Potato Progress

Research and Extension for Washington's Potato Industry
Published by Washington State Potato Commission **www.potatoes.com**
Andrew Jensen, Editor. Submit articles and/or notes to: ajensen@potatoes.com

Volume I, Number 7 *September 28, 2001*

Postharvest Behavior of Vine-Desiccated vs. Green-Harvested Ranger Russet Tubers

Lisa Knowles, Research Associate, Rick Knowles, Professor, Dept. of Horticulture & Landscape Architecture, Washington State University, & Mel Martin, Food Group, J.R. Simplot, Co.

Chemical vine desiccation prior to lifting hastens maturity and facilitates tuber skin set, thus minimizing certain types of mechanical injury during harvest and handling. Proper skin set also confers greater resistance to disease in storage. The disadvantage of poorer skin set for green-harvested tubers may be offset, particularly for short storage periods, by higher yield, larger tuber size, bruise reduction, and the saved costs of desiccation.

Live vines are actively photosynthesizing and translocating sucrose to developing tubers, where numerous carbohydrate inter-conversions take place. Vine death halts this process, allowing soluble sugars to decline in tubers during the maturation process prior to harvest. Tubers from vine-killed plants are thus physiologically different from those harvested from green vines, especially in relation to carbohydrate metabolism. This may affect their ability to retain processing quality during storage.

Grower and processor interest in the impact of green harvest on tuber quality prompted us to investigate the effects of vine status on postharvest behavior of 'Ranger Russet'. Tubers were harvested from commercial fields near Othello, WA during the 1999 and 2000 seasons. Tubers were harvested from live plants and from plants that had been killed (diquat) two weeks prior to lifting. Differences in wound-healing ability, respiration rate, sucrose and reducing sugar concentrations were compared relative to vine status. In addition, changes in sugar concentrations were followed in the tubers over 16 weeks at 48°F to determine whether vine status affects sweetening and thus potential processing quality during storage.

Green-harvested tubers averaged 28% more sucrose than those from vine-killed plants in a plot harvested on September 7, 1999 (Fig. 1). Similarly, tubers harvested green on September 28, 1999 had 17% more sucrose than their vine-killed counterparts (data not shown). These results reflect the uninterrupted transport of sucrose from vines to actively growing tubers and are indicative of the relative immaturity of tubers harvested from green vines. In both experiments, tuber bud ends had higher concentrations of sucrose than stem ends. This was expected, as the bud end is the origin of growth and expansion for the tuber. In contrast to sucrose, the concentration of reducing sugars (glucose + fructose) was not affected by vine status (Fig. 1). Stem ends, however, contained higher reducing sugar concentrations than bud ends.

In the 2000 study, there was no difference in sucrose content between tubers harvested from green and vine-killed plants at harvest (September 15) (Fig. 2), possibly due to the relatively low levels of sucrose in the tubers that year. Sucrose concentrations fell over a 16-week storage interval, regardless of whether the tubers were wound-healed initially for two weeks at 60°F or stored continuously at 48°F, and the rate of decline was not affected by vine status (Fig. 2). While vine status did not affect at-harvest reducing sugar levels in 1999 or 2000, tubers harvested from dead vines had accumulated significantly more reducing sugars than green-harvested tubers by 8 and 16 weeks of storage in both years (see Fig. 2 for 2000 results). Moreover, the two-week wound-healing treatment at 60°F weakened, but did not eliminate, the effect of vine status on reducing sugar buildup (Fig. 2).

Green-harvested tubers initially had higher respiration rates, reflecting their relative immaturity compared with those from dead vines (Fig. 3). The higher respiration rate may have facilitated the conversion of excess sucrose (Fig. 1) to starch. Respiration of the green-harvested tubers fell rapidly to match that of tubers harvested from dead vines within a week of harvest. However, 65 days into the storage season, the respiration rate of vine-killed tubers was 20% higher than that of green-harvested tubers, likely reflecting differences in relative physiological age of the tubers. Our extensive research on aging of seed-tubers has found elevated respiration to be an indicator of advanced physiological age. Vine status did not affect the ability of cores of tuber tissue to wound-heal (data not shown).

