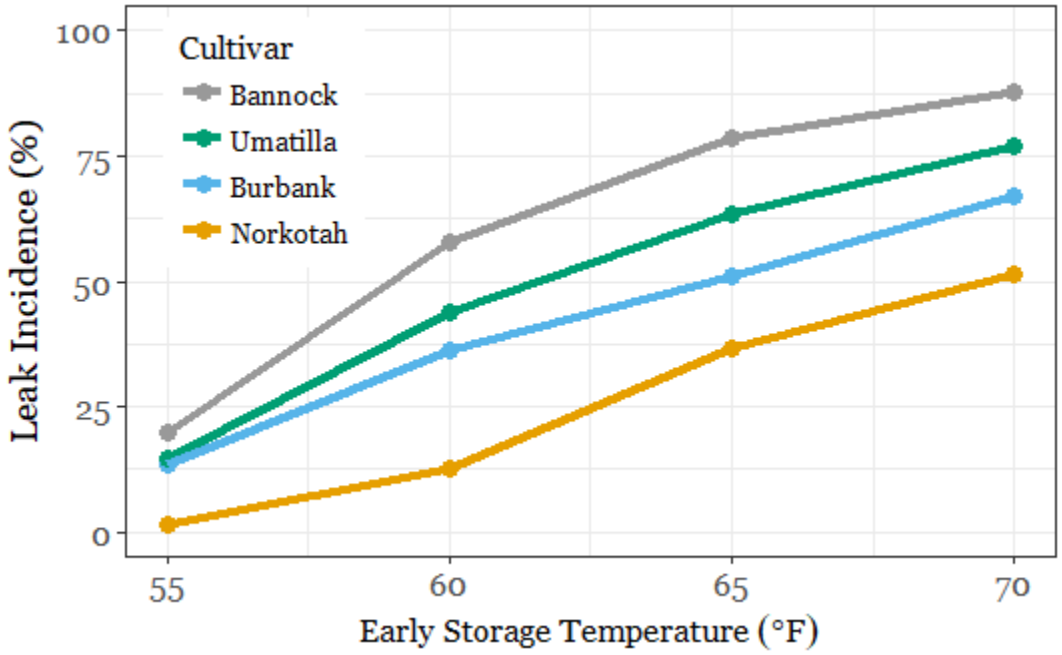

Figure 6: Average leak incidence in cultivars Bannock Russet, Russet Norkotah, Russet Burbank, and Umatilla Russet over a temperature range of 55 to 70°F.

Literature Cited

Jones W. 1935. Soft rot of potatoes caused by *pythium ultimum* trow. Scientific Agriculture. 15:402-410.

Porter LD, Hamm PB, David NL, Gieck SL, Miller JS, Gundersen B, Inglis DA. 2009. Metalaxyl-m-resistant *pythium* species in potato production areas of the pacific northwest of the USA. American Journal of Potato Research. 86(4):315-326.

Salas B, Secor GA. 2001. Leak. In: Stevenson WR, Loria R, Franc GD, D.P. W, editors. Compendium of potato diseases. 2nd ed. St Paul, MN, USA: American Phytopahological Society. p. 30-31.

Taylor RJ, Salas B, Gudmestad NC. 2004. Differences in etiology affect mefenoxam efficacy and the control of pink rot and leak tuber diseases of potato. Plant Dis. 88(3):301-307.