CONCLUSIONS

Initial tuber carbohydrate levels varied with each harvest and year, reflecting the influence of growing environment on tuber metabolism. Multiple harvests thus helped to separate environmental effects from those caused by cultural practices such as 'harvesting green'. Lifting tubers from living plants had no negative effects on wound-healing capacity or sugar accumulation in 'Ranger Russet'. On the contrary, vine desiccation resulted in a greater buildup of glucose and fructose during storage, an occurrence that could eventually result in a decline in processing quality. Reducing sugars, however, did not reach levels high enough to impact processing quality over the storage intervals used in our studies (see estimates of USDA fry colors in histogram of Fig. 2).

While we are not advocating green harvesting, particularly for tubers destined for long-term storage, there may be specific situations in which vine desiccation prior to harvest is unnecessary. For example, a lack of skin set may be of no consequence for tubers moving directly to the processing plant, and a lower blackspot potential in cultivars like Ranger Russet may justify a green harvest. In the event of a delay in processing, wound-healing will proceed normally even in a green-harvested crop. In fact, it is likely that the wound-healing capacity is greater in green-harvested tubers, due to an active phellogen (cork cambium) that is responsible for generating the wound periderm. The methods that we used for comparing differences in wound-healing ability (cut cores) would not have revealed the potential advantage that green-harvested tubers would have in this regard. Further research will more precisely define the effects of green harvest on tuber physiological age. Harvesting green and maintaining tubers in a 'younger' state prior to planting, for example, may enhance seed productivity. It is worth noting that green harvesting is practiced in areas where the growing season is too short to terminate the bulking period early. This may prove to be a factor in the purported 'Northern Vigor' phenomenon.

In Summary, our studies show that:

- At-harvest processing quality of Ranger Russet tubers is not impacted by vine status.
- Green-harvested Ranger Russet tubers initially have a higher rate of respiration following harvest than vine-killed tubers, which likely facilitates conversion of higher sucrose levels to starch.
- Vine-killed Ranger Russet tubers have a tendency to build up reducing sugars earlier in storage and this could eventually lead to lower processing quality relative to that from green-harvested tubers.
- Respiration rate of vine-killed tubers 2 months into storage was marginally higher than that of green-harvested tubers, likely reflecting more advanced physiological age of the vine-killed tubers.
- Vine status had no effect on the efficiency of wound healing of tuber tissue from freshly harvested tubers.

Chlorine Dioxide Section 18 Approved

Based on a request by the Washington State Potato Commission, the U.S. Environmental Protection Agency has approved an emergency exemption (Section 18) for the use of Purogene® and Anthium 200® for the control of late blight in stored potatoes. This is a regional specific exemption which included Idaho, Oregon, and Washington.

Please call Andy Jensen or Pat Boss at (509-765-8845) with questions or comments about this Section 18.

WSPC Research Proposal Review Meeting Dates

The Washington State Potato Commission funds a significant amount of research each year into the production and storage of potatoes. During the fall and winter, research proposals are received from all over the Pacific Northwest. These are compiled and reviewed, with final funding decisions made at the March quarterly meeting of the Commission.

Proposals are reviewed and funding recommendations made by the 17-member Research Council, a committee made up of commissioners and potato industry representatives. Due dates and meeting dates for research proposal consideration are listed below. All meetings are open to the public. Interested potato growers are particularly encouraged to attend. Please contact Andy Jensen, Director of Research & Technical Affairs with any questions or comments you may have. Additional information on WSPC research can be found at: http://www.potatoes.com.

Dates for proposal submission and Research Reviews:

1. All proposals due: **November 12, 2001**.
2. Preliminary Research Review (Moses Lake): **December 11, 2001**.
3. Revised "new" proposals and progress reports due: **January 14, 2002**.
4. Final Research Review (Pullman): **February 13-14, 2002**.

Another Useful Newsletter

Bill Bohl of the University of Idaho in Blackfoot publishes an interesting newsletter with timely articles on potato production, called “the SPUDVINE”. The September issue is particularly timely and potentially valuable, and so I draw your attention to the online version of the article (see **http://www.if.uidaho.edu/~bingham/spudvine.htm**). With Dr. Bohl’s permission, I have also included his Harvester Adjustment Worksheet as an insert in this *Potato Progress*. The worksheet accompanied the September issue of the SPUDVINE.